Inter-generational Variation in the Height of Adult Men: A Study across Caste Categories in Salumber Block, Udaipur District between the Age Groups of 20 to 40 and 41 to 60 years

Thesis Submitted to Jawaharlal Nehru University in partial fulfilment of the requirements for the award of the degree of

DOCTORATE OF PHILOSOPLHY

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DECLARATION

I declare that the thesis entitled "**Inter-generational Variation in the Height of Adult Men: A Study across Caste Categories in Salumber Block, Udaipur District between the Age Groups of 20 to 40 and 41 to 60 Years"** submitted by me for the award of the degree of Doctor of Philosophy of Jawaharlal Nehru University is my own work. The thesis has not been submitted for any other degree of this university or any other university and is my original work

(Krishna Kumar Choudhary)

CERTIFICATE

We recommended that this dissertation be placed before the examiners for evaluation.

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Supervisor	Co-Supervisor	Chairperson
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Krishna Kumar Choudhary

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Abbreviations

ALP	Alkaline Phosphate
ANM	Auxiliary Nurse Midwife
APL	Above Poverty Line
ASHA	Accredit Social Health Activist
AWW	Anganwadi Worker
BMI	Body Mass Index
BPL	Below Poverty Line
CAGR	Compound Annual Growth Rate
CHC	Community Health Centre
CI	Confident Interval
CM	Centimeter
CVD	cardiovascular disease
DAP	Di-Ammonium Phosphate
FPS	Fair Price Shop
GDP	Gross Domestic Product
GNP	Gross National Product
GWA	Genome Wide Association
HH	Household
IAY	Indira Aawas Yojana
ICDS	Integrated Child Development Service
IIPS	International Institute for Population Science
IMR	Infant Mortality Rate
IQ	Intelligence Quotient
LPG	Liquide Petrolium Gas
MBD	Metabolic Bone Disease
MM	Millimeter
MMAY	Mukhyamantri Aawas Yojana
MMR	Maternal Mortality Ratio
MPCE	Monthly Per Capita Expenditure
MPH	Mid-Parent Height
NDDB	National Dairy Development Board
NFHS	National Family Health Survey

NNMB	National Nutrition Monitoring Bureau
OBC	Other Backward Class
OECD	Organization for Economic Co-operation and Development
PDS	Public Distribution System
PHC	Primary Health Centre
PMGAY	Pradhan Mantri Gramin Awaas Yojana
PR	Prevalence Ratio
RR	Relative Risk
SD	Standard Deviation
SNP	Single Nucleotide Polymorphisms
ST	Schedule Caste
ST	Schedule Tribe
TSP	Tribal Sub Plan
UNICEF	United Nation Children's Fund
WFP	United Nation World Food Program
WHO	World Health Organization

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Introduction

My tall or short height is not my fault. It's a reality of fortune or the pathos of deprivation-

Adult height[1] is just not a vertical measurement of the body from bottom to top or head to toe in a standing position. A vast amount of literature tried to correlate height with its determinants and implications. Adult height is primarily determined by a combination of genetic, environmental (Nutrition, disease, etc.) and social (caste, class, gender, etc.) factors. Genome-wise association (GWA) studies identified 600+ variants associated with human traits; however, it explains a small fraction of phenotypic variation (Lango Allen et al., 2010; Weedon et al., 2008). Lai, 2006; Silventoinen, 2003; Silventoinen et al., 1999, 2000, and 2003 studies explore the relative role of genetic and environmental factors. Genetic variation describes naturally occurring variations in an individual height of the same species, and the changes in environmental circumstances permit flexibility in the genetic variation. Twins who shared common environment or living standard were observed that changing environmental factors affect the heritability of height and would be higher when the standard of living is better (Silventoinen et al., 2000). Genes' contribution of height to the heritability of height is determined by genetic potential[2] (Scurt et al., 2015). The role of social factors on health and nutritional status was widely studied (Dubois & Girard, 2001; House, 2002; Marmot, 2005; Yajnik et al., 2008). However, few works of literature (Douglas & Simpson, 1964; Rona et al., 1978) explore the relationship between height growth and social factors, i.e. exposure to disease, reoccurrence of disease, inadequate and low quality of food intake, among others impeding achievement of genetic potential (Varela-Silva, 2013).

Social and environmental factors play a key role in determining genetic potential, and all these determinants determine body shape. As Nancy Krieger explained, body shape is the biological outcome of social determinants (Krieger, 2005; Krieger & Davey Smith, 2004). The Subsequent chapter, *Adult Height and its Determinants: A Review of Literature*, explored comparative studies about height and its determinants.

[1]Height can be measured by vertical, but length is measured by horizontal. Height of individual who are more than two years is measure by using of stadiometer. While children who are less than two years or shorter than 85 centimeter those length is measured by using of infantometer.

[2] Genetic potential –theoretical optimum performance capability, which an individual could achieve in a specific activity, after an ideal upbringing, nutrition and training (source- genetic potential. (n.d.) *Dictionary of Sport and Exercise Science and Medicine by Churchill Livingstone*. (2008). Retrieved June 24 2018 from https://medical-dictionary.thefreedictionary.com/genetic+potential)

There is a multidisciplinary branch called Auxology which involves people from various disciplines like anthropology, endocrinology, mathematics, economics, etc., studying human growth. Auxology is a science that studies human growth and answers questions like how does my child grow? How did our ancestors grow? What is the advantage of being tall and short? Ancient Egyptians and Babylonians deliberated some writing on child growth and variation in height between ethnic groups (Hermanussen & Bogin, 2014a)). Last quarter of the 18th century, sprinkled documents related to child growth began appearing in scientific writing, such as Jamberts in 1754 and annual measurements of the son of Montebeillard published by Buffon in 1777 (Hermanussen & Bogin, 2014a; Tanner, 1981). At the beginning of the 19th century, French economist Louis René Villermé realised that adult height depends on the socio-economic status of the country (Villermé, 1829), and after the number of scientific studies increased rapidly (Hermanussen & Bogin, 2014a). Günther studied the monthly height increment in a group of boys of various ages (Günther, 1839). Kotelmann first noted the adolescent growth spurt, which appears to be a novel achievement in the history of the study of human height (Bogin, 1999; Hermanussen & Bogin, 2014a; Kotelmann, 1879). At the beginning of the 19th century, European nations mainly published a national growth table with data on height and weight.

Soon after, x-ray imaging of the hand and wrist was popular to determine bone age. The present auxological knowledge is based on the large nation-wide studies done in the 1950's, 1960s and 1970s and much of them inaugurated by James Tanner (Tanner, 1981). The history of anthropometric development is also interesting; that explains how height was part of anthropometry and the significant measure of human height (for details, chapter two- *Height Conundrum in the Indian Context: Exploring Intergenerational Change*). As anthropometry has the longest use to measure human variation with surface morphology[3] , one can easily identify physical traits like tall, short, fat, and thin (S. J. Ulijaszek & Mascie-Taylor, 2005). In the nineteenth century, anthropometry was used as a tool for validating racial typology (S. Ulijaszek & Komlos, 2005). By the mid-twentieth century, there was a reframing of anthropometry with a newer understanding of determinants of physical human growth patterns

[3]Within the field of biology, morphology is the study of the shapes and arrangement of parts of organisms, in order to determine their function, their development, and how they may have been shaped by evolution. Morphology is particularly important in classifying species, since it can often reveal how closely one species is related to another. Morphology is studied within other sciences as well, including astronomy and geology. And in language, morphology considers where words come from and why they look the way they do. (from - https://www.merriam-webster.com/dictionary/morphology)

in an evolutionary context by placing human adaptation at the centre become dominant (ibid, p-184). However, the parallel stream of anthropometry was also used for the determination of physical health in terms of stature from the beginning of the eighteenth century. The use of anthropometrics in the social sciences began in the mid of 1970s among developmental economists and Cliometricians[4] (Komlos, 2009). Developmental economists had a major concern about measuring the living conditions of the worker because conventional monetary indicator does not exist in the case of homemaker and children; therefore, economist demands new measurement (Komlos, 2009; S. Ulijaszek & Komlos, 2005) and by the 1990s, Cliometricians introduced physical stature as a measure of biological wellbeing (Fogel, 1994; Steckel, 1995).

The debate on height was started in 1982 with David Seckler's writing "'Small but Healthy': A Basic Hypothesis in the Theory, Measurement and Policy of Malnutrition"(Seckler, 1982). The 'Small but healthy?' hypothesis was widely criticized and debated among scholars (Gopalan, 1982, 1983; Mehta, 1982; Seckler, 1984; P. V. Sukhatme, 1982; P. V Sukhatme & Margen, 1978, 1982). In 2013, a wide discourse on height was started after Dr Panagariya's argument (Panagariya & Bhagwati, 2013) on stunting and subsequent critiques of it by various scholars (Coffey, Deaton, et al., 2013; Gillespie, 2013; A. Gupta et al., 2013; Jayachandran & Pande, 2013; Lodha et al., 2013; Wable, 2013). Therefore, studying the determinant of height at the population level would help us understand the phenomena of height.

Indicators of health status (morbidity and mortality) and nutritional status show a population's health and well-being. Indeed, each indicator has its advantages and limitations. E.g. BMI is a comprehensive measurement of the nutritional status of an adult. However, those who are shorter and have appropriate weight would fall in the normal BMI category, despite being shorter. Similarly, mortality and morbidity as indicators of health status have their own limitations regarding validations (Goldsmith, 1972). The study of children's height is complex due to its dynamic property, whereas adult height is static; there is less possibility of further changes as it reflects overall food intake, socioeconomic status and disease occurrence during the growing age. Therefore, studying height at the population or individual level would be required to analyse the life history of the individual and the social history of the community that would give a plausible explanation for height variation.

[4] Cliometricians those who study the economic history, based on the statistical analysis of large-scale numerical data from population censuses, parish registers, and similar sources.

When we analyse the social determinants of height, it is necessary to understand the social composition of society. The variation in the adult height of an Indian might not be clearly understood without considering caste as an axis. Indian society has a unique feature of social stratification known as caste (Berreman, 1972; Beteille, 1969; Srinivas & Béteille, 1964). The organization of society on caste is different from other forms of social stratification. Class, race and ethnicity inform the debate on social factors involved in height, as the studies have shown (ARYA et al., 2002; Guntupalli & Baten, 2006; Perkins et al., 2011) hitherto. Each caste group has a very strong different social history and social experience across generations. Therefore, we expect variation in the contemporary social change experienced and present change process to be different because of social causes. Earlier studies based on Indian's height could not explain the role of caste in the intergenerational variation and how it affects an individual's height gain. This study extended the Auxology domain with the phenomenon of adult height as a summary marker of nutritional and health status and its determinants among different caste groups living within the same geographical and social space.

This study is based on four population groups, i.e. Rajput, Patel, Meghwal and Salvi, in the Salumber block of Udaipur district in Rajasthan. The rationality behind the selection of the block is: this block constitutes more than half of the population is tribal; another I have completed a study on tribal height and its determinant during the M.Phil. third is that have good liaison with a respective government body and affluent person in the society which helped to smooth completion of data. Out of 292 villages, 30 villages with more than 50 males of scheduled caste community (as per census 2011) were selected for this study and out of that, 29 villages were part of this study. One village was excluded from the study villages due to a different caste group named *Kalbeliya* (other than Meghwal and Salvi). There are 38 Households of the *Kalbeliya* caste recorded in the blocks and which were clustered in a village. Therefore, this village was excluded from the study.

The selection of four caste groups was based on their occupation. Rajput and Patel have sufficient agricultural land and are exclusively involved in cultivation (primary occupation), while Meghwal and Salvi are witnesses to complete change in their traditional occupation. Overall, 2626 adult males (n=32% of the N) aged 20-60 years' height were measured, and 60 father and son dyad's life histories were collected retrospectively. Besides that, the social history of each caste group was compiled through key person interviews[5]and discussion, and

[5] (~150 persons) who are the witness of changes in the last two to three generations

it was corroborated with previous studies based on the Udaipur basin. The methodology of this study was described in detail in chapter three, titled *Methodology for Study of Intergenerational Changes in Adult Height and Its Determinants*.

The community's social history is a history of changes in living conditions and a world view of knowing and doing things. The social history section (chapter four – *Lived Experience: An Exploration of Social History*) compiled the changes in living conditions, occupation, social mobility, and structural changes that affect the studied population group. The major changes and shifting were recorded in the occupation of the communities. At present, both Rajput and Patel have partially moved to a secondary source of income through migration; however, their traditional occupation is still a primary income source. The traditional occupations of Meghwal and Salvi were completely changed due to several reasons, and currently, they are relying on daily wages, self-employment, and permanent and contractual jobs. Changes in educational attainment, food items and consumption patterns, means of agriculture and irrigation, and living conditions were reported among all communities.

Chapter five (*Intergenerational Changes in Adult Height: The Study Results)* of the thesis contains height data analysis and interpretation, and Chapter six *(Determinants of Height: Evidence from Life Histories)* explains determinants of height from life histories. The average height of the current generation is improved significantly across caste or population groups. However, these improvements were not uniform. The average improvement in height was greater in the Meghwal (3.46 cm) and Salvi (3.36 cm), followed by the Patel (2.71 cm) and Rajput (2.01cm). From the pooled data, participants' from urban areas reported a higher improvement in average height, about 0.70 cm, compared to the rural area. The pooled data show that the average height of those who depend exclusively on rain-fed and open-well irrigation was 0.62 cm [95% CI, 0.07 to 1.17, p-0.027], significantly taller than those who benefited from canal irrigation facilities in addition to rain feed and open well irrigation facility. The average height of the offspring of the self-employed father was higher among all occupation categories, and a higher average improvement in height was observed among those whose father worked/as have Temporary worker (6.04 cm), self-employment (5 cm) and daily wages (4.16 cm) occupation category. In the traditional occupation category, all caste groups significantly improved average height. Among the current generation, those who worked as permanent employees are taller than other occupation categories, which supports the assumption that those who are taller have a higher possibility of getting permanent occupation

or have higher earnings compared to shorter individuals (Guntupalli & Baten, 2006). Father's schooling years are positively associated with the average height of the offspring.

Chapter seven, titled *Discussion and Conclusion: Trends in Adult Height as a Socio-Biological Phenomenon,* discuss height and its relationship with different determinants. Birth weight, workload, availability of agricultural land, source of drinking water, consumption of dairy products, food grain, pulses and extra nutritional supplements is positively associated with average height. Exposure to any type of disease and re-occurrence of the disease has a significant and inverse relationship with average height.

Study conclusion, the average height is mostly determined by the environmental factors where the child was born, nurtured and grew. The average height of the study area was increased between the last two generations across the studied population. Oral description of life and social history of community and its relation to height further strengthen the concept of height as reflective of biological and social well-being. The study results concluded opposite views of Dr Panagariya argument i.e. higher prevalence of stunting in India due to the genetic mark-up, because intra-caste analysis provided strong evidence that height was primarily marked by their consumption, accessibility to health care, water and sanitation practice, among other things.

Inter-caste analysis showed that changes in livelihoods with improved socio-economic status led to greater change than with continuing traditional occupations and smaller changes in income levels.

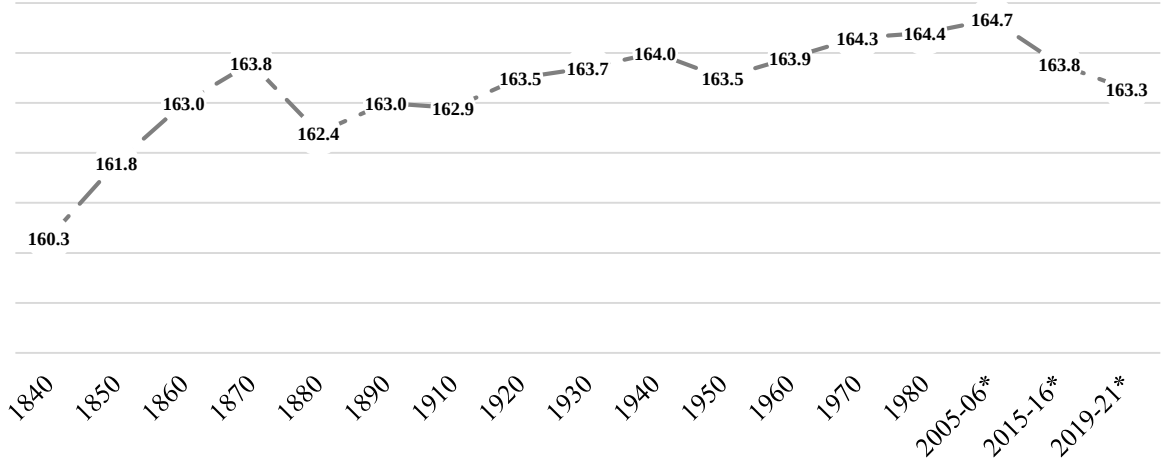
Chapter-1 Adult Height and its Determinants: A Review of Literature

Introduction

India's soaring economic growth in the post-liberalisation period (Baru et al., 2010; Datt et al., 2016) and decline in the national incidence of poverty for the upper line of about 0.65% points per annum, reflects in a sizeable fall in the poverty rate of more than 35% points. In proportionate terms, poverty incidence declined at the rate of 1.3% per annum in the last six decades (Datt et al., 2016). However, the economic growth and poverty decline failed to translate into better health and nutritional status of children (Baru et al., 2010).

Between 2011 and 2019, extreme poverty has declined in India by 12 point percentage; however, the rate of decline was significantly slower than 2004-2011. The declining rate was higher in rural areas compared to urban (Sinha Roy & Van Der Weide, 2022). The recent NFHS-5 result was not in line with the rate of poverty decline. Even Bhalla and Bhasin (2022) graciously admitted false representation (Bhalla et al., 2022) of figures related to the Multidimensional Poverty Index (MPI) in correspondence with Jean Dreze, the fast decline in the MPI is largely driven by the rapid improvement of amenities (Dreze, 2022).

Fig. 1.1 Average Height of Men: Time Trends



Data sources: Height of Indian men from 1840 to 1980 accessed from Max Roser (2017) – 'Human Height'. *Published online at OurWorldInData.org.* Retrieved from: https://ourworldindata.org/human-height/#empirical-view accessed on December 3, 2016.
* Author's calculation from NFHS-3,4,5 round.

A plethora of literature from economic, health and nutritional disciplines has established the relationship between the Gross Domestic Product (GDP) and health status (Akachi & Canning,

2007; Banerjee & Duflo, 2011; Baru et al., 2010; Hoddinott et al., 2013). Despite the economic growth, increase in CAGR of health expenditure, and food production, the average height[6] of Indian men reflects slow and steady improvement over the decades (fig 1.1). Nutritional indicator among the children from the National Family Health Survey fifth round (NFHS-5) shows marginal relief but not as expected to the economic growth, and among health indicators, anaemia among women, adolescent (15-19 years) and children (6-59 months) were increased from last five years (NFHS-4 to NFHS-5) (International Institute for Population Sciences, 2021).

Table 1.1 Trends of Average Height of Men and Women NFHS-3 to NFHS-4

Gender/Age group	NFHS-4		NFHS-3		Coef.	SE.	P-value	[95% Conf. Interval]	
	N	Mean Height	N	Mean Height					
Men									
20-40 years	65128	164.03	41796	164.88	-0.85	0.09	0.001	-1.03	-0.67
40-60 years	27507	163.16	15247	164.09	-0.93	0.11	0.001	-1.15	-0.71
Women									
20-40 years	452769	152.07	79820	152.00	0.07	0.05	0.154	0.03	0.18
40-60 years	122752	151.76	18491	151.57	0.19	0.08	0.012	0.04	0.34

(Source: Author's calculation from NFHS-3 and NFHS-4 by using national sample weight)

Table 1.2 Trends of Average Height of Men and Women NFHS-4 to NFHS-5

Gender/Age group	NFHS-5		NFHS-4		Coef.	SE	P-value	[95% Conf. Interval]	
	N	Mean Height	N	Mean Height					
Men									
20-40 years	56329	163.59	65128	164.03	-0.45	0.09	0.001	0.62	-0.27
40-60 years	25969	162.63	27507	163.16	-0.53	0.10	0.001	0.74	-0.33
Women									
20-40 years	453485	152.15	452769	152.07	0.07	0.03	0.018	0.01	0.14
40-60 years	138053	151.84	122752	151.76	0.08	0.04	0.077	-0.01	0.16

(Source: Author's calculation from NFHS-4 and NFHS-5 by using national sample weight)

NFHS-5 and NFHS-4 both rounds show unfavourable results; the average height of an Indian man has significantly declined among the 20-40 and 41-60 years age group (table 1.1, 1.2 and fig. 1.1). While women of the same age group show marginal improvement. As we will advance to the next, it's remarked that height is a measure of the biological and physical wellbeing of

[6] Adult height is a vertical measurement from the bottom to top in standing position ("Height," n.d.; "Height," 2007).Height can be measured by vertical, but length is measured by horizontal. Height of an individual who is more than two years old is measured by the use of a stadiometer. While children who are less than two years or shorter than 85 centimetres are measured by using an infantometer.

the population. For that matter, the negative trend in height warrants an analytical inquisition into the phenomena of height.

Adult height is a well-established measure of the living standard and well-being of people (Baten & Blum, 2014; Steckel, 1983, 1995, 2009). Several studies also established the relationship of stunting[7] (shorter height) with GDP, per capita expenditure of food, and dietary intake, among other things (Banerjee & Duflo, 2011; Baten & Blum, 2014; Case et al., 2002; Gopalan, 1988; Hoddinott et al., 2013; Huffman et al., 2012). Human height gain is not only affected by purchasing power but also by various factors such as household economy, net nutritional intake, disease occurrence etc (Baten, 2006; Mahan & Raymond, 2016).

This study evaluates how social determinants or factors affect the height attained by an individual when control over resources is outside the agency of individuals and how all aspects of their lives get affected. Furthermore, individual life is not only affected by an outside agency but is also affected by the intra-household allocation of resources (Pfeiffer et al., 2001).

The height of an individual is largely affected by a range of factors, which include environmental factors like nutrition, socio-economic status, disease history, access to health care services, water, sanitation etc. (Bailey et al., 2014; Fogel, 1994; Hatton & Bray, 2010; Steckel, 1995, 2009). This is because the net quantity and quality of nutrition and the disease environment, which is not influenced by purchasing power (Baten, 2006; Mahan & Raymond, 2016), mainly influence height. The average height of people has steadily increased over the past two centuries across the world. This trend is in line with the improvements in nutrition and health during these periods (Max, 2016). Human height until the 19th century showed uniform patterns across the world. After the advent of industrial phenomena, human height has started showing divergence. As Baten and Blum stated that-

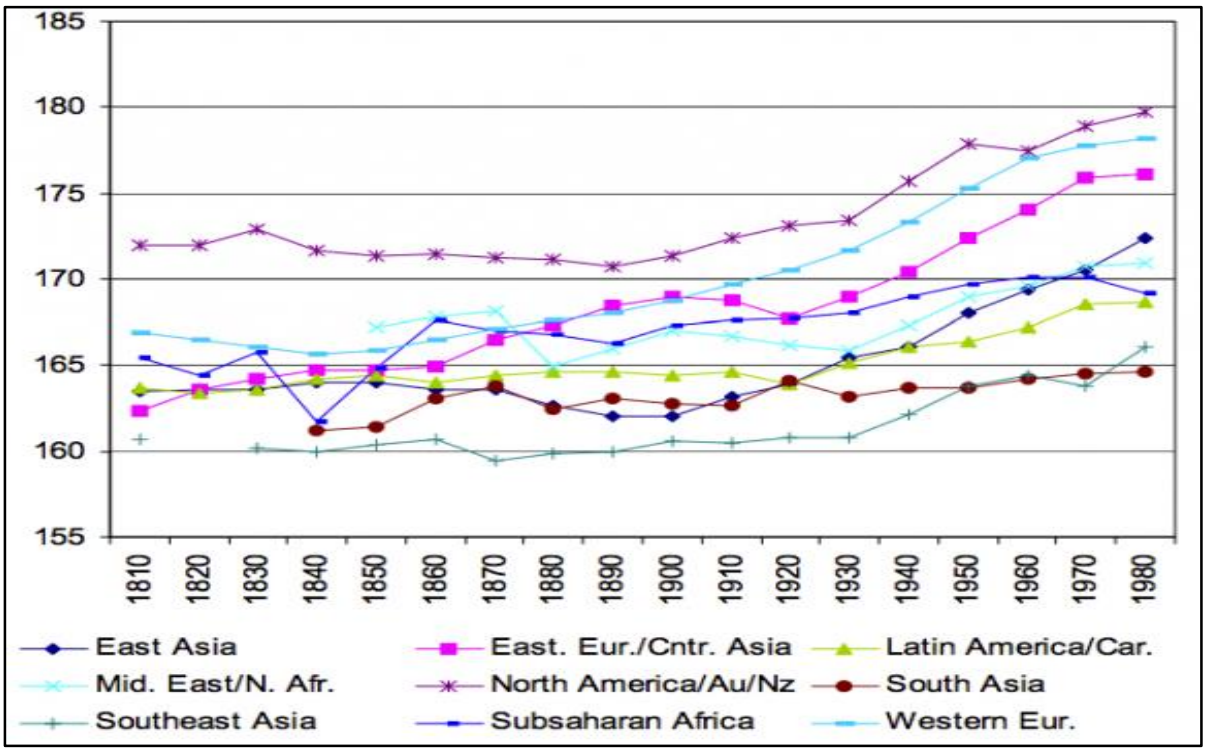
> 'Drawing on anthropometric information from 156 countries spanning the period 1810-1989, we find that regional height levels around the world were fairly uniform throughout most of the 19th century, with two exceptions: above-average levels in Anglo-Saxon settlement regions and below-average levels in Southeast Asia. After 1880, substantial divergences began to differentiate other regions. We find that most of the anthropometric

[7] UNICEF defined as the percentage of children, aged 0 to 59 months, whose height for age is below minus two standard deviations (moderate and severe *stunting*) and minus three standard deviations (severe *stunting*) from the median of the WHO Child Growth Standards. Several studies established the relationship between stunting and growth retardation in later life (Dewey & Begum, 2011; Mendez & Adair, 1999; UNICEF, 1998).

divergence between today's industrial and developing nations took place after this period. While the impressive height level that the region comprising the Middle East and North Africa had enjoyed prior to that point fell back in relative terms, South and Southeast Asia remained from the outset at the back of the pack. Africa performed surprisingly well during the period 1900-65 but has struggled since. In short, after 1880 the world population became taller on average, but more unequal'- (Baten & Blum, 2012, p.S79)

In the above-stated quote, human height started fluctuating after the 19th century and showed international variation in adult height which is clearly visible in figure 1.2.

Fig. 1.2- Trends in the Average Height of Different Regions in the World



Source- Baten. J., & Blum, M. (2012). Growing Tall but Unequal: New Findings and New Background Evidence on Anthropometric Welfare in 156 Countries, 1810–1989. Economic History of Developing Regions, 27 (sup1), S66-S85.

However, in general perception, shorter height is due to genetic dispositions. In this consideration (genetic cause), environmental factors get less credence. It is for this reason that the equation of height and environmental factors are always neglected. The less attention towards environmental factors does not mean that people are not sensitive to nutritional intake and the social-genesis of disease.

The effect of environmental factors on height is marked by every episode of disease, and people usually visit a health centre when the disease becomes severe (Choudhary, 2017). The whole

argument does not neglect the role of genetic factors in the height of an individual, as, without a favourable environment, genetic potential cannot reach its maximum level.

The measurement of genetic potential is unclear because there is no universally acceptable tool that can measure genetic potential. Therefore, we need to rely on environmental factors to understand the etiology of shorter stature. Body height is very sensitive to the environment, and this effect is not only seen when studying the stunting of growth, but it is also evident in the tallest individual (Silventoinen, 2003).

This chapter attempts to build a holistic view of the determinants of the height based on the available literature. The determinants of height have been analysed within two broad categories, namely, genetic and environmental factors. The environmental factors here are an umbrella category and include all factors related to socio-economic status, nutrition, and disease. The implications of shorter height have not been reviewed separately and are part of the review, along with the determinants of human height.

1. Genetic Factors

Genetic factors play an essential role in the understanding of variations within a population (Max, 2016). Evidence from the Genome Wide Association Studies (GWASs) shows that while 45 percent of variations in height can be explained by considering single nucleotide polymorphisms (SNPs), most of the variation could not be explained due to the individual factors (Yang et al., 2010). Ten new and two previously identified loci were strongly associated with variation in height, which contributed about 2 percent of the population variation in height (Lettre et al., 2008).

As Chao-Qiang Lai stated that-

> ‘This question can be rephrased as: "How much variation (difference between individuals) in height is attributable to genetic effects and how much to nutritional effects?" The short answer to this question is that about 60 to 80 percent of the difference in height between individuals is determined by genetic factors, whereas 20 to 40 percent can be attributed to environmental effects, mainly nutrition. This answer is based on estimates of the "heritability" of human height: the proportion of the total variation in height due to genetic factors’ (Lai, 2006).

To explore the influence of genetics on height, besides bio-technological studies, there are also other studies which explore the intergenerational transmission of height. The pathway between gene and height gain remains unclear, like how BMI and stunting are linked with CVD and type two diabetes (DeBoer et al., 2012). The next sub-theme on parental factors analyses the contribution of genetic factors of parents on the body of their offspring.

1.1 Heritability of Height

Geneticists' interest in height study is hardly a recent phenomenon. In the mid-19th century, Gregor Mendel's experiment with pea plants expanded our understanding. Certain traits could be explained by discrete inheritance units commonly known as genes. The single gene determined characteristics like pea colour and shape (Mendel et al., 1993). Before Mendel, Francis Galton explained that the height of children could be approximately predicted by their father's height (Galton, 1886). However, Height is not such a simple trait but is continuous and quantitative in nature and has a transmissibility property. Therefore, it is a source of considerable debate. In the early twentieth century, Ronald Fisher showed a polygenic model, where many (poly) genes affect the individual height in one or other direction with the outside environmental factors that can cumulatively contribute to a person's observed height (Fisher, 1919). The complex property of genes that are responsible for the transmission of height from the previous generation is still one of the greatest challenges for the human geneticist.

As Galton conceptualised that children's height can be predicted by parents' height, hence suggesting the role of genes. By applying The same concept, we can assess how much individual variation in height is due to genetic and environmental factors. The twin studies are the most classical avenue for heritability estimation, as they measure the difference in trait correlation between monozygotic (MZ)[8] and dizygotic (DZ)[9]. Both MZ and DZ are presumed to be growing in the same-shared environment, but only MZ twins share the exact same genetic constitution. The difference in the correlation between the two types of twins provides an estimation of how much variation in height is due to genetics (McEvoy & Visscher, 2009; Visscher et al., 2008).

[8] MZ twins are formed from the splitting of a single embryo and are genetically identical.

[9] DZ twins are the product of separate, albeit concurrent, fertilisations and are no more genetically similar than other siblings are to each other.

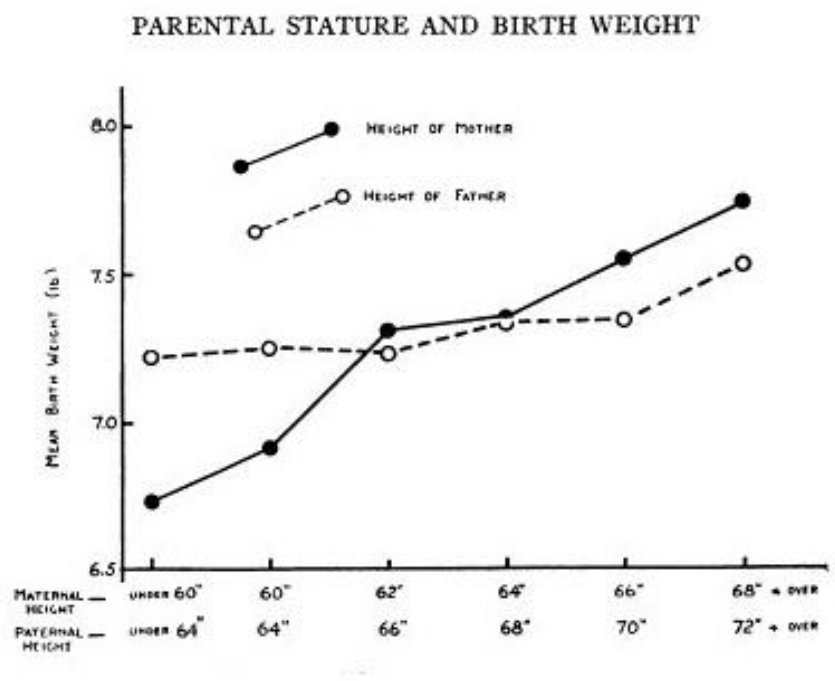
Earlier studies estimated heritability of height is about 0.8, which means that 80 percent of variability seen in people is potentially controlled by the genes (Macgregor et al., 2006; Perola et al., 2007; Silventoinen et al., 2000, 2003). The remaining 20 percent variation is simply interpreted as being due to environmental factors such as nutrition and disease occurrence. As records explained, the height of the population increased over the past 150 years (Cole, 2000; Komlos & Baur, 2004). When social and environmental factors stand in favour of human beings, height can be increased in shorter periods of time (for example- The Japanese increased their average height by eight centimetres between 1950 to 1980) (Max, 2016). This increase in height is unlikely to be explained by the genes. Height traits controlled by the genes are not expected to change much in such short time intervals; thus, the increased height would probably be explained by environmental factors. As McEvory and Visscher, suggested, height heritability fails to explain how many genes contributed to the height trait and what these genes could be? It is only possible to address this question directly by examining the DNA variation found in the human genome (McEvoy & Visscher, 2009).

1.2 Parental Factor

> 'Young girls who grow poorly become stunted women and are more likely to give birth to low-birthweight infants. If those infants are girls, they are likely to continue the cycle by being stunted in adulthood, and so on, if something isn't done to break the cycle'- (UNICEF, 1998, p-34)

UNICEF's quote is a classical explanation of the intergenerational transmission of height from parents to their children. The vicious circle of stunting cannot be stopped until the barricades of intervention. Kuh & Wadsworth, 1989 assumed that parental height is the best proxy for genetic influence that is available, although the genetic contribution will be modified by environmental factors common to parents and children. The close and positive correlation between the mid-parents height with the height of adult males and females was measured, and this result was also similar to Himes, Roche, & Thissen, 1981 study. After the adjustment of parental age using a linear model, parental height could explain about 26 percent variation in adult male and female height (Himes et al., 1981; Kuh & Wadsworth, 1989). A study by Murrin et al. is a relevant example of the association between parental BMI and their child's BMI. Based on 669 families and 529 Irish children aged 5 to 7 years suggested that maternal BMI is significantly associated with child's BMI while paternal BMI is not associated (Murrin et al., 2012).

Fig. 1.3 Birth Weight (Standardized for Height of Other Parent) According to Parental Height (Smethwick Data)



Source- Cawley, R. H., McKeown, T., & Record, R. G. (1954). Parental stature and birth weight. *American journal of human genetics*, *6*(4), 451

Table 1.3 Mean Birth Weight (LB.) According to Height of Parents (Smethwick Data)

Height of Mothers (Inches)	Height of Father (Inches)						Total	Mean Standardized for Height of Father
	Under 64	64-	66-	68-	70-	72 and over		
Under 60	6.28 (8)	5.69 (4)	6.86 (8)	6.58 (9)	7.13 (3)	7.15 (3)	6.61 (38)	**6.73**
60-	6.90 (16)	7.12 (11)	6.61 (24)	7.10 (39)	6.81 (27)	7.09 (12)	6.92 (129)	**6.91**
62-	7.07 (17)	7.07 (38)	7.21 (63)	7.27 (63)	7.52 (56)	7.52 (38)	7.30 (275)	**7.31**
64-	7.37 (9)	7.26 (47)	7.21 (97)	7.40 (65)	7.41 (84)	7.49 (45)	7.34 (347)	**7.35**
66-	7.22 (4)	7.75 (16)	7.68 (40)	7.50 (46)	7.26 (44)	7.90 (27)	7.56 (177)	**7.55**
68 and over	8.41 (2)	7.79 (3)	7.62 (4)	7.81 (11)	7.53 (28)	7.86 (14)	7.70 (62)	**7.74**
Total	7.01 (56)	7.21 (119)	7.22 (236)	7.32 (233)	7.35 (245)	7.57 (139)	7.31 (1028)	-
Mean Standardized for Height of Mother	**7.22**	**7.25**	**7.23**	**7.34**	**7.33**	**7.53**	-	-

Source- Cawley, R. H., McKeown, T., & Record, R. G. (1954). Parental stature and birth weight. *American journal of human genetics*, *6*(4), 451

Leaner[10] height growth of adults is the observable characteristic of an individual height relating to the result of genotype with environmental effect. For example, the adequacy of diet during pregnancy is a well-known determinant of birth size. Maternal birth length and birth weight are significant predictors of a child's birth length. An increase in 1 cm of maternal birth length was positive and significantly correlated with the child's birth length by 0.2 cm after adjusting for known confounding factors, i.e. social and economic status, maternal age, gestational age, and sex of the child. Similarly, a 100g increase in the mother's birth weight was associated with an increase in the child's birth length by 0.1 cm (Ramakrishnan, Manjrekar, et al., 1999). Venkataramani's 2011 study suggests that after controlling for parental and HH characteristics, maternal height is strongly associated with the height of boys rather than girls (Venkataramani, 2011). However, the path of association of maternal height and male child height is unclear, and the reasons were not described.

Based on the 1028 single-birth Smethwick children, table 1.3 and fig. 1.3 shows that the birth weight of children regularly increases as the height of their parents' increases. The association between the father's height and childbirth weight is less marked and less consistent compared to the mother's height. The relationship between the mother's height and childbirth weight is virtually unchanged, but the same relationship with the father's height is less evident. Table 1.4, based on 506 Birmingham children, produced a similar result as the Smethwick children data. Parental height and birth weight of child's correlation of both datasets presented in table no. 1.5 showed that the birth weight of the child is highly correlated with the mother's height compared to the father's height. The correlation value is 0.18 and 0.9 (Smethwick) and 0.16 and 0.5 (Birmingham), respectively. Table 1.6[11] represents correlations with child weight at the ages 6, 9, 12, and 24 months with parents' height also producing a similar result to table 1.5 (Cawley et al., 1954). Experience from the Smethwick and Birmingham studies showed the correlation between birth weight and height of parents, which indicates that a mother's height is a more significant determinant of a child's birth weight compared to the father's height. The mother's height and childbirth size association might be explained by the gestational age and dietary intake during the pregnancy because the height of adult males and women is equally affected by parental height (Pearson & Lee, 1903)[12].

[10] Leaner height growth is a proportional of age and height growth of individual after controlling of environmental and genetic factors.

[11] This table data based on 625 children from Smethwick. The data of this table is unadjusted.

[12] This result based on more than 4000 individual and 1000 families.

Table 1.4 Mean Birth Weight (LB) According to Height of Parents (Birmingham data)

Height of Mother (Inches)	Under 60	60-	62-	64-	66 and Over
Mean Birth Weight	6.67 (44)	7.28 (120)	7.45 (154)	7.42 (120)	7.59 (68)
Mean Standardized for Height of Father	6.62	7.32	7.46	7.41	7.76
Height of Father (Inches)	**Under 66**	**66-**	**68-**	**70-**	**72 and Over**
Mean Birth Weight	7.13 (108)	7.46 (93)	7.36 (134)	7.33 (116)	7.66 (55)
Mean Standardized for Height of Mother	7.25	7.55	7.33	7.33	7.65

Source- Cawley, R. H., McKeown, T., & Record, R. G. (1954). Parental stature and birth weight. *American journal of human genetics*, *6*(4), 450-453

Table 1.5 Correlation Between Birth Weight and Parental Height

Sex of Infants	Correlation Between Birth weight and Height of	Smethwick Data				Birmingham Data		
		Total	Corrected for Height of other parent	Corrected for gestation and Height of other parents	No of observations and Standard Error	Total	Corrected for Height of other parent	No of observations and Standard Error
Males	Mother	0.20	0.18	0.18	545 (0.04)	0.22	0.18	248 (0.06)
	Father	0.10	0.07	0.06		0.13	0.05	
Females	Mother	0.21	0.18	0.19	483 (0.05)	0.17	0.15	258 (0.06)
	Father	0.16	0.12	0.10		0.10	0.05	
Both Sexes	Mother	0.20	0.18	0.18	1028 (0.03)	0.19	0.16	506 (0.04)
	Father	0.13	0.09	0.08		0.11	0.05	

Source- Cawley, R. H., McKeown, T., & Record, R. G. (1954). Parental stature and birth weight. *American journal of human genetics*, *6*(4), 450-453

Table 1.6 Correlation Between Infant Weight and Parental Height

Sex of Infants	Correlation Between Birth weight and Height of	Smethwick Data								
		Total	6 Corrected for height of other parent	Total	9 Corrected for height of other parent	Total	12 Corrected for height of other parent	Total	24 Corrected for height of other parent	SE
Males (328)	Mother	0.22	0.21	0.19	0.19	0.20	0.19	0.20	0.19	0.06
	Father	0.13	0.11	0.12	0.11	0.14	0.12	0.14	0.12	
Females (297)	Mother	0.20	0.18	0.20	0.18	0.21	0.18	0.25	0.22	0.06
	Father	0.10	0.06	0.13	0.10	0.15	0.11	0.18	0.14	
Both Sexes (625)	Mother	0.20	0.18	0.19	0.17	0.19	0.18	0.22	0.20	0.04
	Father	0.11	0.09	0.13	0.10	0.14	0.12	0.16	0.13	

Source- Cawley, R. H., McKeown, T., & Record, R. G. (1954). Parental stature and birth weight. *American journal of human genetics*, *6*(4), 450-453

The above studies established the relationship between parental height and offspring birth weight and birth length. The offspring's birth weight and length are significantly associated with the child's height and height at adult age (Karlberg & Albertsson-Wikland, 1995; Sørensen et al., 1999). The effect of low birth weight on adult height is mainly determined by childhood disease and nutritional intake (D. J. Barker et al., 1991).

Addo et al., 2013 examined the correlation between maternal height and Child growth at four stages of development, i.e., intrauterine, birth to age two years, age two years to mid-childhood, and mid-childhood to adulthood. This study used 7630 mother-child pair data from four cohorts (Pelotas Birth Cohort–Brazil[13], The New Delhi Birth Cohort–India[14], CLHNS–Philippines[15], BT20 Cohort–South Africa[16]) and one community trial (INTCS–Guatemala[17]).

Based on the stated data, the correlation (Table No. 1.7) between the mother's height and the offspring's height/length varies from 0.15 to 0.55 (p-0.001).

After controlling all nutritional interventions in the linear regression model, maternal height was inversely associated with the stunting of offspring at two years of age (Table 6). The prevalence ratio (PR) is 0.88 [95% CI: 0.87-0.89]. Short mothers were more likely to have a stunted child at two years (PR = 3.20 [95% CI, 2.80-3.58]) and as an adult (PR = 4.74 [95% CI, 4.13-5.44]), compared with taller mothers. Stunted offspring at two years of age was strongly associated with subsequent adult shortness (PR =12.81; 95% CI, 10.70-15.35). In conclusion, it was found that maternal height was a strong influence on offspring linear growth over a development stage and adulthood; that affects the intergenerational growth cycle (Addo et al., 2013).

[13] Victora, C. G., & Barros, F. C. (2005). Cohort profile: the 1982 Pelotas (Brazil) birth cohort study. International journal of epidemiology, 35(2), 237-242.
[14] Sachdev, H. S., Fall, C. H., Osmond, C., Lakshmy, R., Dey Biswas, S. K., Leary, S. D., ... & Bhargava, S. K. (2005). Anthropometric indicators of body composition in young adults: relation to size at birth and serial measurements of body mass index in childhood in the New Delhi birth cohort–. The American journal of clinical nutrition, 82(2), 456-466.
[15] Adair, L. S., Popkin, B. M., Akin, J. S., Guilkey, D. K., Gultiano, S., Borja, J., ... & Hindin, M. J. (2010). Cohort profile: the Cebu longitudinal health and nutrition survey. *International journal of epidemiology*, *40*(3), 619-625.
[16] Richter, L., Norris, S., Pettifor, J., Yach, D., & Cameron, N. (2007). Cohort profile: Mandela's children: the 1990 Birth to Twenty study in South Africa. *International journal of epidemiology*, *36*(3), 504-511.
[17] Stein, A. D., Melgar, P., Hoddinott, J., & Martorell, R. (2008). Cohort profile: The Institute of Nutrition of Central America and Panama (INCAP) nutrition trial cohort study. *International Journal of Epidemiology*, *37*(4), 716-720

Table 1.7 Associations Between Maternal Height (cm) and Offspring Growth Measures for 5 Cohorts (n = 7630)

Child growth measures	Partial correlations (r) (pooled all sites)*	Linear associations with maternal height, cm
		Pooled analyses (all sites)
Size at birth, Z-Scores:		**Estimate, β (95% CI)+**
Birth Weight	0.19	0.024 (0.021-0.028)
Birth length#	0.15	0.034 (0.026-0.042)
Attained Size, Z-scores:		
Height at 2	0.42	0.078 (0.074-0.083)
Height at MC[@]	0.47	0.080 (0.077-0.085)
Adult Height	0.54	0.082 (0.079-0.086)
Conditional growth, z-scores:		
Conditional height 0-2 y	0.24	0.037 (0.033-0.040)
Conditional height 2-MC	0.15	0.025 (0.021-0.029)
Conditional height MC-adulthood	0.26	0.044 (0.040-0.048)

*Pearson partial correlations adjusted for offspring sex, site, and SES. +Regression coefficients calculated from multiply imputed analyses. #Pooled estimates excluding Brazil and South Africa. All P values for partial correlation coefficients were significant at P< .001. @ MC: 48 months of age for Brazil, Guatemala, and India, 60 months of age for South Africa, and 102 months of age for the Philippines. Mother–child correlation coefficients for attained height, cm are 0.32, 0.15, and 0.54 at 2 years, MC, and adulthood, respectively. All models adjusted for offspring sex, site, and SES (household wealth in quintiles), childbirth order, and nutrition supplementation. Mother–child adjusted linear associations for attained adult height cm β= 0.568 (95% CI: 0.546-0.590
Source:- Addo, O. Y., Stein, A. D., Fall, C. H., Gigante, D. P., Guntupalli, A. M., Horta, B. L., ... & Richter, L. M. (2013). Maternal height and child growth patterns. *The Journal of pediatrics*, *163*(2), 549-554.

Table 1.8 PRs (95% CI) for Offspring Stunting and Maternal Height in 5 Cohorts (n = 7630)

Models	Adjusted PR*	
	Childhood stunting (at 2y) PR (95% CI)	Stunted adult[+] PR (95% CI)
Independent effects models		
Maternal height, Cm	0.88 (0.87-0.89)	0.83 (0.82-0.84)
Short mother (<150.1 cm)	3.20 (2.80-3.58)	4.74 (4.13-5.44)
Offspring stunting at 2 y	-	12.81 (10.70-15.35)
Joint Effect models[#]		
Shorter mother	-	3.38 (2. 91-3.92)
Offspring stunting at 2y	-	10.34 (8.61-12.43)

* Estimates were calculated from 5 multiple data sets. All models have been adjusted for child sex, site + SES (household wealth), childbirth order, and nutrition supplementation. Site–sex interaction terms were tested for heterogeneity, found non-significant, and dropped from the final models
+ Stunted adult: Adult height <150.1 cm and <161.9 cm for female and male offspring, respectively.
# Models include both short mother and offspring stunting at 2 years
Source:- Addo, O. Y., Stein, A. D., Fall, C. H., Gigante, D. P., Guntupalli, A. M., Horta, B. L., ... & Richter, L. M. (2013). Maternal height and child growth patterns. *The Journal of pediatrics*, *163*(2), 549-554.

A study by Stein et al. on the same cohorts concluded that growth failure in childhood is affected by the setting in which a child grows, and to reduce that effect, the need is to reduce the prevalence of stunting by improving the nutritional environment (Stein et al., 2010).

Table 1.9 Adjusted and Mutually Adjusted RRs for the Association Between a 1- cm Increase in maternal/Paternal Height and Mortality, Anthropometric Failure Measures, and Anaemia Among Children Aged 0 to 59 Months*

	Adjusted		Mutually Adjusted for Parental Height	
	RR (95% CI)	***P* Value**	**RR (95% CI)**	***P* Value**
Mortality				
Maternal height	0.978 (0.970-0.987)	<.001	0.976 (0.963-0.989	<.001
Paternal height	0.997 (0.986-1.008)	.59	1.001 (0.989-1.012)	.93
Underweight				
Maternal height	0.971 (0.968-0.974)	<.001	0.974 (0.970-0.978)	<.001
Paternal height	0.978 (0.974-0.982)	<.001	0.982 (0.978-0.985)	<.001
Stunting				
Maternal height	0.971 (0.968-0.973)	<.001	0.975 (0.972-0.979)	<.001
Paternal height	0.978 (0.975-0.981)	<.001	0.982 (0.979-0.985)	<.001
Wasting				
Maternal height	0.989 (0.989-0.994)	<.001	0.993 (0.985-1.001)	.08
Paternal l height	0.992 (0.986-0.999)	.02	0.993 (0.987-1.000)	.04
Anaemia				
Maternal height	0.998 (0.997-0.999)	.02	0.998 (0.995-1.000)	.06
Paternal l height	1.000 (0.998-1.002)	.77	1.000 (0.998-1.002)	.97

Abbreviations: CI, confidence interval; RR, relative risk.
*The models in this series of analyses are based on data sets from which children with missing information for father's height were removed. All models are adjusted for child age, sex, and birth order; maternal age at birth, marital status, occupation, and education; and household wealth, caste, religion, father's education, and urban/rural location

Source:- Subramanian, S. V., Ackerson, L. K., Smith, G. D., & John, N. A. (2009). Association of maternal height with child mortality, anthropometric failure, and anemia in India. *Jama*, *301*(16), p-1699.

Table no. 1.9[18] explained that in adjusted models, a 1 cm increase in maternal height is associated with a decrease in relative risk of child mortality by 0.978 [95% CI, 0.970-0.987; P < .001], underweight 0.971 [95% CI, 0.968-0.974; P < .001], stunting 0.971 [95% CI, 0.968-

[18] This study data is based on the National Family Health Survey third round which conducted in India during 2005-2006.

0.0973,P < .001], wasting 0.989 [95% CI, 0.984-0.994; P < .001], and anaemia 0.998 [95% CI, 0.997-0.999; P = .02]. Paternal height also produces almost similar results in the categories of underweight, stunting and wasting. Another finding of this study suggested that children from mothers whose average height was less than 145 centimetres [absolute probability (AP), 0.09; 95% CI, 0.07-0.12] were more likely to die compared who are more than 145 or at least 160 cm height [AP, 0.05; 95% CI, 0.04-0.07]. Short maternal height is associated with increase mortality and anthropometric failure among children in India. This association indicates the pathways of health transfer from future generations in between from womb to childhood. Poor nutritional status and health of mother and offspring during childhood provide favourable conditions for malnutrition indicators. The breaking of this pathway via intervention from the womb to late childhood may result in good stature (Subramanian et al., 2009).

Statistically compounded above-described studies explained the link between parental height and their offspring's birth weight, height, and stunting prevalence. However, all studies explained a causal relationship, not the pathway of how parental attributes influence offspring height. Much of the cited studies explore mother and father height and its outcome on child nutritional indicators (underweight, stunting, and wasting). Cawley et al., 1954; Murrin et al., 2012; Ramakrishnan, Martorell, et al., 1999; Venkataramani, 2011 studies showed that maternal height has more influence on child height and birth weight than that paternal height. While Pearson & Lee, 1903 concluded that parental height equally influences the offspring's height. The area of the genetic pathway that is responsible for height determinants is still open to researchers because much of the work is done based on the cause-and-effect relationship with the add-up of nutritional status and disease. The consideration of population genetics is important for the comparison of bodily traits of different communities. In the Indian context, it is more important to understand this because the Indian society defers from other countries or societies because of the existence of the caste system. The composition of caste is based on purity, and it decides the major social institutions such as marriage and family (Chakravarti, 1993; Fuller, 1979). The 15 polymorphic autosomal STR loci based 419 samples of Madhya Pradesh (Central India) showed that there was a significant pairwise genetic distance between Gond tribal and Brahmin, Rajput, Yadav and Muslim. The Yadav population significantly genetically differ from the Brahmin and Rajput (Shrivastava et al., 2017). Indo-European-speaking Bhil community from Gujarat significantly differ from the Dravidian group of South India (Chaudhari & Dahiya, 2014). The genetic evidence of the origin of the Indian caste population also shows the closeness of the upper caste with Europeans, while the lower caste

is similar to Asians (Bamshad et al., 2001). Other studies based on Madhya Pradesh show genetic variation according to the social and geography among the Brahmin, Khatri, and Dhimer caste populations (Mastana et al., 2000). A study by Majumder and Mukharjee found that there is no significant heterogeneity within the state or interstate of Northern India (Majumder & Mukherjee, 1993).

Current pieces of literature could be inferred that genetic factor does not entail strong difference on the height between different caste groups in India.

2. Environmental Factors

Environmental factors play an essential role in the determination of the final height of an individual. The environmental factors, that is, the social environment, which includes food intake, socioeconomic status, caste relationship, religions, and disease exposure, are of much significance to understanding height. As discussed previously, the final outcome of height depends on both genetic and environmental factors. Environmental factors help an individual to achieve his/her genetic potential of height.

As Max Roser stated -

> 'Breakthroughs in sequencing the human genome have allowed identification of 697 genetic variants that influence the height of an individual. Although genetics plays an important role in understanding variation within a given population, human growth can be limited by poor childhood nutrition and illness. This makes height strongly correlated with living standards and hence a good proxy for them'- (Max, 2016)

The following pages of the chapter explain the earlier work which has been done on environmental factors and it is relation to human height. Alacevich & Tarozzi, 2016, study explains the effects of an environmental factor on attaining the height growth of the individual. Based on the NFHS-3 round and Health Survey for England (HES) 1999 and 2004, table no 1.10 reveals that children born in India are significantly shorter than ethnic Indians children born in England (for significance, see column 8). The average height of white children and ethnic Indian children born in England was almost similar, and it showing not a significant difference (see columns 2, 3, and 6). However, white children are significantly taller than children born in India. Column 4 computed from pool data from ethnic Indian children and immigrant family children from Pakistan and Bangladesh (Alacevich & Tarozzi, 2016).

Table 1.10 Comparison of Children Height, Household Survey of England vs. NFHS-3, India (2005-2006)

	(1)		(2)		(3)		(4)		(5)	(6)	(7)	(8)
	India		England (HSE)						Tests of equality			
	NHFS-3		White		Ethnic Indians		Ethnic South Asians		(*p*-values)			
	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	(1) = (2)	(2) = (3)	(2) = (4)	(1) = (3)
Boys												
Age 2	84.2	4886	91.4	92	92.4	26	91.2	111	<0.001	0.554	0.435	<0.001
	-0.15		-0.58		-1.44		-0.49					
Age 3	91	4929	98.9	97	99.6	28	99.5	126	<0.001	0.677	0.964	<0.001
	-0.14		-0.48		-1.59		-0.58					
Age 4	97.9	4945	105.2	137	104.5	23	106.7	110	<0.001	0.543	0.066	<0.001
	-0.15		-0.52		-1		-0.68					
Girls												
Age 2	82.7	4438	89.5	108	88.7	18	88.9	90	<0.001	0.5	0.862	<0.001
	-0.16		-0.44		-1.07		-0.63					
Age 3	89.8	4638	97.8	96	98.8	25	99.5	108	<0.001	0.346	0.631	<0.001
	-0.16		-0.53		-0.93		-1.12					
Age 4	96.4	4451	104.9	124	104.4	22	105.6	113	<0.001	0.72	0.444	<0.001
	-0.16		-0.52		-1.29		-0.94					

Note- estimations from NFHS-3 (2005–06), HSE 1999 and HSE 2004. The means and (in parentheses) standard errors in columns 1–3 are the same used to construct In columns 5–8 we report *p*-values for tests of equality in means between the two groups specified in the column header. All estimates are calculated using survey-specific sampling weights and standard errors and tests allow for correlation within the primary stage unit of the survey.

Source- Alacevich, C., & Tarozzi, A. (2017). Child height and intergenerational transmission of health: Evidence from ethnic Indians in England. *Economics & Human Biology*, *25*, 65-84.

Indeed, half of the world's malnourish children are to be found in just three countries India, Pakistan, and Bangladesh (Ramalingaswami et al., 1996; Vulimiri et al., 1996). If these three countries are primarily responsible for the 'South Asian Enigma' and it is due to genetic origin, then the column 4 result might be helpful in the rejection of the hypothesis that the south Asian enigma is due to its genetic origin. The average height of ethnic south Asian children and white children is almost similar, and there is no significant difference (see columns 2, 4 and 7).

They also estimated that the average height of ethnic Indian men and women who were grown in England was shorter (about 5.1 and 6 cm, respectively) compared to white men and women. The reason behind these might be due, on average, the socio-economic and epidemiological environment is more conducive to child physical growth in England than in India. Another reason cited is that the catch-up of the height of the mother might be slow in the growing age, and it further resulted in short adult stature, which might have the possibility of shorter stature children (Alacevich & Tarozzi, 2016).

2.1 Socioeconomic Factors

Socio-economic factors play a vital role in human stature because household characteristics (number of siblings, occupation, class, locality, and among other things) affect height through nutrition and disease (Bailey et al., 2016). The number of children in the family, the effect of locality regarding overcrowding, and industrial areas are well documented. The number of siblings and overcrowding have an inverse relationship with height. The number of siblings affects height via- the trade-off between quality and quantity of food that described that the quantity (number) of children is larger than the quality (regarding health) of food is reducing due to an increase in the share of food (ibid).

A sociological understanding of height is also necessary when we are dealing with human life because humans live in a society, and every society has pre-defined roles and responsibilities for each and every individual based on their occupation, caste, religion, gender, and among other things. The social stratification based on caste, occupation, religion and gender might lead to inequality within the group that will mostly affect their access which is needed to survive the quality of life. The association between height and socioeconomic factors could be assessed by establishing a link with caste, religion, gender, income, and occupation.

2.1.1 Caste and Religion

The study of caste factors is important for understanding the variation in average height in the Indian context. Caste-based discriminations are one of the significant barriers for lower caste people to get opportunities in a different field. Caste is not merely an overview of the social stratification that explains differences, hierarchy, a division of labour and endogamy in Indian society. At the same time, caste is itself an ideology and practice that support inequality and oppression (Jogdand et al., 2016). Caste is a major root of socio-economic determinants in India that leads to inequality in all aspects of life (Baru et al., 2010). Religions also play an important role in the determination of child health regarding food restriction and relation-based discrimination where particular religions have a majority (Brainerd & Menon, 2015).

Table 1.11 Distribution of Mean Height According to Social Group (Age Group 20-60 years), 2019-21

	Men			Women		
Social Category	**Height**	**SD**	**N**	**Height**	**SD**	**N**
Scheduled Caste	162.90	7.11	35099	151.23	6.20	116044
Scheduled Tribe	162.02	6.92	33475	151.50	6.05	113718
Other Backward Caste	164.11	7.34	70353	152.23	6.32	218966
None of them	165.35	7.33	41477	153.08	6.33	113411
Don't know	162.79	7.58	804	150.92	6.36	3459
Religion						
Hindu	163.86	7.29	141233	151.96	6.29	446194
Muslim	163.73	7.46	24029	152.34	6.33	71853
Christian	163.71	7.38	14459	152.63	6.16	43869
Sikh	168.69	7.04	3895	155.44	6.11	13266
Buddhist/neo-Buddhist	162.77	6.76	2799	151.25	5.90	7878
Jain	166.25	6.82	368	154.28	6.23	766
Jewish	162.35	4.62	4	154.76	1.74	5
Parsis /Zoroastrianism	160.11	6.68	15	151.71	4.96	24
No religion	160.01	5.35	86	150.42	6.05	323
Donyi-Polo	162.15	5.08	91	-	-	-
Other	160.31	7.15	2239	150.77	6.18	7360

Source: - Author's calculation from NFHS-5 round (2019-21) data by using the national sample weight.

The distribution of the average height of Indian according to their religious and caste groups (Table 1.11) shows how caste and religion are important factors influencing the final height attained. The average height of people belonging to the Schedule Tribe (ST) and Schedule Caste (SC) category are shorter than Other Backward Classes (OBC). Further, OBC is shorter than the Other Caste group. The correlation between the Social Category and average height is

strong and significant (P<0.001). The average height in a relationship with religions shows the marginal difference between the three major religions (Hindu, Muslim, and Christian). Indeed, Muslims are taller than Hindus and Christians, about 0.04 cm and 0.09 cm, respectively. Sikhs are taller than all other religious groups (average height 168.03 cm).

Average monthly per capita expenditure (MPCE) is highest in Sikhs and Christians, while Muslims have the lowest MPCE (John & Mutatkar, 2005). These show that only economic status cannot explain the variation in adult height. In various fields, variations in opportunities available to different castes explain the inter-caste variation in adult height. However, MPCE across castes in relation to heights are not available. The different caste groups explain Intra-religion variations in average adult height with wealth index (table 1.12), which explains the inequality within the social category

Table 1.12 Distribution of Mean Height and Standard Deviation of Adult Men Across Social Category and Wealth Index (Age Group 15-54 years) 2019-21

Wealth Index/ Social Category	Scheduled Caste	Scheduled Tribe	Other Backward Class	None of them	Don't know
Poorest	160.17 ±7.33	159.62 ±7.1	161.14 ±7.76	161.15 ±8.07	160.14 ±8.22
n	4026	7518	5333	1392	111
Poorer	161.68 ±7.39	160.07 ±7.36	162.08 ±7.69	162.62 ±7.69	160.96 ±8.08
n	4657	5502	7766	2800	128
Middle	162.42 ±7.65	160.79 ±7.29	163.13 ±7.72	163.6 ±7.91	163.53 ±6.85
n	4430	3443	8621	3606	118
Richer	163.79 ±7.46	161.49 ±7.12	163.96 ±7.73	164.56 ±7.84	164.02 ±7.35
n	3488	2079	8463	4482	69
Richest	165.03 ±7.78	163.28 ±7.29	165.31 ±8.03	166.07 ±7.84	166.15 ±6.91
n	2,466	818	6,383	6,108	58

Source: - Author's calculation from NFHS-5 round (2019-21) data by using of national sample weight.

2.1.2 Gender

To attain the height of British women, Indian women will take another 250 years.

Angus Deaton[19]

The trends in the average height of Indian men and women have improved over a period. However, the average improvement in height was higher in males than females (Deaton, 2008).

[19] in forward written to Where India Goes by Dean Spears and Diane Coffey

The steady improvement in the average height of women could be due to gender-based childhood discrimination. Gender-based discrimination starts at the birth of a female child and it continues for the whole life of the female; another lower nutrition intake during the growing age and teenage could slower height growth; therefore, gender description might give an additional perspective while studying height.

The recent NFHS-5 survey shows that the prevalence of stunting, wasting and being underweight was higher among boys compared to girls who are under five years of age. The lower prevalence of malnutrition among under-five girls does not mean that they got equal opportunities in a further year of the life course because more than 11.5 percent of women are shorter than 145 cm. When we see the anaemia prevalence among men and women aged 15-49 years from the same survey, it is shown that the prevalence of mild anaemia is 5 point percentage among women, and the prevalence of moderate anaemia is higher about seven times higher compared to men. The percentage of specific food[20] consumption at least once a week is higher in men compared to women. The data of adult mortality due to medical reasons is also higher in women compared to men. The morbidity and its relationship with gender elucidate that women face higher physical stress due to the triple burden of work such as work at household, outside the household, and reproduction that affects the health of women in various forms. The physical stress is higher at working place as compared to their native place (migrated workers). The reason is the nature of their work besides caring for children, and in a patriarchal society, women have the pre-defined role of taking care of their children and men are perceived as earning members only.

The other studies also explain maternal education (Frost, Michelle Bellessa & Haas., 2005) 2005), occupation, health status (Kanjilal et al., 2010), and social status (Coffey, 2015; Coffey, Spears, et al., 2013; Ramalingaswami et al., 1996) have a significant relationship with child nutritional status, and the indices of malnutrition which are inversely associated with height at adult age.

The height differentials of male and female mainly start at birth, and continues till late adulthood, and the child growth chart is the purest witness of it.

[20]Milk or curd, Pulses or beans, Dark green, leafy vegetables, Fruits, Eggs, Fish, Chicken or meat, Fish or chicken or meat, Fried foods, Aerated drinks.

2.1.3 Income

The pathway of an influence of income and height is structured through purchasing power and workload difference between manual workers and others (Priya, 2000). Higher-income groups have more purchasing power compared to lower-income groups. We can understand the correlation between height and income through a cross-sectional study based on schoolchildren from four regions (North, East, West, and South) of India. A total of 106,843 schoolchildren were recruited for this study. Out of the total children, 42,214 children (19,303 boys and 22,911 girls) were measured from the lower socio-economic strata, and 64,629 children (34,411 boys, 30,218 girls) from the upper socio-economic strata. The upper and lower socio-economic strata decided based on fee-paying and non-fee-paying, respectively.

Table 1.13 Comparison of Weight, Weight and BMI Centiles (3rd, 50th and 97th) of Lower Socioeconomic Strata (LSES) *v.* Upper Socioeconomic Strata (USES) Schoolgirls and Schoolboys at Ages 3, 10 and 18 years

Age (years)	LSES boys			USES boys			LSES girls			USES girls		
	3rd	50th	97th	3rd	50th	97th	3rd	50th	97th	3rd	50th	97th
					Height (cm)							
3	88	97	109	91	101	112	87	96	112	90	100	111
10	118	133	149	125	139	152	119	133	147	126	140	152
18	155	169	182	160	174	186	147	155	165	149	159	168
					Weight (kg)							
3	11	14	18	11	14	21	10	13	19	10	14	21
10	19	26	40	23	33	53	19	27	39	23	34	53
18	41	55	78	46	66	99	37	47	63	41	56	80

Source- Marwaha, R. K., Tandon, N., Ganie, M. A., Kanwar, R., Shivaprasad, C., Sabharwal, A., ... & Narang, A. (2011). Nationwide reference data for height, weight and body mass index of Indian schoolchildren. *The National Medical Journal of India*, (24 (5), 270.

Table 1.13 indicates boys who are 18 years old from upper socio-economic strata are 4 cm taller and 20.1 kg heavier than children from lower socio-economic strata at the 97th percentile. Similarly, girls who are 18 years old from upper-socioeconomic strata are 3.4 cm taller and 17.3 kg heavier than girls from lower socio-economic strata. The average improvement in height and weight of children is higher among upper socio-economic strata compared to lower socio-economic strata (Marwaha et al., 2011).

Komlos J. and Baur's analysis explained the complexity between the height of American and East and West Germany. The American population were being tallest in the world till world war II, and America became one of the most obese at the onset of the 21st century. In the mid-19th century, American has the advantage of the height of about 3 and 9 cm in comparison to Western and Northern European, respectively. However, at the beginning of the 21st century,

the Americans height is completely metamorphosed in comparison to people from East and West Germany (fig. 1.4 and 1.5). The Americans are shorter than Dutch, Swedes, Norwegians, Danes, British, and Germans; even the East-Germans. Americans are shorter about 2-6 cm compared above described countries, and the gap is probably slightly greater among women.

Fig. 1.4 Height of Males (cm), NHANES III and BGS ´98

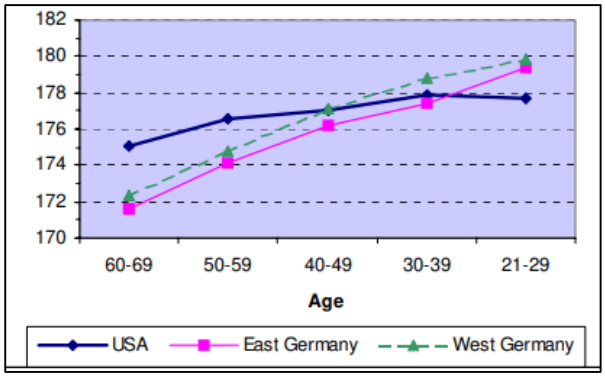
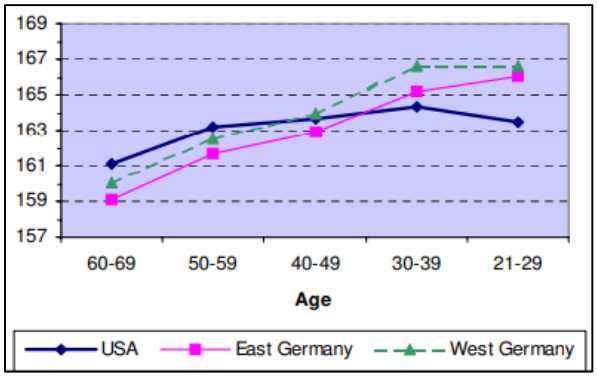


Fig. 1.5 Height Female(cm) NHANES III and BGS ´98



Source- *J. Komlos, M. Baur, From the tallest to (one of) the fattest: the enigmatic fate of the American Population in the 20th century, Economics and Human Biology 2 (2004) p. 60*

America is a high-income country with some of the most advanced medical services in the world. As discussed, the American obesity rate is one of the highest in all Organization for Economic Co-operation and Development (OECD) countries. At the same time, the life expectancy of Americans is 3.2 years less than Japan. Moreover, the infant mortality rate in the US is the highest among the OECD countries, even twice in Sweden.

The above evidence suggests that the advantage of the strong economic background of Americans has not translated into the attainment of a high level of biological well-being compared to other economically advanced countries. The Americans spend about 13.7 percent of their GNP on health, whereas Japan spends 7 percent and the UK 6 percent. The argument of the author is why American lags behind other OECD countries despite higher per capita income. The distinction between conventional conceptualizations of living standards (based on monetary aggregates) and a population's biological well-being is necessary for explaining the causes behind it.

The biological standard of living indicates how well the human organism thrives in its socio-economic and epidemiological environment. The concept generally captures the component of welfare related to the quality of life. As we know, human experience is multidimensional, and a measure of welfare should include more than the command over goods and services: it should

include health as a component of well-being, the frequency, and duration of sickness, longevity independent of income and the extent of exposure to disease. At the onset of the 21st century, the Americans are lagging the achieving the highest biological standard of living in the world, despite their higher average per capita income.

Komlos and Baur's tried to convincingly answer the question of why does the apparent economic prosperity in America manifest itself in greater-than-average weight but not in greater physical stature of the population? The plausible explanations are- i) Socio-economic inequality in America is greater than in Western Europe, and it has been continuously increasing since the end of the 20th century. The highest income or per capita GNP is just one indication of the relatively skewed income distribution. Insofar as the lower class is concerned, they have a higher tendency to obesity; the US social structure might be conducive to obesity but not to the attainment of the physical metamorphosis. It is well noted that income inequality is associated with a smaller average physical stature and with health inequality. However, the other question remains again why height within the higher income group in the US has was failed to increase in recent years? ii) the Health Care Systems in Europe provide a comprehensive health insurance coverage than in the US. In the US, the share of those who have no health insurance rose from 12.9 to 14.6 percent in 1998. Better prenatal care is an important advantage of Western European. iii) the quality of healthcare services in America is far below recommended levels in Europe. iv) In the western European welfare state, subsistence income is more or less guaranteed, which provides a more comprehensive social safety net or social security to all, including unemployment insurance. The unemployment rate is much lower in United States than in Western Europe, but only about half of the unemployed are insured and receive the benefit. So that the unemployment of parent without appropriate insurance or social security may affect the purchasing power that reflected in nutrition care. v) in the US, spatial inequality is much greater than in Europe, as characterized by the suburban–inner-city dichotomy. The role of welfare component and social security plays an essential role in determining the physical stature of an individual. Just increasing in per capita income does not mean it necessarily translates into the tallest, healthiest society and longest life expectancy (Komlos & Baur, 2004).

Anne Case and Christina Paxson studied childhood correlation of height with socioeconomic status and childhood health conditions, and child health status and socioeconomic status with

their educational attainment and occupation. They used data from the Health and Retirement Survey conducted by the University of Michigan.

Table 1.14 Determinants of Height, Education, and Occupational Choice

	Dependent variable			
	Height in inches	**Completed education**	**White collar occupation**	**White collar occupation**
Height in inches	—	0.106 (0.007)	0.010 (0.001)	0.003 (0.001)
Completed education	—	—	—	0.067 (0.001)
Childhood SES reported as "well off"	0.195 (0.073)	1.417 (0.072)	0.105 (0.013)	0.010 (0.012)
Childhood health status reported as "excellent" or "very good"	0.245 (0.045)	0.759 (0.045)	0.091 (0.008)	0.040 (0.007)
N	20,202	20,137	20,202	20,137

Notes: OLS coefficients reported with standard errors in parentheses. All regressions include a complete set of five-year age category indicators, wave indicators, and race and sex indicators. All regressions are weighted using sample weights.

Table 1.14 reported that those who are reported from a better socio-economic environment or a well-off family in their childhood are, on average, 0.20 inches taller than those who are less comfortable[21]. Nevertheless, people who reported excellent childhood health status are significantly taller in their adulthood by about 0.25 inches[22]. Excellent childhood health conditions and well-off family conditions in childhood are highly significantly correlated with education and occupation. A household with a better socioeconomic status is associated with 1.4 years of additional schooling year, and an 11 percentage point increase in the probability of white-collar occupation. In contrast, excellent childhood health conditions are associated with 0.8 years of additional schooling and increase the probability of a white-collar job by about 0.9 percentage points. The one additional inch increase in height is also associated with 11-years addition in education and increases the 0.1 percentage point probability of white-

[21] However, the relationship between well off family condition and height is not significant, p value is more than 0.05.

[22] Note- It is not possible to know whether the absence of chronic health conditions in childhood led cohort members to be taller, or whether both height and health were driven by the same underlying environmental conditions, or perhaps both. However, these results are consistent with height providing a marker of a healthier and financially more comfortable early life environment. The effects of childhood health and socioeconomic status (SES) may attach to height in regressions of the determinants of adult outcomes, if information on childhood circumstance is not available.

collar occupation. The description of Case and Paxson's study suggests that childhood environmental factors made a positive and significant impact on education and occupation, and also taller people have a higher possibility of educational attainment and in the job market (Case & Paxson, 2008).

Workload also contributes in the decline of the average height of an individual. As Ritu Priya stated that-

> 'If there is a real decline in adult heights, it indicates a serious negative change in the worker's health status as height is an outcome of nutritional consumption, workload and morbidity load. Lower heights are known to be associated with greater physical stress and higher mortality. However, the measured decrease in heights has to be interpreted with caution as an index of trend in health. It has to be considered in conjunction with (a) a significant decline in mortality rates, and (b) changes in dietary consumption, workload and morbidity. Understanding the process of this change is crucial to its interpretation. In earlier years acute food shortage was experienced annually by the Chamaars/Bairwas in the pre-harvest and harvest months. These were the summer end and monsoon months with a high load of infectious disease as well. Further, they were the most agriculturally hectic months, most demanding of time and physical energies of the labour providers. This combination of factors placed a heavy toll on health of the adults and children. Mortality was high. Added mortality occurred among the group in the not infrequent years of drought and famine which affected all villagers but more so the lowest rungs.'-(Priya, 2000)

Bozzoli et al., 2009 also found that height is widely affected by stress during early life and workload in adolescence.

2.1.4 Occupation-

Occupation or wages and height growth share a two-way relationship. Taller people earn more compared to short-statured persons (Deaton, 2007). Parental occupation is one of the major determinants of their children's height. Better occupation of parents leads to an increase in the average income of the household, and household income adds an extra slice to their purchasing power. Furthermore, it leads to increasing household food consumption. Several studies explained that food consumption or expenditure on food translated into better nutritional status (Arimond & Ruel, 2004; Casey et al., 2001). Taller people earn more than shorter. For example,

people involved in fishing are taller than those involved in menial work and pottery (Guntupalli & Baten, 2006), and similar findings have arisen from the study on the height of tribal men (Choudhary, 2020).

Study based on 1992 (679 boys and 661 girls) Vietnamese (Hanoi) school children age group 7 to 11 years; explore the relationship between parents' occupation and education with offspring height. Height, weight, and BMI were recorded for all recruited children. Most of the children were repeatedly measured after one year to obtain the average improvement in height in a particular age group. The overall occupational group is not showing any significant differences in height, weight, and BMI of children except girls. However, girls who belonged to farmers/workers' families were significantly shorter ($p<0.05$), lighter ($p<0.001$), and had lower BMI ($p<0.05$) than those mothers who belonged to a higher occupational group (governmental staff). The average height of Vietnamese children (11 years) was very close to the children from Bangkok, but an average of 6 cm and 11 cm shorter than children from Tokyo and Sweden, respectively. Surveyor doctors classified children into two categories (good general condition and bed general condition). Indeed, overall, 36 percent of children fell into bed general condition and among this higher proportion of girls than boys ($p<0.01$), and a higher proportion of girl's mothers belonged to farmers and workers' families ($p<0.01$). The higher proportion of girls in bed general condition category would be due to less care of girls compared to boys during childhood (Aurelius et al., 1996).

Case et al., (2009) found that a one-inch increase in height was associated with a 1.5 to 1.8 percent increase in wages for both men and women, respectively, among all working ages. Table 1.15[23]showed that a one-centimetre increase in height was associated with a positive increase in probit index in both men and women. In the first set of the table, 4 inches increase in height is associated with higher educational attainment. The second set of the table shows that taller people have a probability of high-skill occupation for both men and women

As Rosenberg mention in the study titled *'Height Discrimination in Employment, '* every additional inch in height is associated with a 1.8 to 2.2 percent increase in wages or roughly

[23]In this study, they examine the height earnings nexus using nine waves of panel data from the British Household Panel Survey (BHPS). Labor market outcomes for the NCDS cohort are currently available only at ages 33 and 42, and the BCS at age 30, while the BHPS annually reports on labor market outcomes of adults of all working ages. In Wave 14 of the BHPS, information was collected on adults' heights. They use this information, together with labor market data collected annually from 1997 to 2005, to analyze the association between height, education, occupation and earnings in the BHPS.

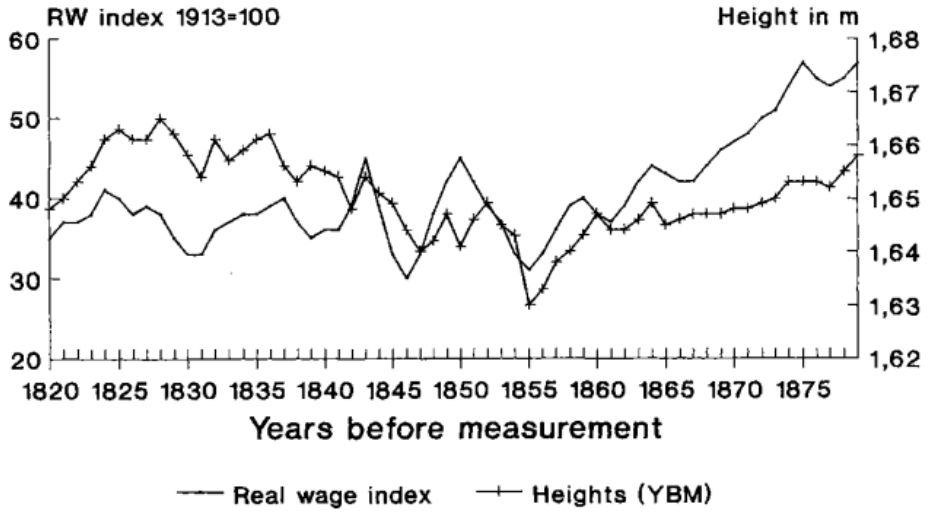
$789 income per inch per year. Moreover, 25 percent taller people get a 13 percent higher boost in median income compared with 25 percent shorter populations (Rosenberg, 2009).

Table 1.15 Education & Height and Occupation & Height in Wave 14

	Dependent variable: highest education category completed	Dependent variable: Skill level of occupation held most often between 1997 and 2005	
	Ordered Probit:	Multinomial Logit: (base outcome: Low Skill Occupation)	
	Education	High Skill Occupation	Medium Skill Occupation
	Men		
Height	0.040*** (0.006)	0.118*** (0.017)	0.055** (0.015)
Observations	3857		3673
	Women		
Height	0.038*** (0.006)	0.064** (0.018)	0.050** (0.015)
Observations	3892	3718	

Standard errors in parentheses.
***p<0.01; **p<0.05; *p<0.1.
Note: For ordered probits, the education categories are (from lowest to highest): none, CSE, O-Level, A-Level, HND/HNC, 1st degree, and higher degree. All regressions include controls for age, age squared, and an indicator that the respondent was white. If race is missing, the person is assigned a race value of "zero" and an indicator variable is included that race was missing. Results are unchanged if persons with missing race are not used in the analysis. *Source*: BHPS 1997–2005.
Source:- Case, A., Paxson, C., & Islam, M. (2009). Making sense of the labor market height premium: Evidence from the British Household Panel Survey. *Economics letters*, *102*(3), 175.

Figure 1.6 Dutch Height and Real Wages, 19th Centaury



Baten, J. (2000). *Heights and Real Wages in the 18th and 19th Centuries: An International Overview. Jahrbuch Für Wirtschaftsgeschichte / Economic History Yearbook, 41(1).* doi:10.1524/jbwg.2000.41.1.6

Figure 1.6 clearly explains that when the height of the Dutch is increased, the real wages also increase. Especially during the crisis and recoveries around the mid of 19th century, heights react very sensitively to real wages (Baten, 2000).

2.2 Nutrition

> "Nutrition is fundamental. The story of human history, reduced to essentials, revolves around the basic requirements for life"
> - Ben Crow In Eds. Tim Allen, Alan Thomas, 2000; 51)

Malnutrition in childhood is a major cause of height retardation in later life because several studies explained the relationship between nutrition and height growth (de Beer, 2012; He & Karlberg, 2001; Komlos & Baur, 2004; Lynn, 1989; Orr, 1928; Priya, 2000; T RUEL et al., 1995; Tyrrell et al., 2016; Waaler, 1984; Xueqin et al., 2004). As WHO stated -

> 'Nutrition is the intake of food, considered in relation to the body's dietary needs. Good nutrition; an adequate, well-balanced diet combined with regular physical activity – is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity'-World Health Organization.

Adequate nutrition is a basic requirement of one's body to achieve his/her genetic potential of height growth. The impact of nutrition on height growth may start as early as during the fatal life. (D. J. . Barker et al., 1993; Kusin et al., 1992; Subramanian et al., 2010). The role of malnutrition during infancy, especially stunting take place in puberty, significantly affect the final height gain in adulthood (Akachi & Canning, 2007; Steckel, 1987). Delayed initiation of breastfeeding, lack of colostrum feeding, and improper weaning practice are significant risk factors for undernutrition among under-five children, which can be resulted in slower height gain in later life (Kumar et al., 2006).

Overall, changes in the physical parameters of Indian schoolchildren related to environmental factors such as nutritional, sanitation, hygiene, transport, and income led to an increase in height. Improvement in health services also contributed to an increase in height and weight (Sharma, 2012). A study of childhood poverty estimated that the implementation of the mid-day meal program in schoolchildren also made a positive and significant impact in the

improvement in the nutritional status of both stunted and underweight (Young Lives- An International study of Childhood Poverty, 2010).

Nutrition is an umbrella category that cannot be limited to a particular variable. For example, one particular indicator cannot measure the nutritional status of an individual. It has to be needed broader measurement from various perspectives such as sociological, bio-medical, and economical, among other things. However, this literature is mostly focused on the sociological aspect of nutrition; how social determinants affect individual height through various pathways. Literature related to dietary intake and hunger is reviewed for the understanding of the link between nutrition and height.

2.2.1 Dietary Intake

> "If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have the safest way to health."- Hippocrates

Dietary intakes refer to a daily eating pattern of specific food and calories consumed and relative quantities[24]. Consumed calories or calories received from the specific food or liquid by an individual provide the energy needed for the metabolic process, recreation, work, growth and disease resistance. Lack of adequate dietary intake is not able to produce sufficient energy for bodily required metabolic and another allied processes, and the absence of sufficient energy for bodily activities like growth, recreation, disease resistance, metabolic process and among other things are unable to sustain or perform their maximum potential (Riley, 1994). Deficits in final height, compared to the genetic potential of a population, are reflections of the prior nutritional stress, and stress is linked with malnutrition. The proportion of the genetic potential of height that an individual achieve is determined by the composition of the diet and net nutrition. Optimum height gain would be achieved by an individual who takes sufficient calories regularly, as recommended or in excess of the demands of growth, work, metabolism and other claimants, and whose diet includes protein-rich foods in large quantities, especially meat and dairy products (ibid, 467-468). Akachi and Canning study based on 24 countries of Sub-Saharan Africa (among females born between 1945 to 1985) examined the relationship between nutritional intake, GDP and infant mortality rate with an average height of females in

[24]"Dietary Intake and Nutrition Status." The Gale Encyclopaedia of Senior Health: A Guide for Seniors and Their Caregivers. . Retrieved May 24, 2018 from Encyclopedia.com: http://www.encyclopedia.com/caregiving/encyclopedias-almanacs-transcripts-and-maps/dietary-intake-and-nutrition-status

adulthood. Column 1 of table 1.16 reports the effect of infant mortality rate, income per capita, protein intake and calorie intake at birth and ages 5, 10 and 15. Colum 2 of table 14 reported that infant mortality rates are not significant, while GDP per capita at ages 5 and 15 and protein intake at birth and at the age of 15 show a significant relationship with height.

Table 1.16 The Proximate Determinants of Adult Female Cohort Height

	Average cohort height			
	1	**2**	**3**	**4**
Constant	145.97 (3.02)***	146.75 (2.95)***	149.84 (2.59)***	152.66 (1.73)***
Infant mortality rate at birth	1.48 (1.21)	1.56 (1.21)	2.66 (0.47)***	2.50 (0.45)***
Infant mortality rate at age 5	2.93 (1.96)	2.70 (1.95)		
Infant mortality rate at age 10	3.13 (1.68)*	2.64 (1.63)		
Infant mortality rate at age 15	0.38 (0.96)	0.39 (0.92)	0.80 (0.56)	
GDP per capita at birth	0.12 (0.26)	0.13 (0.25)	0.15 (0.21)	
GDP per capita at age 5	0.59 (0.25)**	0.49 (0.24)**		
GDP per capita at age 10	0.37 (0.27)	0.27 (0.26)		
GDP per capita at age 15	0.89 (0.29)***	0.94 (0.29)***	1.11 (0.26)***	0.98 (0.24)***
Protein at birth	4.29 (1.68)**	3.47 (0.78)***	3.05 (0.74)***	3.07 (0.73)***
Protein at age 5	0.36 (1.56)	0.86 (0.75)		
Protein at age 10	3.71 (1.55)**	1.37 (0.693)		
Protein at age 15	0.40 (1.35)	1.10 (0.68)**	1.41 (0.60)**	1.17 (0.58)**
Calories at birth	0.04 (0.06)			
Calories at age 5	0.01 (0.05)			
Calories at age 10	0.07 (0.05)			
Calories at age 15	0.02 (0.04)			
N	438	438	438	438
R2	0.958	0.958	0.956	0.956

Data from 24 countries. Coefficients estimates with standard errors in parentheses, significance level indicated as *10%, **5%, ***1%. We include a fixed effect for each country and time dummies. Each observation is weighted by the number of heights used to calculate the cohort average height. The infant mortality rate is deaths (per 10 births) before age 1, while protein is 100g per day per person, and calories 100 calories per day per person. GDP per capita is in natural logarithms.

Column 3 of table 14 shows that at birth and at the age of 15 years, protein intake and GDP per capita have a significant relationship with height. Infant mortality at birth has a significant relationship, while the age of 15 shows no significant relationship with adult stature. Column 4 of this table shows that 100 per 1000 increase in infant mortality is associated with a 2.5 cm decrease in the average height of an adult, while a one percentage increase in GDP per capita at the age of 15 years is associated with 0.98 cm increase in average adult height. 10 gm increase in protein intake at birth and at 15 years are associated with an increase in an adult height of about 0.3 cm and 0.1 cm, respectively. From the perspective of the coefficients, nutritional intake at birth are more necessary for adult height than nutrition in adolescence (Akachi & Canning, 2007).

Protein intake during the growing age has a significant impact on an average height in adulthood. Evidence from Bangladesh study reports that energy-adjusted protein from non-cereal sources (animal, pules, and vegetables) and energy-adjusted total protein was significantly associated with height and weight gain after controlling for sex, age, land ownership, diarrhoea, ARI and fiver (Torres et al., 1994). The inclusion of pulses or legume in the routine diet might be beneficial for physiological effects in the prevention and control of disease (Campos-Vega et al., 2010; Tharanathan & Mahadevamma, 2003).

Availability and consumption of dairy product in the household are significantly associated with height gain (Choudhary, 2017; Priya, 2000). The US base school children who received milk with their diet increased their weight and height by about 20 percent compared to those who did not receive milk (Orr, 1928). A two-year milk intervention trial was carried out with 757 Chinese schoolgirls aged ten years; results show that those who consumed milk with or without added cholecalciferol had significantly more height gain (Xueqin et al., 2004). A review by Rizzoli shows that the consumption of dairy products would improve bone health and reduce fracture risk in later life (Rizzoli, 2014). Jörg Baten study found a positive relationship between dairy product consumption and average height gain in Bavaria, Prussia, and France (Baten, 2009).

Mamidi et al. analysed 'Secular trends in height in different states of India about the socioeconomic characteristic and dietary intakes' based on the NFHS-3, examined the average height in India and secular changes in height about socio-economic variables collected during the survey. Residence in an urban area, higher education, belonging to 'other' (forward) caste and higher wealth index were associated with greater height for men and women. The

difference between religions and height association shows that Sikhs and Jain were taller than people from other religions. After the adjustment for the other variables, the consumption of animal sources food (meat, chicken) was not related to height. Egg consumption and increment in height were positively associated with women. The consumption of dairy products (milk and curd) with associated with greater height gain. The interstate variation occurred due to food consumption, production patterns vary by the state, and it is reflected in height as well as health care services (Mamidi et al., 2011).

Hans de Beer's systematic review and meta-analysis of controlled trials reported the impact of dairy products on a diet on height. Most of the studies were conducted since the 1990s, and other studies were conducted between 1926 and to1980 (table 1.17). These studies were conducted in Europe, the USA, China, Northern Vietnam, Kenya, Indonesia, and India. Among these, seven studies are randomized control trials, and five studies lack randomization. The reviews and meta-analysis showed moderate evidence that the level of dairy product consumption in the 19^{th} and 20^{th} centuries contributed to height growth (de Beer, 2012).

Table 1.17 Main Characteristics of Controlled Trials Included in Meta-Analysis.

	Study identification	*N*	Sex (M/F ratio)	Age (years)	Baseline heights in cm (height-for-age z-scores)a	Type and amount of supplement f	Duration of intervention (mo.)	Height change in cm (SD)b	Height change in cm per month	Energy control group?
Randomised controlled trials										
1	Baker 1980	581	M + F (1.06)	8	IG: 123.7 (−0.49)c CG: 124.1 (−0.42)c	Milk (190 ml)	21.5	IG: 9.46 (1.68) CG: 9.18 (1.67) (S)d	IG: 0.44 CG: 0.43	N
2	Cadogan 1997	82	F (–)	12.2	IG: 151.7 (−0.07) CG: 152.9 (0.10)	Milk (568 ml)	18	IG: 8.8 (3.78) CG: 8.2 (2.95) (NS)d	IG: 0.49 CG: 0.46	N
3	Chan 1995	48	F (–)	11.1	IG: 145.6 (0.01) CG: 148.0 (0.37)	Milk, yoghurt or cheese	12	IG: 7.8 (2.40) CG: 7.4 (1.68) (NS)	IG: 0.65 CG: 0.62	N
4	Cheng 2005	195	F (–)	11	IG: 144.4 (0.05) CG: 145.5 (0.22)	Cheese	24	IG: 13.1 (0.43) CG: 12.7 (0.44) (S)	IG: 0.55 CG: 0.53	N
5	He 2005	402	M + F (1.17)	3.3	IG: 101.0 (0.88) CG: 100.8 (0.83)	Yoghurt (125 g)	9	IG: 5.43 (0.69) CG: 5.24 (0.76) (S)	IG: 0.60 CG: 0.58	N
6	Lampl 1978	86	M + F (2.58)	8–13	IG: 113.5 (−3.87) CG: 114.3 (−3.74)	Skim milk powder (ca 55 g)	8	IG: 3.45 (0.71) CG: 1.75 (0.93) (S)	IG: 0.43 CG: 0.22	N
7	Lien 2009	454	M + F (1.09)	7–8	IG: 117.4 (−1.66) CG: 116.8 (−1.77)	Milk (500 ml)	6	IG: 3.6 (4.8) CG: 3.2 (5.6) (NS)	IG: 0.60 CG: 0.53	N
8	Aykroyd 1937	122	M (–)	±12	IG: 144.7 (−1.07) CG: 142.7 (−1.34)	Skim milk (255 ml)	3.3	IG: 1.55 (1.59)e CG: 0.89 (0.91)e (S)	IG: 0.47 CG: 0.27	Y
9	Bailey 1962	144	M (–)	7–13	All groups (age 10): 124.1 (−2.15)	Skim milk (200 ml)	12	IG: 5.12 (4.11)e CG: 5.25 (4.37)e (NS)	IG: 0.43 CG: 0.44	Y
10	Du 2004	757	F (–)	10	IG: 140.4 (0.28) CG: 140.7 (0.32)	UHT milk (330 ml)	24	IG: 13.4 (2.99)e CG: 12.2 (3.19)e (S)	IG: 0.56 CG: 0.51	N
11	Grillenberger 2003	554	M + F (1.07)	7.1	IG: 115.5 (−1.3) CG: 114.6 (−1.4)	UHT milk (ca 190 ml)	23	IG: 10.29 (3.76) CG: 10.29 (3.56) (NS)	IG: 0.45 CG: 0.45	Y
12	Morgan 1926	36	M + F (1.0)	10	IG: 128.1 (−1.58) CG: 127.1 (−1.74)	Pasteurized milk (235 ml)	3.3	IG: 1.47 (1.62) CG: 0.69 (0.85) (NS)	IG: 0.45 CG: 0.20	Y

a Reference data for calculating z-scores are from WHO (2007); sources: http://www.who.int/growthref/who2007_height_for_age/en/index.html; http://www.who.int/childgrowth/standards/height_for_age/en/index.html (accessed 04.09.10)., **b** Pooled outcomes for boys and girls. **c** IG, intervention group; CG, control group. **d** S, statistically significant ($p < 0.05$); NS, not statistically significant. **e** Standard deviation was corrected for unit of analysis error (A unit of analysis error occurs when cluster randomised trials are analysed as if individuals instead of groups were randomised resulting in too small standard errors. These errors have been corrected as follows. A design effect was calculated as: $1 + (c - 1)ICC$ where c is the average cluster size and ICC is the intracluster correlation coefficient. The standard error (with unit of analysis error) of the effect size was multiplied by the square root of the design effect. ICC was estimated 0.016. This estimate was derived from Du et al. (2005).).**f** Study number 2: whole or reduced fat; study number 3: amounts of foods not reported, but mean intake of Ca^{2+} was at least 1200 mg/day; study number 4: 110 g Edam with 17% fat and 100 g Turunmaa with 15% fat in a daily quantity equivalent to 1000 mg Ca^{2+}. Source: de Beer, H. (2012). Dairy products and physical stature: a systematic review and meta-analysis of controlled trials. Economics & Human Biology, 10(3), 303.

2.2.2 Hunger

Hunger is a major determinant that significantly affects the average height of the population (Choudhary, 2017; Zurbrigg, 1984). There are multiple factors, i.e., famine, drought, poverty, and flood, among other things, that lead to widespread hunger. Famine and drought are episodic, while hunger and poverty have endemic prevalence.

Famine is a crisis in which starvation from insufficient intake of food is accompanied with a high rate of disease. It is also associated with a sharp increase in death rates. While hunger is a long-term condition, it was rarely given attention in the media. Hunger is a silent killer and leads to more deaths than famines. **Famine-** A sharp increase in mortality arising from acute starvation and starvation-related diseases**.** Drought is one of the commonest causes of famines, along with the failure of social arrangements to deal with such a crisis situation. **Drought-** drought is generally defined as a shortfall of rain over a period- a season, a year or even longer. Shortfall or lack of rainfall leads to an inadequate supply of water for plant, human beings, and animals. Due to a drought, major water sources such as rivers, streams, lakes, the wells can go dry, and finally, a drought may result in other disasters such as famine, food insecurity, malnutrition, epidemic, and among other things (International Federation of Red Cross and Red Crescent Societies, n.d.). **Chronic hunger-** is defined in terms of sustained nutritional deprivation (Crow, 2000). In general, terms, food shortage is related to famine and felt pain from fasting indicates hunger.

The response by government and international organizations is restricted to famine because it leads to mass casualties or mass migration in search of food (ibid, 54). There is a visible difference in national and international responses to hunger and famine. Episodes of famine get more attention than chronic hunger because the trait of chronic hunger is not visible at a mass level as much as during a famine.

The United Nations World Food Program estimated that every six seconds, one child dies from hunger (Alexander, 2013). As Grameen Foundation's estimation, in 2013, 9 million under-five children died worldwide, out of which more than half died due to hunger (Grameen Foundation, n.d.). In India, Bhookh.com estimated that every day over 7000 Indians die due to hunger (Bhookh.com, n.d.). Chronic hunger is a silent killer that murders a large number of children every day worldwide, while famine gets attention much more than hunger. However, the above

explanation does not indicate that control of famine is not important, but that attention towards chronic hunger is also important.

Examples of the famines in Thailand (in the 1970s), Sudan and Somalia (in the early 1980s) recorded very high mortality in the refugee camp and distribution centres. These deaths were mostly due to the interaction between disease and undernutrition. In the camps, people resided in close quarters and had an inadequate supply of clean water. Therefore, the rate of infection was high, and due to low appetite, the immunity to infection was lower, which resulted in high mortality. A report by Toole and Waldman stated:

> 'The major causes of death-acute respiratory infections, diarrheal diseases, measles, and under-nutrition in all three study populations are largely preventable through low-cost primary health care interventions. Up to 80% of deaths in the camps in Somalia and Sudan during emergency phases were due to diarrhoeal diseases and measles alone, with major outbreaks of the latter occurring in most of the major camps in eastern Sudan and almost all the camps in Somalia. Immunization was very effective in reducing measles mortality in the Somali camps after 1980, and in 1981 immunization coverage was 86-97%, as determined by standard WHO coverage survey methods.' In 1986 the estimated coverage rate for refugee children in the country was 78 % (RHU, personal communication, September 1986). Also, in Thailand, early immunization was effective in preventing large outbreaks of measles'- Toole & Waldman, 1988, p.243)

A study by Meng and Qian examined the long-term effects of famine on the survivors in the great Chinese famine. An estimated 16-30 million people died in 1959-61 due to the famine. Table 1.18[25] reports the average effects of famine on those exposed during the famine in their childhood. The average effect of famine shows that those who were exposed to famine in-utero reduced their height by 2.8 cm, 1.4 kg weight and 0.6 years of education. While those exposed in early childhood showed that it reduced their height by 2.7 cm, 3 kg weight, 0.004 kg WFH, 12.7 hours of work per week (Meng & Qian, 2009).

[25]This paper constructs a panel of birth cohorts by matching several existing data sets: the 1% sample of the 1990 Population Census, the 1989 China Health and Nutritional Survey (CHNS), the 1% sample of the 1997 Agricultural Census, and GIS data on suitability for grain cultivation which we construct using data from the Food and Agricultural Organization's GAEZ database.

Table 1.18 The Effect of the Great Famine. Average Effects of the Famine Calculated with the Sample Mean, 2SLS Estimates on the 90th Percentile, and the Average Estimated Intensity of Famine

	Variables				
	Height (1)	Weight (2)	WFH (3)	Edu Yrs (4)	Total Work Hrs (5)
A. Coefficient for LnFampop x Born 1959-61	0.047	0.064		0.238	
B. Coefficient for LnFampop x Born 1955-58	0.045	0.138	0.0325		0.387
% Effect of famine = 2SLS Coefficient x (1 - 1959-61 cohort size/1952-54 Cohort Size)					
C. In Utero Cohort: A x -0.36	-0.017	-0.023		-0.086	
D. Early Childhood Cohort: B x0.36	-0.016	-0.05	-0.012		-0.139
Level Effect of famine = % Effect x Sample Mean					
E. Sample Mean for 90th Percentile	165.29	61.19	0.38	6.8	90.8
F. In Utero Cohort: E x C	-2.8	-1.42		-0.58	
G. Early Childhood Cohort: E x D	-2.7	-3.03	-0.0044		-12.64

Notes: Estimates in Rows (A) and (B) show 2SLS estimates on the 90th percentile. These calculations assume that absent the famine, 1959-61 cohort sizes would be equivalent to the average size of 1952-54 cohorts. P<0.005 at 5% and 1 % level of Significant.
Source:- Meng, X., & Qian, N. (2009). *The long term consequences of famine on survivors: evidence from a unique natural experiment using China's great famine* (No. w14917). National Bureau of Economic Research p. 6.

David Arnold stated the major cause of malnutrition in colonial India in his paper titled *'The 'discovery' of malnutrition and diet in colonial India'* -

> 'a well-balanced and satisfactory diet is beyond the means of a large section of the population. The poor man is forced, in order to satisfy hunger, to depend largely on the cheaper kinds of food. The lack of purchasing power is thus a most important, perhaps the most important, cause of malnutrition'- Arnold, 1994

The cause of malnutrition in India is related to poverty, which affects the purchasing power of people, and people are unable to get adequate food that they need for necessary bodily functions. Hunger during growing age made a significant impact on height in later life. Even inadequate and inappropriate nutrition would increase mortality and morbidity (McKeown et al., 1972).

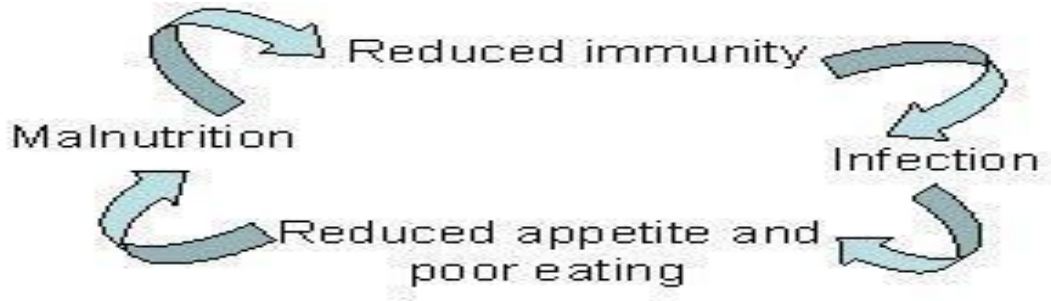
2.3 Disease- Morbidity and Mortality

> "Economists focus on income, public health scholars focus on mortality and morbidity, and demographers focus on births, deaths, and the size of populations. All of these factors contribute to wellbeing, but none of them is wellbeing. " - Angus Deaton

Mortality and morbidity directly affect the average height in the given population. Improvements in the public health and nutritional level have led to a decline in infant mortality and rising adult height (Akachi & Canning, 2008). An increasing number of any disease episodes in the given community or territory during the growing age may contribute to declining in the average height of the population.

Malnutrition is both a cause and a consequence of ill health (Atkuri, 2013; Bourke et al., 2016). Inadequate dietary intake or hunger leads to malnutrition, and malnourished persons have lower immunity, which makes them more susceptible to infections. Poor appetite during the illness episode reduces their body weight, which further affects their immune system, thus making them more susceptible to infection (fig.1.7).

Fig. 1.7 Link Between Malnutrition and Ill Health



Source- **Ramani Atkuri with Jan Swasthya Sahyog, from** http://fojss.org/newsite/laypersons-guide-to-nutrition-and-malnutrition/ dated 20/07/2017

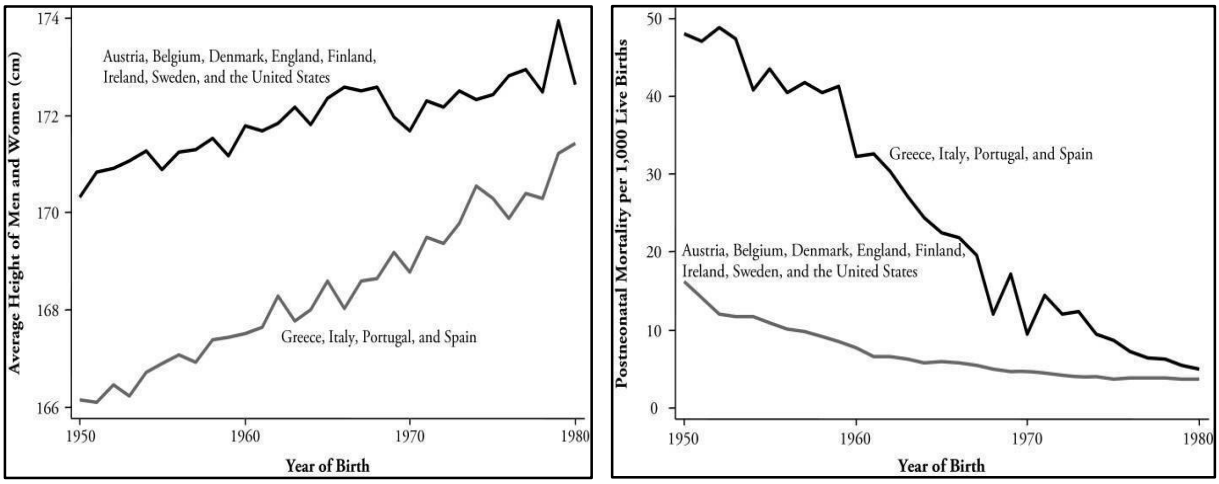
Malnutrition in children increases the risk of morbidity and mortality from many diseases, most prominently pneumonia, measles, and diarrhoea. A well-nourished child, who gets measles, will lose some body weight. S/he may also get diarrhoea and pneumonia after measles but will recover quickly. However, when children who are malnourished get measles, they get severe

diarrhoea or pneumonia, and the chance of death is higher than in well-nourished children (Atkuri, 2013). Payne, 1994 notes on the linkage between disease and undernutrition:

> "An infection can result in loss of appetite and hence initiate undernutrition; it can also result in the depletions and hence malnutrition. Dietary deficiencies on the other hand, can reduce the effectiveness of response of the body's immune system, making infection more likely and increasing its severity" (Payne, 1994, cited in Ben Crow's Understanding Famine and Hunger, edited by Tim Allen and Alan Thomas, Poverty and Development into the 21st century)

Bozzoli et al. investigated the relationship between childhood mortality and adult height from 31 cohorts (born between 1950 and 1980) from the United States, England, and ten continental European countries.

Fig. 1.8 Average Height of Men and Women (cm) and Post-Neonatal Mortality of Two Groups of Countries.

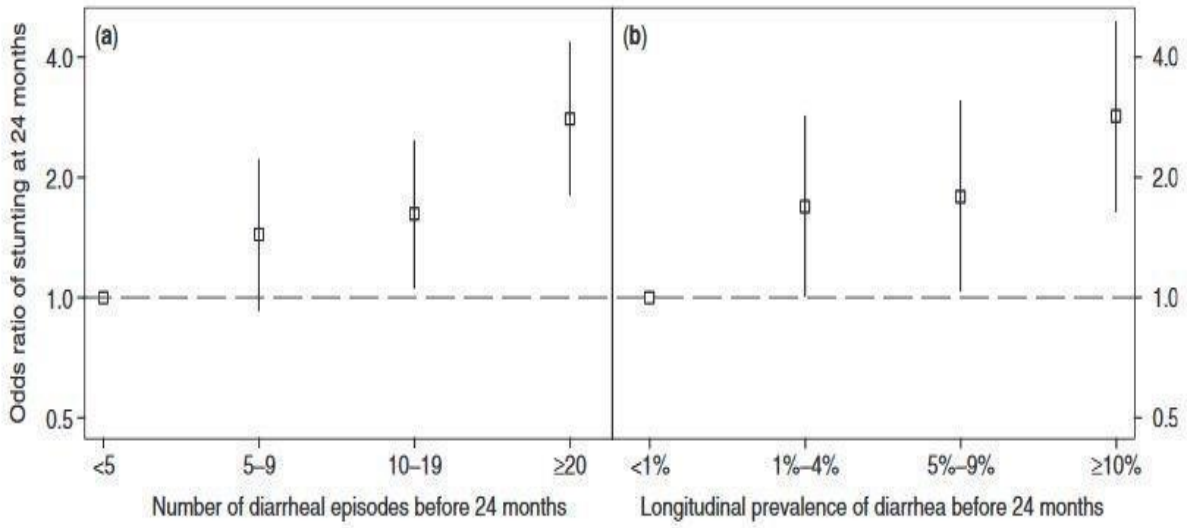


Source- Bozzoli, C., Deaton, A., & Quintana-Domeque, C. (2009). Adult height and childhood disease. *Demography*, *46*(4), 650.

Figure 1.8 shows the causal relationship between adult height and childhood mortality. they explain the pattern of height across countries and the shape of country-specific trends within the country. The pattern of Post-Neonatal Mortality (PNM) and height shows that those who were born during the lower rate of PNM are taller compared to those who were born during the peak PNM rate. In the richer countries, at the starting point, PNM rates were lower, and heights were taller, but they did not grow over time as compared to other countries described above. The pooled cross-sectional and time series data from Europe and the United States show more than 60 percent variation in adult height associated with high PNM. The fall in PNM can

account for almost all of the increase in adult height between those born between 1950 and 1980. These results suggest that a disease-free environment in early infancy led to a higher stature, and it also reflects long survival or life expectancy (Bozzoli et al., 2009).

Figure 1.9[26] Odds Ratio of Stunting at 24 Months of Age Across Categories of Diarrhoeal Incidence and Longitudinal Prevalence of Diarrhoea Before 24 Months.



Source- Checkley, W., Buckley, G., Gilman, R. H., Assis, A. M., Guerrant, R. L., Morris, S. S., ... & Childhood Malnutrition and Infection Network. (2008). Multi-country analysis of the effects of diarrhea on childhood stunting. *International journal of epidemiology*, *37*(4), 823.

Checkley et al. (fig. 1.9) analysed the effect of cumulative diarrhoea incidence on stunting, the five or more episodes of diarrhoea attributed to stunting about 25% (95% CI, 8-38%) at the age of 24 months. The longitudinal prevalence of diarrhoea on stunting, for five or more episodes of diarrhoea, was attributed to stunting, i.e., about 18% (95%CI, 1-31%) at the age of 24 months. That description from the nine studies shows that the higher burdens of diarrhoea before 24 months of the life cycle were associated with a greater risk of stunting at the age of 24 months. The best suggestions of the study were that the early prevention of diarrhoea would reduce the problem of stunting and growth retardation in later life (Checkley et al., 2008).

Another study by Deaton titled *Health, height and development* examines the international patterns of adult height growth and focuses on the link between adult height, national income, and disease. In this study result, it is interesting to see that African countries have higher disease

[26]Panel A: effect of diarrhoeal incidence before 24 months by category on the odds of stunting at 24 months. The reference group is comprised of children who had fewer than five episodes before 24 months. The squares represent estimated odds ratio and the vertical segments represent their corresponding 95% CI. Panel B: effect of longitudinal diarrhoeal prevalence before 24 months by category on the odds of stunting at 24 months. The reference group is comprised of children who had a longitudinal diarrhoeal prevalence of 1% before 24 months. The squares represent estimated odds ratio and the vertical segments represent their corresponding 95% CI.

burden and low income, but the height of Africans was taller as compared to South Asian countries.

On this puzzle, he explained one possible argument that per capita income is not a good indicator of nutrition and that African is well endowed with land compared to its population, so nutrition might be a good wager, despite low national income. Therefore, the contrast between South Asian countries and Africa would be one side has low income and a high disease burden but good nutrition, and on another side, they have good income and low disease burden but poor nutrition.

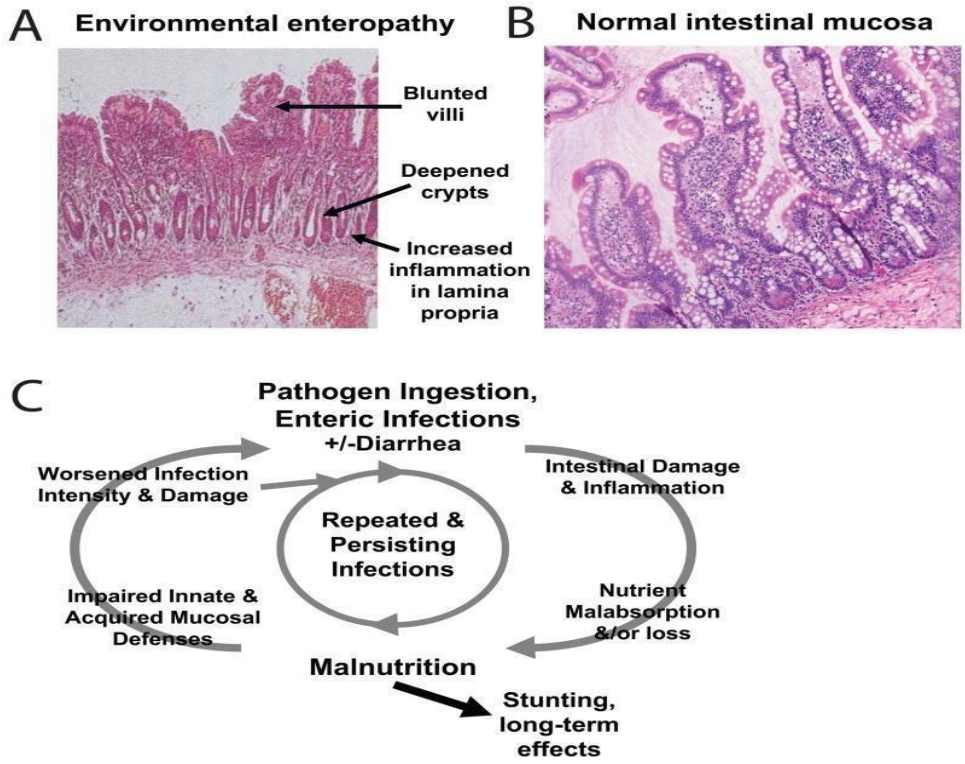
Africans are deprived in all dimensions, yet are taller than less deprived people except European and American poor people. He also states that it is not difficult to speculate about the importance of genetic differences in population. However, genetic speculate also have criticism when trying to relate international variation in height. Finally, he argued that we need to go beyond the disease burden, nutrition, and genetics to understand the international variation in height. The International pattern of the height of the adult female, i.e., the combined average height for three countries (Bangladesh, India, and Nepal), is 151.2 cm as compared to 155 cm for Latin American countries and the Caribbean. The Combined average height of five Central Asian countries (Armenia, Kazakhstan, Kyrgyz Republic, Turkey, and Uzbekistan) is 156.9 cm, and Africa is 157.8 cm, according to the 29 surveys conducted in 27 counties. Child mortality was inversely associated with height growth in the context of all countries except African countries (Deaton, 2007).

A study by DeBoer et al. suggests that enteric infections in early childhood, such as diarrhoea, are associated with the reduced capacity of absorption of macronutrients and micronutrients, and that leads to an increase in systemic inflammation of the body. The low absorption of micro and macronutrient and increase in the systemic inflammation of the body led to slow growth in later life and/or adult life.

DeBoer et al,, 2012 study indicates that low BMI and stunting are linked with the risk factors of cardiovascular disease (CVDs) and type-2 diabetes. Although the etiology of this causal relationship remains unclear, it is an assumption that both calorie deficit and infections are related to inflammation and may play a significant role in this mechanism (fig. 1.10). The prevalence of enteropathy-related growth failure and increasing rates of obesity in the developing countries, might be important contributors to further CVDs and metabolic disease

besides to impacts on cognitive and physical development. If this association is confirmed through further research, then this could bring important attention worldwide to prevent malnutrition and enteric diseases in childhood (DeBoer et al., 2012).

Figure 1.10[27]Environmental Enteropathy: Villus Atrophy and a Cycle of Infections and Malnutrition



Source- DeBoer, M. D., Lima, A. A., Oría, R. B., Scharf, R. J., Moore, S. R., Luna, M. A., & Guerrant, R. L. (2012). Early childhood growth failure and the developmental origins of adult disease: do enteric infections and malnutrition increase risk for the metabolic syndrome?. *Nutrition reviews*, *70*(11), 644.

The evaluation of the existing literature on the interaction of genetic and environmental factors with height indicates that the overall socioeconomic status of a household plays a significant role in achieving the height of an individual. The literature review of height growth and the interaction of genetic and environmental factors open up many questions for inquiry, like how the environmental factors act differently in different population groups and shape their average height

[27] Children in developing areas in the world frequently exhibit abnormalities in their intestinal mucosa referred to as "environmental enteropathy." Associated findings following on biopsy of the intestinal mucosa include villus blunting and deepened crypts (A) compared to normal mucosa (B). C. As shown in this model, these cases of environmental enteropathy are thought to be due to reciprocal relationships between malnutrition and recurrent enteric infections due in part to contaminated drinking water and poor sanitation. This cycle of undernutrition ultimately leads to poor weight gain and stunting.

Chapter-2 The Height Conundrum in The Indian Context: Exploring Intergenerational Change

2.1 Height as an Indicator of Biological and Social Well-being.

Anthropometry has been used for the longest period of time for measuring human variations in relation to surface morphology, and it is intuitively understood at the elementary level. By using anthropometry, one can easily measure human physical diversity, i.e. tall, short, fat, and thin, among other things (S. J. Ulijaszek & Mascie-Taylor, 2005). In the nineteenth century, Anthropometry has used as a tool for validating racial typology (S. Ulijaszek & Komlos, 2005). Initially, anthropometry faced challenges in classification and the idea of typology due to the dynamicity of human diversity and its production. Consequently, by the mid-twentieth century, there was a reframing of anthropometry with a newer understanding of determinants of physical human growth patterns in an evolutionary context by placing human adaptation at the centre become dominant (ibid, p-184).

The parallel stream of anthropometry was also used for the determination of physical health in terms of stature from the beginning of the eighteenth century. Much of the application of anthropometry was used in the assessment of the physical attributes of slaves in America and the recruitment of army persons in Europe and North America. From the nineteenth century onwards, it was used for the investigation of a group's welfare by using the anthropometric description in the general population (Tanner, 1981). By the third quarter of the twentieth century, the application of anthropometric characteristics embedded in epidemiological practices became a proxy for nutritional status (Jelliffe, 1966). In recent decades, it has been extended to the understanding of human welfare through the investigation of historical anthropometric data sets (S. Ulijaszek & Komlos, 2005).

Tanner suggested that anthropometry was good for the empire to assess the physique of slaves because the poor physical quality might produce an inferior quality of 'stock'[28] that did not fit in the agenda of empire and enterprise. In addition, they thought that this inferior stock might reduce if we improve environmental circumstances (Boas, 1912; S. Ulijaszek & Komlos,

[28]Linnaeus included classification of human groups within his taxonomy of species He proposed subdivisions of humanity into four 'stocks', each with particular characteristics. According to him, Homo sapiens Americanus were reddish, stubborn, and easily angered; Homo sapiens asiaticus were yellowish, greedy, and easily distracted; Homo sapiens africanus were black, relaxed, and negligent; and Homo sapiens europeanus were white, gentle, and inventive. The characters attributed to each stock placed each grouping according to the perceptions of the dominant European imperial powers of the time, and the science hat served them.

2005). In the context of the physical characteristics of the children, Boas stated that- 'the change in stature and weight increases with the time elapsed between the arrival of the mother and the birth of a child' (Boas, 1912). This comment opens the door for new areas of enquiry that we should focus on, that is, improvement in the environmental conditions like nutrition for mother and child (S. Ulijaszek & Komlos, 2005).

The primary use of anthropometrics in the social sciences began in the mid of 1970s among developmental economists and cliometricians (Komlos, 2009). However, by the 1830s, Villerme recognized that nature and socioeconomic, and environmental factors affect the biological outcome (Villermé, 1829). The interest of economists was limited to the measurement of malnutrition and its synergetic effect on economic performance (Scrimshaw, 2003). In cooperation with United Nations, developmental economists expanded their work on nutrition to combat poverty and its impact on labour productivity (Strauss & Thomas, 1998). Their effort reached a peak during the formulation of the Human Development Index in the 1990s (Komlos, 2009). Cliometricians simultaneously analysed the secular changes and cross-sectional patterns in biological welfare in order to understand the hidden effects of economic development on human growth. In other words, cliometricians were primarily responsible for extension in the field of anthropometry and deployed physical stature as a complete conventional indicator of wellbeing (Fogel, 1994; Steckel, 1995).

Developmental economists faced difficulties in measuring the living condition of workers in the 1970s, and this was a major concern for developmental economists because conventional monetary indicators do not exist in the case of housewives, children or self-sufficient peasants. Therefore, economic historians demanded the need for alternative measurements (Komlos, 2009; S. Ulijaszek & Komlos, 2005), and around the 1990s, Cliometricians introduced physical stature as a measure of biological well-being (Fogel, 1994; Steckel, 1995).

As historical trends show that developmental economists showed their interest in human growth for measuring nutritional status to extend their understanding of labour productivity because they assumed that a person with shorter stature might possibly be connected to lower economic productivity.

Anthropometry is a universally applicable, non-invasive, and inexpensive method to assess the growth, size, and composition of the human body. Anthropometry may also be used as a predictor of overall health and welfare (Kolimechkov, 2014; World Health Organization,

1995). Average height is an outcome of the overall health and welfare of the population. The maximum cumulative height of an individual of 0 to 2 years of age gain up to 80-90 cm; from 3 to 7 years up to 120 cm, 7 to 14 years age, it gains up to 160 cm; and later periods 14 to 18 is about 170 to 180 cm. The maximum height increment visible from 7 to 18 years is about 50 to 60 cm. This process of height gain could be achieved in an ideal situation (adequate nutrition and a disease-free environment) (Bogin, 1999).In national surveys[29], the measurement of height is used for assessing the nutritional status of children and the Body Mass Index (BMI)[30] of the adult.

In social sciences, Intergenerational transmission denotes the transfer of individual traits, behaviour, abilities, and outcomes from parents to their children (Lochner, 2008). Social scientists paid much attention to studying the intergenerational transmission of socioeconomic status that includes education attainment, income and earnings, fertility decision, and welfare receipts status to the next generation. They have tried to study the transmission of these attributes from the earlier generation to the current generation (ibid). Infect, the studies on whether children from poor childhood or families become poor as adults have been of great interest to policymakers (Venkataramani, 2011). The results obtained from empirical estimations of intergenerational mobility of economic factors support the argument for intergeneration transmission of poverty (Solon, 1992; Venkataramani, 2011; Zimmerman, n.d.). Recent studies concluded that education and health are possible vehicles by which economic status is transmitted across generations (Banerjee & Duflo, 2011; Venkataramani, 2011).

Economic studies have examined the various aspect of child health with respect to human capital (Currie, 2009; Currie & Stabile, 2006; Fletcher & Wolfe, 2008). Very few studies have examined the intergenerational transmission of health (Coneus & Spiess, 2012; Doyle et al., 2009). The intergenerational transmission of health can be studied at three levels; first, health is a genetic component. Second, parents and children are affected in a similar way by a shared environment[31]. Third, parents directly influence and indirectly child's health- the process

[29]NFHS-2 (1998-99), NFHS-3 (2005-2006), NFHS-4 (2015-16), NFHS-5 (2019-21) and NNMB rounds of different years.

[30] The ratio of weight in kilogram divided by the height in meter square. Initially, the Quetelet Index developed by the Adolphe Quetelet in 1832. Later Quetelet Index was termed as Body Mass Index by Ancel Keys in 1972 .

[31] Geneticists distinguish between two types of environmental effects: shared environmental effects that are due to common rearing factors such as parent's socioeconomic status, childhood nutrition, and the like; and

begins from the embryonic stage itself (Ahlburg, 1998; Coneus & Spiess, 2012). The transmission of health from parents to children is assessed through anthropometric indicators as well as disorders (Ahlburg, 1998; Akbulut & Kugler, 2007; Coneus & Spiess, 2012).

There are some of the literature available that establishes the relationship between parental height and childbirth weight and child height (Addo et al., 2013; Cawley et al., 1954; Ramakrishnan, Manjrekar, et al., 1999; Stein et al., 2010; Subramanian et al., 2009; Venkataramani, 2011). Based on these studies, the intergenerational transmission of height can be defined as the transfer of height genes and growth factors from parents to their offspring that are responsible for determining the child's genetic potential and living conditions (Socioeconomic status) would help in the final shaping of stature. In this case, understanding the influence of genetic variables is necessary to study the phenomena of height; by controlling genetic influence, the relative role of the social determinants of adult height can be studied.

2. Social Determinants of Height

The WHO commission takes a holistic view of Social determinants of health and states that-

> 'The poor health of the poor, the social gradient in health within countries, and the marked health inequities between countries are caused by the unequal distribution of power, income, goods, and services, globally and nationally, the consequent unfairness in the immediate, visible circumstances of peoples live- their access to health care, their homes, communities, towns, or cities -and their chances of leading a flourishing life. The unequal distribution of health – damaging experiences is not in any sense a 'natural; phenomenon but is the result of toxic combination of poor social policies and programs, unfair economic arrangements, and bad politics. Together, the structural determinants and conditions of daily life constitute the social determinants of health and are responsible for a major part of health inequities between and within countries'- World Health Organization, 2008,p-1

The determinations of the boundaries of the social determinants are ambiguous because social determinants are a complex phenomenon which cannot be summarized by direct pathways. Social determinants not only operate at an individual level but at the population level too

non-shared environ-mental effects that include all environmental factors not shared by individuals who were reared together, such as accidents, and adult nutrition (Ahlburg, D. (1998). Intergenerational transmission of health. *The American Economic Review*, *88*(2), 265-270.)

because people are interdependent, and every individual possesses differential social, physical and personal resources to recognise and achieve personal goals and needs of daily living and also cope with an environment (Halfon et al., 2010; Raphael, 2009). Therefore, addressing the social determinants of health is necessary for understanding health problems holistically.

3. Height of Indian and its Contemporary Debates-

The contemporary Deputy Chief of Niti Aayog, Dr. Panagariya argues that low height and weight among Indians are due to their genetic composition, and currently used nutritional anthropometry is not appropriate in the Indian context. He argued that the sample from the healthy population of Delhi did not represent the healthy children of the country (Panagariya & Bhagwati, 2013). However, the 8,440 sampled from the healthy children of Delhi was evidence (not "assumptions") for WHO's new growth reference and has been reviewed by numerous experts and government agencies over many years (Gillespie, 2013).

Panagariya explained that India has a higher proportion of malnourished children than Sub-Saharan African (SSA) countries despite lower mortality and higher economic growth. Panagariya compared India with Chad on the basis of health indicators such as mortality, life expectancy, and other nutritional indices like stunting and wasting, while he is completely silent on environmental factors such as sanitation. India has a huge open defecation problem as compared to Chad. In Chad, on average, seven people defecate in the open per square km, while in India, on average, over 200 people defecate per square km (Coffey, Deaton, et al., 2013). Similarly, in China, about 1 percent defecate in the open. In Sub-Saharan Africa and India, a large fraction of the difference in average height can be explained by the prevalence of open defecation (Coffey, Deaton, et al., 2013; Spears, 2013). Wable, 2013 noted that 'Controlling for GDP, the difference between Nigeria's 26% open defecation rate and India's 55% is associated with an increase in child height approximately equivalent to quadrupling GDP per capita'.

After three months, two weeks and six days of Panagariya paper[32] economic and political weekly published six-discussion papers written by prominent economists, paediatricians, social activists, and nutritionists in response to Panagariya and Bhagwati. In these six papers (Coffey, Deaton, et al., 2013; Gillespie, 2013; Gupta et al., 2013; Jayachandran & Pande, 2013; Lodha et al., 2013; Wable, 2013), they identified plausible factors responsible for the Indo-African

[32] 04 May, 2013 Economic and Political Weekly published a special article written by Dr. Arvind Pangariya and Jagdish Bhagwati titled "Does India Really Suffer from Worse Child Malnutrition Than Sub-Saharan Africa?"

puzzle. Indian society differs from other countries based on the 'Caste', and caste in Indian society determines occupation, employment and accessibility. While in all papers, not a single word of 'caste' is used. Indo-African puzzle could not be resolved utterly without understanding the caste factor in India; it may have a higher possibility of underestimation of important phenomena about health status.

The dynamic relationship between the genetic potential of height and socioeconomic and epidemiological environmental conditions evolves over a long time (from womb to late adulthood) of the growing phase of life and is expressed as the height of an individual. Suppression of a particular community over centuries has a higher possibility of shorter height compared to those who are oppressors, which would affect the average height of the population in the given community. Life histories shape the height that an individual achieves, and social histories of their community would shape conditions affecting life histories, which gets reflected in the average height of a population group.

Historical changes in a population group, as captured in social history (*Chapter-4 Lived Experience: A Exploration of Social History*), might provide plausible explanations for changes in height among different generations. Intergenerational change in height, when seen in relationship with the social history of the population group, offers the possibility of studying different population-level determinants of height.

4. Conceptual Framework

The height of an individual is a natural and continuous process as one cannot achieve their genetic potential in a shorter period of time. Individual height could be a good measure of the well-being of a population because height is the constitutive outcome of health and food intake during the growing age, as Komlos states-

> 'One can think of the average height reached at a particular age or of the average adult height attained by a population as a historical record of the nutritional experience of the individuals composing that population. This line of reasoning is based on medical research, which has established beyond doubt that the cumulative nutritional intake of a population has a major influence on its average height, with the epidemiological environment also playing a part. Therefore, physical stature can be used as an indicator of how well the human organism thrives in its socio-economic environment. Specifically, nutritional status-and thus height-is related to food consumption and

> therefore to real family income, and therefore to wages and to prices and therefore to the standard of living broadly conceived. Therefore, we can use height as a proxy measure for these economic variables' - (Komlos, 1991, p-353)

Indicators of health status, such as mortality and morbidity, measure the death and disease burden in a given population. Nutritional status measures through height-weight-age, MUAC, and skinfold thickness are indicators that also show the health and well-being of a population. Each indicator has its own advantages and limitations. For example, BMI is a comprehensive measurement of the nutritional status of an adult. However, those who are shorter and have appropriate weight would fall in the normal BMI category, despite being shorter. Similarly, mortality and morbidity as an indicator of health status have their own limitation regarding validations (Goldsmith, 1972). As described earlier, studies based on children's height reveal a positive association with food intake, higher socioeconomic status, and a disease-free environment. Where adult height is static, there is less possibility of further changes as it is a reflection of overall food intake, socioeconomic status and disease occurrence during the growing age.

Achieving the genetic potential of heights is dependent on environmental and social factors; in that case, emphasis on a particular phenomenon would not give a holistic understanding of the determinants of heights. While analysing the social determinants of height, it is necessary to understand the social composition of society. The variation in the adult height of an Indian might not be clearly understood without the consideration of caste as the central axis of the analysis.

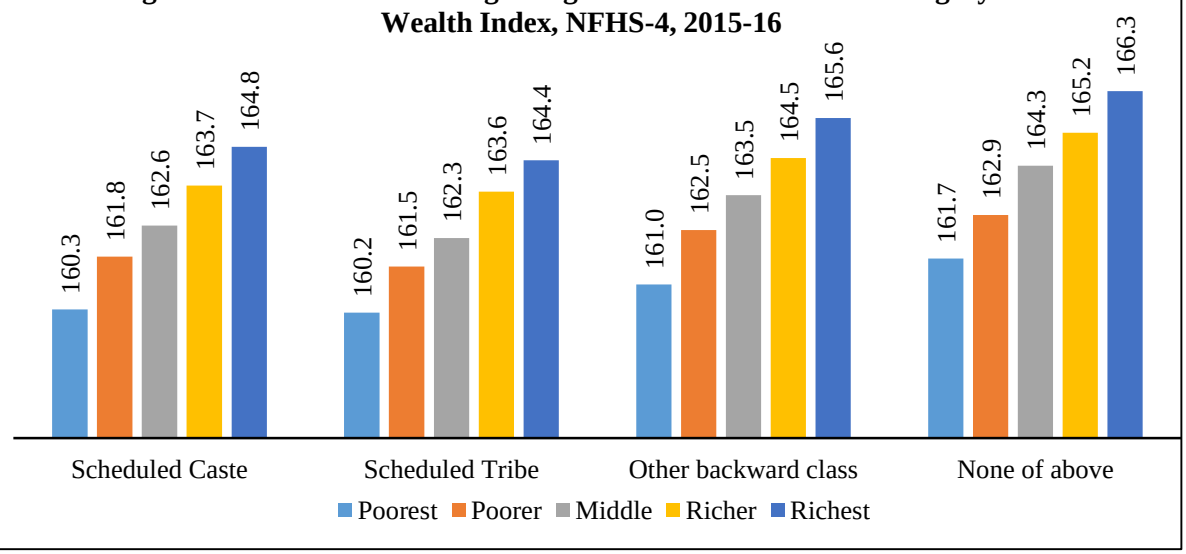
Indian society has a unique feature of social stratification known as caste (Berreman, 1972; Beteille, 1969; Srinivas & Béteille, 1964). The organization of society on caste is different from other forms of social stratification, like class, race, and gender. Class, race and ethnicity inform the debate on social factors involved in height, as the studies have done hitherto show (ARYA et al., 2002; Guntupalli & Baten, 2006; Perkins et al., 2011).

Attached to caste are human dignity and self-respect governed by the birth of an individual. An individual born into a particular caste has to face difficulties in dignified living throughout their lives, irrespective of their economic and professional status (Hoff & Pandey, 2006; Lanjouw & Shariff, 2004). In most cases, it leads to inequality in access to healthcare (Baru et al., 2010; Nayar, 2007; Pallikadavath et al., 2004; L. Singh et al., 2012), education (Naik, 1979; Nambissan, 1996), employment (Deshpande & Newman, 2007; Jain & Venkata Ratnam, 1994)

and other necessities (Bosher et al., 2007) required for realizing one's social and intellectual abilities.

Indeed, caste is not just a vertical division of society, but it is a complex interplay of religion and patriarchy. In India, people are discriminated against on the lines of religion and gender too. When religion and gender interact with caste, it formulates multiple layers of marginalization. A Dalit Muslim woman tends to face much more difficulty than a Dalit man or an upper-caste woman. A disabled Dalit man has many difficulties in getting a job than a disabled upper caste man, and these are just a few scenarios. The interplay of this axis of marginalization intersects with one individual and incapacitates them in realizing their potential. Different caste groups have their own social experience across generations. Therefore, we expect variation in the contemporary social change experienced, and also present change process would be different because of social causes.

Fig. 2.1 Distribution of Average Height of Men Across Social Sategory and Wealth Index, NFHS-4, 2015-16



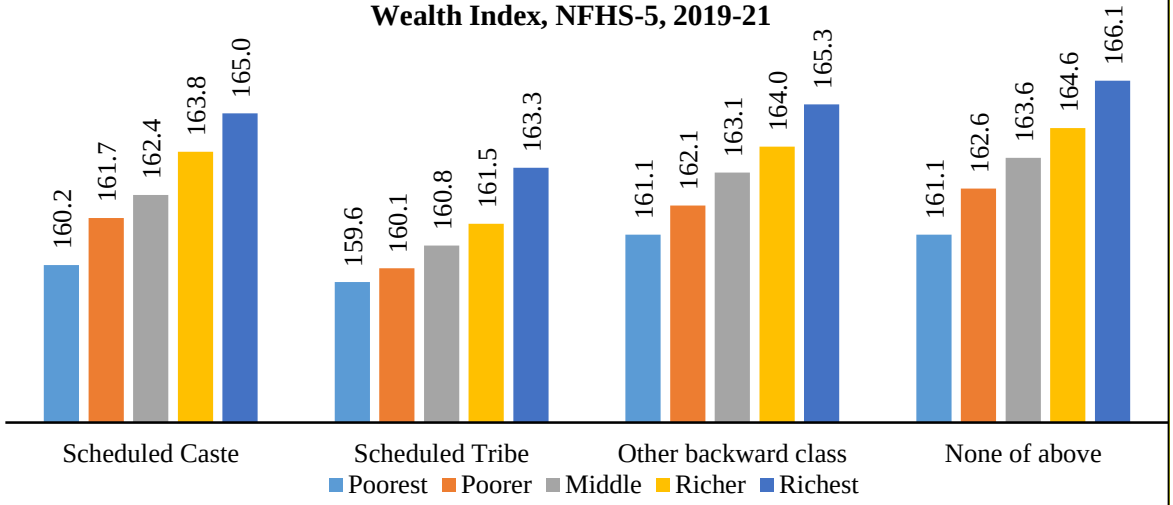
Source- Author's Calculation from NFHS-4 by using national sample weight.

Figure 2.1 (NFHS-4, 2015-16) can be used for reference; scheduled Caste (SC) category, those who belong to the richest wealth index are 4.5 cm or 3 percentage[33] taller than poorest wealth index. The average height of richest wealth index men from scheduled caste is equal to the average height of middle wealth index men from none of the above categories. The gap between the poorest and richest strata of SC increased by about 0.5 cm (the richest are 5 cms

[33] Calculation of percentage difference is [Percentage difference=100×(difference/mean of two variable)]. So, percentage difference= 100 x (4.50/162.56). Source- Cole, T. J., & Altman, D. G. (2017). Statistics Notes: What is a percentage difference?.*Bmj*, *358*, j3663.

taller than the poorest) in the NFHS-5 round (2019-21) due increase in the average height of the richest from NFHS-4 to NFHS5. The average height was a decline among the poor and middle wealth index category (figure 2.2) in the last two consecutive rounds of NFHS. The difference between the mean height of the poorest and richest wealth index in intra social category has its own sociological aspect, and here agency plays a major role. Intra-caste control on resources such as land ownership, occupation, education, and gender allows intra-caste variations in height.

Fig. 2.2 Distribution of Average Height of Men Across Social Category and Wealth Index, NFHS-5, 2019-21



Source- Author's Calculation from NFHS-5 by using national sample weight.

Studies by Alacevich & Tarozzi, 2016; Baten, 2006, 2009; Baten & Blum, 2012, 2014; Berkman et al., 2002; Bozzoli et al., 2009; Coffey, 2015; Coffey, Deaton, et al., 2013; de Beer, 2012; Deaton, 2007; Deaton & Drèze, 2009; Guntupalli & Baten, 2006; Komlos & Baur, 2004; Mamidi et al., 2011; Marwaha et al., 2011; Murrin et al., 2012; Panagariya & Bhagwati, 2013; Popkin et al., 1996; Ranabhat et al., 2016; and Subramanian et al., 2009 have expanded our understanding about the phenomenon of height in some context. However, the variables identified and discussed through the above studies do not explain the phenomenon of height sufficiently due to the selective approaches such as disease, education, food composition, income and their relationship with height. The phenomenon of height, given its nature, would require the study of the dynamics of these variables over a long period, especially during the growth phase of life. Life histories of people, especially of an intrauterine stage until adulthood, with a focus on the enquiry of different determinants of height, would further enrich our understanding of the phenomenon of height. They lack historical context, that is, how childhood situation affects later height gains.

As discussed, height is affected by genetic constitution and is affected to a significant extent by environmental factors such as adequacy and quality of food consumed, diseases and access to health care, and exposure to hazardous environmental conditions throughout early life, especially from the intrauterine stage until late adolescence. Therefore, height is a reflection of the combination of all these factors over a long period of time. Studying all these factors in relation to height at any one point of time during the life course with respect to the selective approach will give some explanation about the observed heights. However, the phenomenon of height can be better understood by understanding the life histories where all the above-mentioned factors can be studied over a long period of time, especially over a time period of life which has growth potential, i.e. from womb to late adolescence. The changes in some of the environmental factors affecting the average height of the societies can be captured through social histories.

Life histories with special reference to determinants of height, e.g. food, illness, and access to health care histories, will explain the observed heights in a better manner. Life histories are placed in the social context and linked with the social histories of the communities. Differences in heights in different societies can be attributed to different social histories.

Height differences in different societies also have been explained by attributing it to the race and/or genetic constitution of the social groups. If a given community or a social group shows changes in height over time, then much of this change in height can be attributed to the social histories with the assumption that there are no significant changes in the genetic composition of the social group. Long-term records on the height of society would be ideal for capturing the changes in height over time.

Inter-generational changes in average adult height can be explained by linking it with life histories and social history. Studying the intergenerational changes in height and its determinants can give additional insights into understanding the phenomenon of height. This study endeavoured to understand the intergenerational changes in heights and their determinants.

Intergenerational variation in height refers to the average decline or increase in height across generations. For example, if the difference in the height of the two generations is examined, there could be many adverse situations which may alter the height of an individual. i.e., the occurrence of any disease, inadequate nutrition, social histories of the village, availability of

resources like land ownership, livestock, occupation, etc. A few studies have been done on intergenerational variation in height in developed countries, and a small number of studies have been done in developing countries (Alacevich & Tarozzi, 2016; Murrin et al., 2012; Ramakrishnan, Manjrekar, et al., 1999; Subramanian et al., 2009; Venkataramani, 2011).

The historical background of food consumption and disease environment, and the social history of the community have scope to affect the height. The changes in these circumstantial factors are reflected in patterns of heights, and it gives further weightage and value to these factors as determinants of height.

This study attempted to understand the adult height, its patterns (adult heights are studied as these are the final outcome with little possibility of further change) and its determinants (an attempt is made to get a broad history of the select determinants over growing ages) by studying different population groups. The important questions that this study examined are as follows- what was the family conditions in term of food availability, quantity and quality of food consumed by adults during their growing ages? What is illness history and history of availability, accessibility and utilization of health care services among adults in their early childhood and during their growing age? What was the landholding/income/occupation of the family (to get an idea about the economic condition) during the growing age? All these questions are pertinent to the study as height gain does not ensue at the shorter stage; it is a continuous process from infancy to adulthood. Past food and health experience are more likely to reflect in the current stature of an individual.

4.1 Research Question:

In this study, I have attempted to answer the following questions

1. What are the intergenerational differences in average adult heights across various caste groups in the same geographical space, if there are any?

2. What are the determinants of intergenerational changes in average heights and how these determinants function differently in different castes?

4.2 Objectives of the Study-

The overall objective of the research is to study the phenomenon of adult height as a summary marker of nutritional and health status and its determinants among different caste groups living within the same geographical and social space.

The specific objectives are-

1. To study intergenerational changes in adult heights and its patterns among Patel, Meghwal, Salvi, and Rajput communities of Salumber block between the age group of 20-40 and 41-60 years.

2. To study the determinants of intergenerational changes in average heights of above communities through their social history.

3. To study the observed pattern of changes in height with special reference to occupation, livelihood, adequacy and quality of food, source of and access to safe drinking water, living standard, disease exposure and access to health care and any other variable identified during the study process.

Chapter-3 Methodology for Study of Intergenerational Changes in Adult Height and Its Determinants

3.1 Introduction

The term ‘social determinants of health are used to denote its contemporary meaning, which includes the circumstances in which people are born, grow up, work, live and age. These circumstances are shaped by political, historical, and economic contexts, community resources at different levels, health behaviour, and physical and social environment (Reading & Wien, 2009; World Health Organization, 2012). Similarly, height is affected by their social environmental (Baten et al., 2013; Komlos & Baur, 2004; Silventoinen, 2003); therefore, while explaining the intergenerational variation in height, the environmental factors should be taken into account for analysis. This study appraised how the social determinants affect the height attained by the individual. When control over resources is outside the agency of individuals, all aspects of their lives get affected.

My M.Phil. (2016) Work on “Intergenerational Variation and Its determinants among tribal male” based on Scheduled Tribe (ST) population. It answered questions like ‘what are the intergenerational changes in height, and how is it shaped by their life and social history?’ and ‘how opportunities and entitlements add an extra centimetre to the height?’.

In this study, 572 males from the ST community were recruited from the two sites of geo points. One site is located on the bank of Jaisamand Lake, and another site surrounds the marble mining area. Two groups of tribal communities (Bheel and Meena) from six villages were part of the study, and their height was measured and also explored the details social history of villages and the life history of respondents. Furthermore, the social history of the village and life history was corroborated with measured height. For measuring the intergenerational changes in height, two categories were created based on age. Two who are 20-40 years age group represent the current generation, and 40-60 years represent the previous generation. The intergenerational changes in the average height were analysed intra-group. Inter-group analysis was used as the reference category (to compare average height across study groups).

Study results showed that among the residents living near the banks of Jaisamand lake, there was a one-centimetre decline in height among Meena (i.e. current generation is shorter than the previous generation). However, the Bheel living near the banks showed nearly a two-centimetre increase in height as compared to their previous generation. In the current

generation, Bheel is taller than Meena. But in the previous generation, Meena was taller than Bheel. Similarly, Mining site villages showed that the current generation of Meena is significantly taller than their previous generation. Among the previous generation of Meena, those from the lake site were taller than those from the mining site, while in the current generation, this had reversed (i.e. those from the mining site were taller than those from the lake site).

The social history explained these dynamic changes in the height of Meena and Bheel from both sites. Meena was mostly involved in the cultivation and daily wage labour for livelihood, while Bheel had fewer opportunities for cultivation as they were a landless community. They were doing fishing and daily wage labour for survival. Around 1960, the Government of Rajasthan legally provided fishing rights to Bheel on the Lake, and thereafter, all community members started fishing, and fish consumption also became a part of their food basket. By selling fish to the pre-designated points, they started earning cash which increased their purchasing power. So, the fishing rights led to improvement in the overall standard of living of the Bheel community, while Meena lacked this. Mining started in the study area around 1962, and the Meena community from nearby villages started working in the mines as labourers. The availability of daily wage work at the doorstep led to an increase in their purchasing power, which translated as a significant improvement in their average height.

Giving entitlement (fishing rights and availability of employment) have increased their capability to buy food, avail better health care service, improve cultivation, etcetera. Political interventions are defined as those which improve capabilities. Giving options to people, whether it is pursued or not, is left entirely to them (Sen, 1995, 2014[34]). Bheel most benefitted from these political interventions. Entitlement of fishing rights was given to all villagers residing on the bank of the lake. But, due to their cultural and religious views, Meena was completely out of fishing occupation. So, the entitlement was there, but it was used only by a specific community and not the entire village population.

All these entitlements improved the quality of life of people who availed of these. And as suggested by embodiment pathways, improved life conditions reflected on their physical body as Nancy Krieger explained that body shape is the biological outcome of social determinants

[34] the description is from the 1999.

(Krieger, 2005; Krieger & Davey Smith, 2004). So, it can be inferred that an improvement in the living standard led to an increase in height.

3.2 About the Study Area and Groups

Salumber Thikana was part of the Sarada Sub-Division till the reconstitution of the administration of Udaipur State. After the formation of United Rajasthan in 1948, Salumber block became one of the taluka of Udaipur district (Government of India, 2011).

Salumbar and neighbouring Sarada sub-divisions went through some jurisdictional changes from 1951 to 2011, affecting their status as well as boundaries. Recently, Salumbar has been one of the 14 sub-divisions of the Udaipur district.

Due to the higher presence of the tribal population, it's come under the tribal sub-plan (TSP) (Government of Rajasthan, 2018) to manage and monitor the development of tribal areas of south Rajasthan. Salumber block shared its boundary with three districts, i.e. Banswara, Dungarpur and Pratapgarh. Salumbar sub-division is a kind of representative area of South Rajasthan in terms of its natural resource like mines as well as historical influences and consequences.

Administratively, the Salumbar sub-division is one of the twelve sub-divisions of the Udaipur district of Rajasthan (Fig 3.1). Salumber has located 70 km from the district headquarters in the southern part, and it has 54-gram panchayats covering 292 villages (table 3.1).

Table: 3.1: Administrative and Revenue Units, 2020

Administrative Units	Revenue Inspector Circle	No. of Gram Panchayats/ Municipality	No. of Patwar Mandals	No. of Villages/Wards
Jhallara Block/Sub-Tehsil	Bhabrana	10	9	55
	Jhallara	11	8	74
	Baroda	12	9	56
Salumbar Block	Kharka	10	10	41
	Salumber	10	9	46
Salumbar Town		1	1	20
Salumbar-Division	5	54	46	292

Source: Land Revenue office, Teshil Salumbar, Udaipur

Figure 3.1 Administrative Setup of Salumber Block

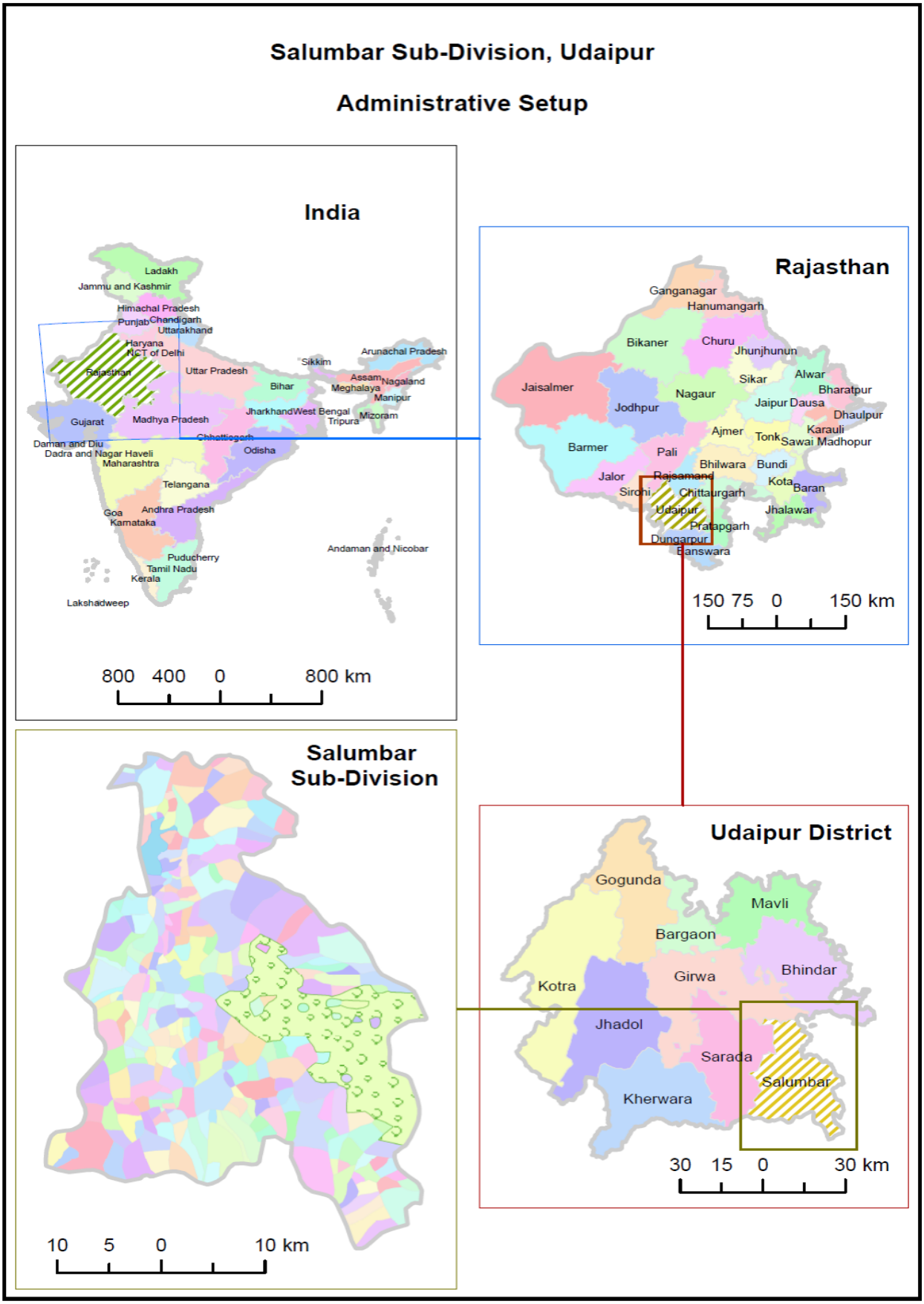
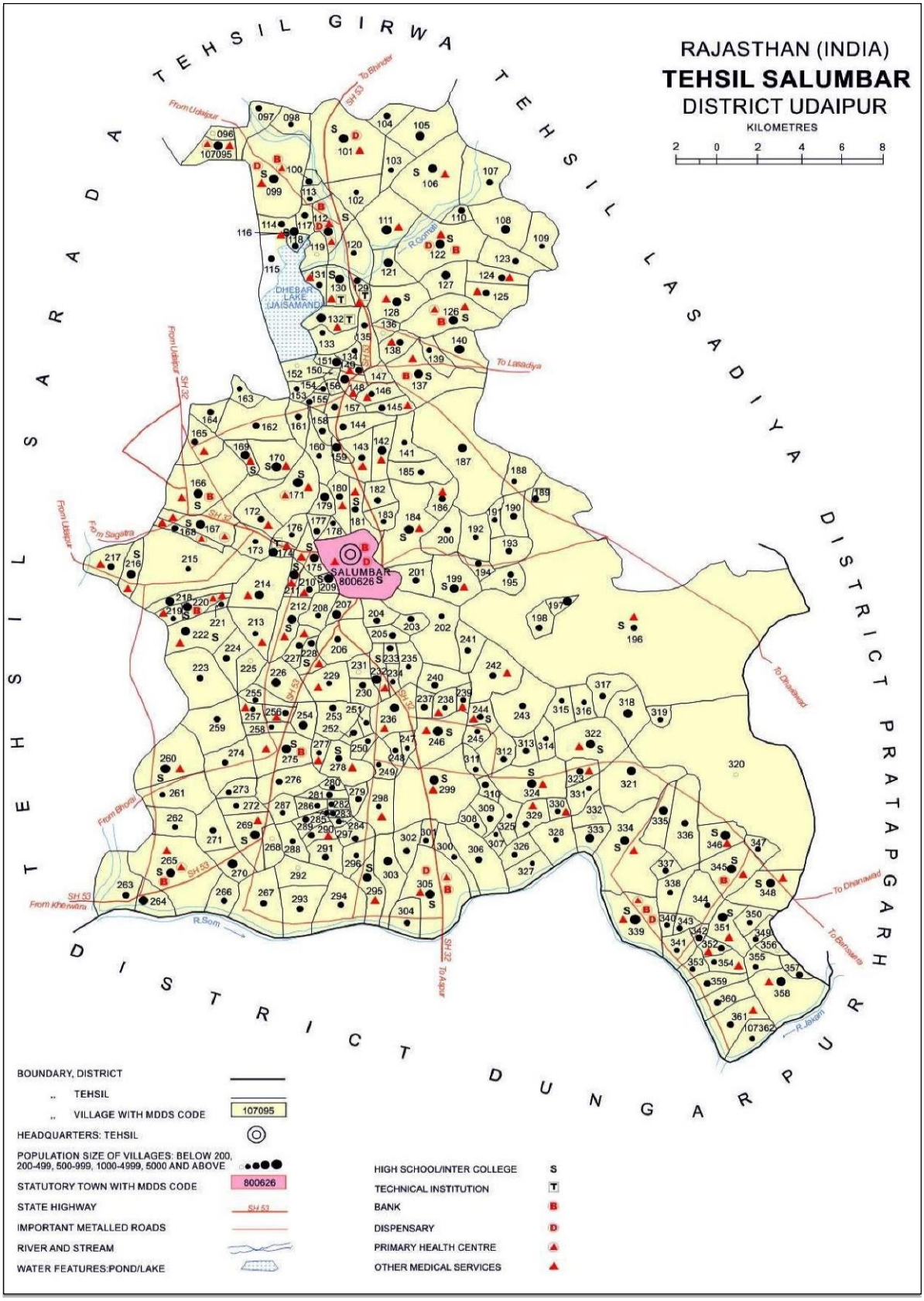


Figure 3.2 Identical Maps of Salumber Block as per Census 2011



Source: District Census Hand Book 2011, Udaipur

As per the Census of 2011, the total population of the block was 248,337 (231,912 rural and 16,425 urban), comprising 125,974 males and 122,363 females. The sex ratio of the block is 971.33 per 1000 males.

Table 3.2 Demographic Profile of Salumber Block, Census 2011

Area	Total Population	Male Population	Female Population	SC population	ST population	Non-SC/ST population
Rural	231,912	117,554 (50.69%)	114,358 (49.31%)	10,705 (4.62%)	132,047 (56.94%)	89,160 (38.45%)
Urban	16,425	8,420 (51.26%)	8,005 (48.74%)	1,835 (11.17%)	426 (2.59%)	14,164 (86.23%)
Total	248,337	125,974 (50.73%)	122,363 (49.27%)	12,540 (5.05%)	132,473 (53.34%)	103,324 (41.61%)

Source- Census of India 2011, Office of the Registrar General & Census Commissioner, Government of India

As per the 2011 census, the tribal population comprise about 53.34 percent of the total population (table 3.2). The literacy rate of the block is (57.12 percent) 8.99 point percentage lower than the state (66.11 percent). The overall literacy rate of the block among males and females is 71.92 percent and 42.08 percent, respectively. The female literacy rate is 29.84 point percentage lower than the male (Ministry of Statistics and Program Implementation, 2011).

This study endeavoured to identify determinants of intergenerational changes in height among the Rajput, Patel, Meghwal and Salvi communities in the Salumber block of the Udaipur district. As per the classification of a social group by the government of India, the Patel caste belongs to the Other Backward Class (OBC), Salvi and Meghwal belong to the Schedule Caste (SC) category, and the Rajput caste is the general caste category.

Historical analysis of the six caste groups provides initial guidance to understand the determinants that affect height gain. As discussed, every caste has a different experience of socio-economic development and caste-based advantage and disabilities. In the caste organization of Indian society, Rajput (general caste) gets more privilege than Patel (OBC), and in turn, than Bheel (tribal), Meena (tribal), Meghwal and Salvi (Dalits). Meena, Bheel and Dalits are placed in the lowest category of the social hierarchy. The Patel and Rajput communities own higher land due to their caste advantage, while Meghwal and Salvi's communities have very small pieces of or no agricultural land at all. Meena community

traditionally resided in the forests. So, they got forestland, but Meghwal and Salvi communities could not even get this opportunity.

There is a short description of the study caste written following while the details history of caste groups is described in the chapter-4 titled *"Lived Experience: An Exploration of Social History"*.

3.2.1 Patel

The Patel community is an agrarian community. Generally, the Patel community is known as the Dangi-Patel, a term applied to a well-to-do farming community. Bhattacharya and Vyas (1979) believed that the Dangis are the inhabitants of Dangs (dangs is the Sanskrit word that means high or upland) and western Khandesh (north-western corner of Deccan Plateau, in the Valley of Tapi River, Maharashtra and Madhya Pradesh). The oral traditions of the *Bhat* (a chronicler) claim that they were Yaduvanshis or Chandravanshis who originally belonged to Mathura (Uttar Pradesh) and they migrated from Mathura to Rajasthan through the Malwa region (South-east of Rajasthan and western Madhya Pradesh). At present, they are residing in Southern Rajasthan (Dungarpur, Banswara, Udaipur, Chittorgarh, Bhilwara, Kota, and Jhalawar districts of Rajasthan. The dialect of language varies to the area where they live; for example, in the Dungarpur and Banswara districts, they speak *Vagadi* (a mixture of *Mewari and Gujarati*), while rest of the area, they speak the *Mewari* language and the Devanagari script was used for both reading and writing (A. N. Bhattacharya & Vyas, 1979).

3.2.2 Rajput

With the domination of the great Thar Desert, the state of Rajasthan is a land of sand and rocks, dusty farms and plateau, river and forests. The Rajput community is the ancient ruler; they have their own governing and administrative system. The ruling states by Rajputs are titled *Rajputana* (lands of Rajputs). According to Kapil (1999), George Thomas, one of the British officers, gave these titles to Rajputs in 1800. However, everyone agrees that the British Government conferred these titles to Rajputs (Kapil, 1999). The present Rajasthan is unified at the end of 1956 after six steps of merging. Before that, Rajasthan was divided into twenty-two big and small princely states (19 big princely states and 3 *Thikanas* (Chiefship) governed by Rajput King (J. Singh, 2016). In 1947, when the princely state of Rajasthan started merging, Rajputs were not in support. When 1947 arrived, due to institutional changes, they lost their ruling power (Harlan, 1992). However, the history of *Rajputana* explores many glorifying

facts that were unconstitutional and supernatural religions with strong feudalistic tendencies, such as glorifying *Sati, Johar,* and *Parda*.

Rajput kings lost their ruling power after the independence, but they continued their governing practice until the three-quarter of the 20th century. Their status in social hierarchy gave them undue power to usurp land from the farmers and lower castes. After the implementation of The Rajasthan Land Reforms and Acquisition of Land–Owners Estates Act 1963, people got relieved from the levy that was earlier collected by the Thakurs. However, a recent example from the Dungarpur, one of a tribal district of Rajasthan, reveals that after the implementation of this act, the king or Thakur still acquired huge land compared to other communities (Dutta, 2015).

The study area is also one of the *Thikana* of Udaipur (Mewar princely state) (Harlan, 1992) and Rawat Chunda Singh was the first King of Salumber, and he was authorized to sign all documents related to Udaipur princely state (Rathore, 2018).

The other community members greet Rajput males with '*Bapu'* (a respectful way of addressing in the local language) words. As earlier collected social history reveals, the Rajput community owned landholdings of greater size than other communities have, and they owned types of machinery for irrigation and other agricultural work too.

3.2.3 Meghwal

This community identified itself as Meghwal, while neighbouring communities called themselves Meghwal or Chamar. According to Mathur (1969), The *Megh rishi* was the ancestor of this community, claiming to have the power to bring rain from the cloud by prayer. Therefore, they called themselves Meghvanshi (Mathur, 1969). The major occupation of this group was the tanning of hides from the dead animal. Most of the agricultural labour in the state comes from the Meghwal community. This community is mostly residing in Udaipur, Sirohi, Jalore, Jaisalmer, Barmer, Jodhpur, Pali, Bikaner, Ganganagar, and Nagaur districts of Rajasthan, which is notified under the Scheduled Caste category.

3.2.4 Salvi

The Salvi community in Rajasthan migrated from Gujarat. The word Salvi is traced from the *'sal' or* '*hal', which* means loom. They were engaged in the waving of '*sal'* or *'hal'* therefore, they were called *Salvi* or *Halvi.* Salvi was associated with the waving of silk in their originated

place (Mathur, 1969). The majority of the Salvi population resides in the Udaipur district in Rajasthan. They speak the Mewari dialect, and the script was Devanagari (Biswas, 1998). According to the 2011 census, the total population of the Salvi community was 85,719 in Rajasthan. The Salvi community belongs to the lower category in the social hierarchy. Salvi was included in the scheduled caste category by the Constitution (Scheduled Castes) Order, 1950 1 (C.O.19) Part XV with the effect of a previous gazette notification on August 11, 1950 (*The Government of India*, 1950).

3.3. Methodology

3.3.1 Study Design

The attempts of this study made to identify the intergenerational variation in adult height among Rajputs (General community), Patels (OBC), Meghwal (SC) and Salvi (SC) communities and the social determinants of these variations across the age groups of 20-40 years and 41-60 years. The design of this study involved the measurement of the heights of adult men. The social history of villages and communities was assessed through the key person's informal interviews with those who had witnessed the changes in food consumption, social relationship, accessibility and availability of health care services, workload and working conditions, and employment, among others things, in last 5 to 6 decades. The changes in average height were explained by the social history of the villages and caste retrospectively. Also, an enquiry of life histories of selected persons was made to understand the effects of different determinants that influence height variable, retrospectively

The difficulties in recollecting social and life histories are genuine, and there is a possibility of recall bias, but the lived experience is also important evidence. It is also important to recognize that these might not be accurate histories but an attempt to get as close responses as possible about their social/life histories while growing for identifying determinants of height.

There are three major steps followed in the study, first, assess the heights of adult men and see if there is any change over time in the average heights of adults, Second, it is to understand the determinants of this change in height over time by relating it with social histories. Third, based on the analysis of height data, few life histories were collected at an individual level. The height assessment and social history were collected simultaneously.

The study did not account for shrinking height in later age groups as the height of people starts shrinking after 50 years onward due to loss of bone density (osteoporosis), loss of muscle in

the torso, or stooped posture. The average reduction is about ¼ to ½ inch, that is, 0.635 cm to 1.27cm (Wellness, 2015). The shrinking of height after a certain age included some possibility of errors, but this is expected to affect all caste groups.

3.4 Methods for Data Collection in the Study

This study used both qualitative and quantitative approaches with equal weightage. The qualitative approach included discussion/informal interview/participatory observation of the key informants for assessing the social history of the community and village. Further, the social history was by reading it out to local persons or making them read to avoid inclusion of the value-laden perception of the researcher. The qualitative approach is also employed in in-depth interviews of adult men to understand their life histories, focusing on food consumption patterns, disease history, access to medical or health care, and livelihood patterns. The life history of the individual was constructed by interviewing him and his parents/guardians, as the individual might not provide answers to all the questions related to his childhood. For assessing the heights of adult men in the study area, along with data on other key demographic variables that are needed for understanding the different patterns of height, quantitative approaches were used.

3.4.1 Sampling

3.4.1.1 Selection of the Block-

Salumber block is selected for the study, as it has a composition of various castes and tribal groups. Further, researcher has already conducted a study on height and its determinants among tribal males in the Salumber block. During the earlier fieldwork, the researcher developed a good rapport with the local administration, and that facilitated the fieldwork.

3.4.1.2 Study population selection criteria-

Male Population with age group of 20 to 60 years-

Given the marriage practice in the region, most of the adult women are married and have spent their childhood and growing ages in their parental houses, and it has been difficult to collect information about their childhood histories in the absence of their parents or other family members who were involved with their upbringing. When you concerning that shorter stature is a major problem of public health, then both men and women should be part of the study. However, given the above reason, I excluded the women participant from the study. This could be a significant limitation of the study. Indeed, the recent national survey (NFHS-4 and NFHS-

5) showed different height growth patterns in both men and women and might have a greater possibility that if women participant was studied, then the results were provided with another dimension such height difference in gender gap that might be useful for this study.

The 20-60 years adult males were studied for this study in 2019-20. Based on the previous study and results from the social history of the villages, many structural changes happened from the 1970s onwards. On that basis, the study group (20-60 Years) was classified into two age groups, one ranging between 20-40 years and another between 40-60 years. Therefore, the age group 20-40 years represent the current generation and 40-60 years denotes the earlier/previous generation. As per the age group classification, the expected birth year of the age group of 40-60 year and 20-40 year was 1955 to 1975 and 1975 to 1995, respectively. As per the birth year, the expected growing year of 20-40 years age group was 1975 to 2015, and subsequently, 1955 to 1995 for the age group of 40-60 years. However, the year 1975 to 1995 might have a higher chance of affecting both age groups due to the structural changes at the policy level.

3.4.1.3 Selection of study unit-

Caste was the primary sampling unit of the study. Because the main themes of this study is to analyse the intergenerational variation in adult height among different caste groups. The earlier fieldwork exploration reports that the different developmental histories of the community or village, or group were a significant predictor of adult height and its variation.

The caste groups of this study were based on the differential status of land holding and occupation by members of the selected communities based on their caste status as a marker of their social history that continues to affect their present health and socioeconomic conditions. The castes studied were Rajput, Meghwal, Salvi and Patel because Meghwal and Salvi's communities have a small amount of land ownership which was not available for cultivation purposes. In contrast, the Patel and Rajput communities have much and sufficient land for cultivation. These communities are mainly cultivators. Meghwal and Salvi mostly depend on daily wages, and their traditional occupation completely disappeared.

As per the sociological aspects, different caste has their own struggle to survive, and many of caste-based disabilities lead to the different developmental history of an individual. The study answered if individuals with different developmental histories experienced in their growing age exhibit variation in their adult height.

Landholding pattern was the auxiliary purpose of the selection of these caste groups, and ownership directly affects the food production and consumption in the household. The availability of sufficient food grain in the household was a significant predictor of adult height.

3.4.1.4 Sample Size

Table 3.3 Required Sample Size for the Study of Intergenerational Variation in Adult Height of Men in Salumber block, Udaipur district

Social category	20-40 year age group		40-60 year age group		Required Sample size	
	height	SD	height	SD	20-40 year of age	41-60 year of age
SC (Meghwal and Salvi)	163.63	5.50	164.52	8.74	1057	1057
OBC (Patel)	166.35	10.51	165.16	5.12	754	754
Gen (Rajput)	165.38	7.55	167.096	6.11	254	254
					2065	2065
Total Sample size required					4130	

Results from OpenEpi, Version 3, open source calculator—SSMean (sample size calculation formula used by Open Epi from Rosner, B. (2015). Fundamentals of Biostatistics (8th ed.). United States of America: Cengage Learning.
Data source- Author's calculation from NFHS-4 , 2015-16

The Calculation of the above sample size is based on the following formula-

$$n_1 = \frac{(\sigma_1^2 + \sigma_2^2/k)\,(z_{1-\alpha/2} + z_{1-\beta})^2}{\Delta^2}$$

$$n_2 = \frac{(k*\sigma_1^2 + \sigma_2^2)\,(z_{1-\alpha/2} + z_{1-\beta})^2}{\Delta^2}$$

The notation for the formula are:

n_1 = sample size for the group 1, and n_2 = sample size for the group 2

σ_1 = standard deviation for the group 1 and σ_2 = standard deviation for the group

Δ = differences in group means, and k = ratio = n_2/n_1

$z_{1-\alpha/2}$ = two-side Z Value (ex. 1.96 for 95% confidence interval) and $z_{1-\beta}$ = power (80%)

In words, n is the appropriate sample size in each group to have a probability of 1-β of finding a significant difference based on a two-sided test with significance level α, if the absolute value of the true difference in means between the two groups is Δ, and a two-sided type 1 error of α

is used. If the sample estimates (s_1, s_2) are used as estimates of the population parameters (μ_1, σ_1^2, μ_2, σ_2^2) for each community, then ensuring an 80 percent of chance of finding a significant difference using a two-sided significance test with $\alpha = 0.05$ would require a sample size of 2065 adult men in each age group (table 3.3). The total sample size required for assessing the height measurement was 4130 people. During the data collection, I visited every household of the selected caste groups in each selected village. A total of 2626 adult men's heights were measured. As per the required sample size, it compensates about 64% men's heights were measured. The reason behind not fulfilling the required sample size was out migration for work and other purposes.

The social history of castes and villages was recorded through the key persons (men and women) from each caste group. From each caste group, thirty persons were included for collecting information on social history. A total of 120 persons were studied. Life history was based on a sample of 60 father-son dyads (15 persons in each caste group) where the dyad of father and son was available in between the age group of 20-60 years.

3.4.1.5 Selection of the villages-

The Salumber block is a tribal-dominated block, which has more than 50% tribal population and the rest of the other community. (Table 3.4 and Figure 3.3)

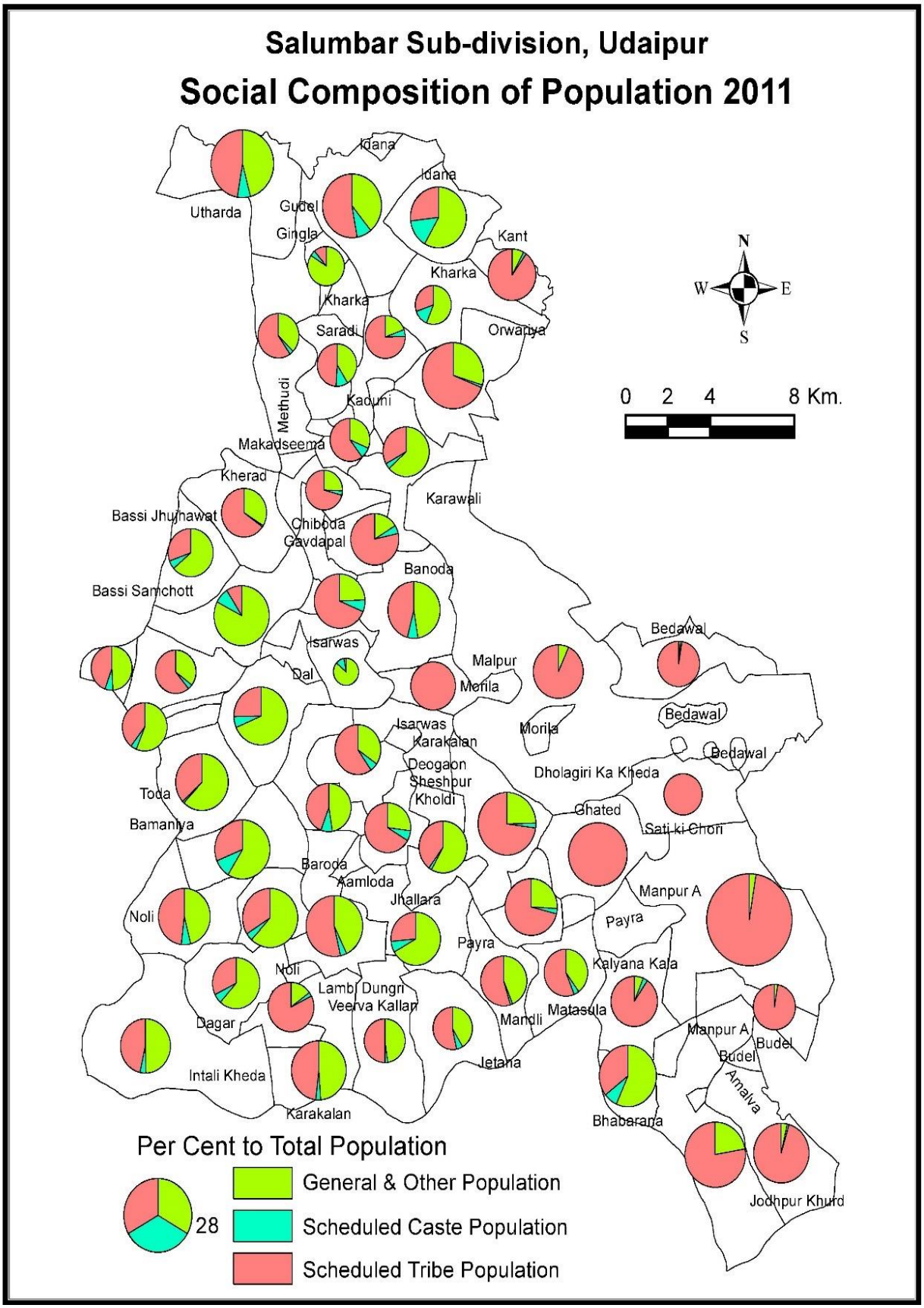
Table 3.4 Population Distribution of Rajasthan, Udaipur, and Salumber Block, Census 2011.

Regions	Total Male Population	Total Male population 21-60 years	Total Male Population ST (21-60 years)	Total Male Population SC (21-60 years)	Total Male population of Non-SC/ST (21-60 years)*
Rajasthan	51500353	11596568 (22.52%)	1858400 (16.03%)	2085855 (17.99%)	7652313 (65.99%)
Udaipur	2459994	546166 (55.96%)	305625 (55.96%)	28353 (5.19%)	212188 (38.85%)
Salumber[1]	117554		66625 (56.68%)	5502 (4.68%)	45427 (38.64%)

*[Total Male population (21-60)]-[Total ST male population 21 to 60 years + Total SC male Population 21-60 Years]

[1] Data of Salumber block according the age group of 21 to 60 years were not available. Therefore, here data is only male population of all age. Source:- Census of India 2011.

Fig. 3.3 Social Composition of the Population, Salumber 2011



The selection of the villages and respondents for the study was based on the following processors-

1. Listing of all villages with social composition from the census of 2011.
2. Identified those villages where more than 50 men from scheduled caste category recorded in the census of 2011.
3. Contacted respective Anganwadi Workers to know the household location, and number of community members in the villages who fulfil the age criteria (20-60 years)
4. Visited each household, discussed the study objectives and measured height with the help of respective Anganwadi worker and ASHA.

As followed by the above processors, 30 villages were selected for this study. Out of that, 29 villages were included, and one village was excluded from the study. The reason behind the exclusion of the village was there was less population of the Meghwal and Salvi communities. Indeed, there was a higher population of *Kalbaliya* that also belonged to the SC category. Based on the 2011 census, the exact number and percentage of the study population were described in Annexure -1

Selection of respondents for social history-

1. Selection of village and household was done akin to respondents for height measurement.
2. Interaction with older persons (men and women) in the household and discussed as per the social history checklist.
3. Researcher participated in social activities such as the death feast, marriage and birth celebration and interacted with them about their social history among the selected community.

Selection of respondents for life history-

1. Identified the dyads of father and son in households during height assessment.
2. Discussed with the parents of respondents and collected data according to the checklist of life history.

3.5.2 The Data Collection Tools

The data collection process was conducted in two steps. In the first step, the oral social history of the caste and the measurement of height were conducted simultaneously in the second step, based on the height data, where father and son dyads were selected for in-depth inquiry about the life history. The local field-level functionaries and government officials at the block level

helped me a lot in the study. The block chief medical officer (BCMO) office also issued a letter to all Anganwadi workers to help in the study during the data collection. The respective Anganwadi worker and ASHA put her much contribution to the data collection.

A portable Stadiometer with a sensitivity of +/- 1 mm was used for the measurement of the height of adult men. The Demographic and Health Survey manual for anthropometry was followed while taking the measurements (The U.S. Agency for International Development, 2012). The mobile application (ODK based) was used to collect height measurement data. No paper or pen was used for height measurement data collection. In contrast, life history and social history were collected through a semi-structural interview schedule.

3.5.3 The Data Analysis and Management

The study is both qualitative and quantitative in nature; therefore, the study analysed quantitative data using STATA version 15.0, and qualitative data based on interviews and narratives were analysed thematically. The transcriptions of the interviews of all respondents were documented and kept confidential. The anonymity of each respondent was maintained.

3.5 Sample Weight Estimation

The block sample weight was constructed to correct for inadequacies in the sample that might have the possibility of leading to bias and other departures between the sample and reference population. In other words, there are two aims of sample weight one is to compensate for unequal probabilities of selection and non-response, and another is to adjust the weighted sample distribution for key variables of interest to make it conform to a known population distribution (Yansaneh, 2003). The process of weight estimation for this study was following-

First – estimation of sample weight caste population in the village.

The total caste population (CP) was divided into the caste sample (CS) in the study. This process was followed for each caste group. The CP and CS for the Rajput, Patel, Meghwal and Salvi were CP_i, CP_{ii}, CP_{iii}, CP_{iv} and CS_i, CS_{ii}, CS_{iii}, CS_{iv}, respectively.

Caste population in the village sample weight (CSW) = $\frac{CPi}{CSi}, \frac{CPii}{CSii}, \frac{CPiii}{CSiii}, \frac{CPiv}{CSiv}$

Second- estimation of sample weight of category population (General, SC and ST) in the village

Total caste-category population (CCP) was divided the caste-category sample (CCS) in the study. This process was followed for each caste group. The CCP and CCS for the Rajput, Patel, Meghwal and Salvi were CCP_i, CCP_{ii}, CCP_{iii}, CCP_{iv} and CCS_i, CCS_{ii}, CCS_{iii}, CCS_{iv}, respectively. So, Caste-category population in the village sample weight (CSSW)

$$\text{CCSW} = \frac{CCPi}{CCSi}, \frac{CCPii}{CCSii}, \frac{CCPiii}{CCSiii}, \frac{CCPiv}{CCSiv}$$

Third- estimation of sample weight of village population in the block.

Total village population (VP) was divided the sample (VS) taken from the village. This process was followed for each village. Therefore, the village sample estimation for one village was

The village sample weight (VSW) $= \frac{VP}{VS}$, and the similar process was followed for all studied villages.

The block sample weight was not constructed because there this study is limited to the single block.

In the Next process,

Sample weight (SW) $= \frac{\text{CSW} * \text{CCSW} * \text{VS}}{higher\ value}$

Note= higher value refers that if the highest value $\text{CSW} * \text{CCSW} * \text{VS}$ are 3456 then all the sample of individual would be divided by 1000, irrespective of their lower value.

3.6 Possible Error in the Measurements of Height

Anthropometry is quick and cheap means of nutrition assessment. In this study, researcher measured the height of adult males (2-60 years) of different social groups. Predominantly, two types of measurement errors affect the quality of data collection (Habicht et al., 1979). (a) Repeated measures give the same value, and (b) measurements depart from the 'true' values. The first class error includes reliability and unreliability. Reliability is the degree of variations within a subject due to factors other than measurement errors. Unreliability refers to the Intra and inter-observer bias. The second class of error includes the term bias, validity, accuracy, and inaccuracy. Accuracy is the true value of the measurement attained. Inaccuracy is a systematic bias that may be due to the error of measurement technique and instrumental error. Validity is extended to a closer value to accuracy than given the true value of measurement (S. J. Ulijaszek & Kerr, 1999). Reading out the social history of caste by the community member

is also a possible way to check bias and errors and further triangulate with observing height patterns and life histories.

3.7 Limitations of the Study

The prime limitation of the study was that there were no women in the sample. Height is an important indicator of the physical and biological well-being of society (Baten et al., 2013; Komlos, 2009), which cannot be fully achieved without the consideration of the environment and genetic factors (Lai, 2006; Silventoinen, 2003). Patriarchy is at the base of all other forms of oppression in society (Walby, 1990). Beginning from family to workplaces to other social spheres, the systematic subjugation of women has placed them inferior to men. In fact, the condition of women in India is worse than in sub-Saharan Africa (Sen, 1992). The steadily improved or stagnant sex ratio and increasing difference in the child sex ratio show that chances of survival for women are much less than for men. Given this background, missing women on fundamental health indicators such as height limit the study to only one-half of the population.

After much deliberation, it was found that due to the patriarchal nature of marriage practices in Rajasthan, women were not available to narrate childhood history. The women we met during the field survey for my M. Phil was either living with their in-laws or was married into some other village. This makes corroborating their childhood history with their parents much more difficult.

Another was information from the life history of the respondents will determine the intergenerational changes in the community. Given the high chances of recall bias creeping into the study, questions were asked in a probing manner then the responses were corroborated by the elder members of the household, mostly the respondent's parents.

Chapter-4 Lived Experience: An Exploration of Social History

4.1 Geographical and Human Settlement

The Salumber block is characterised by a hilly region. The region is part of the Aravalli hill ranges in the south-north direction. The surface elevation of the region varies between 157 meters to 553 meters and based on the surface elevation view, Salumber block may be categorised into eight physiographic regions (See figure 4.1) (Edana hills, Karawali inter-hilly rolling plain, Jaisamand and neighbouring *roon,* Bedawal hills, Bassi-Kherad hills and plains, Sarwani inter-hilly basin, Khadela pal piedmont and Jhalara-Bhabharana plain). There is a close correspondence between physiography and slope in the region, which might affect the groundwater restoration and constitution of lake, ponds and rivers.

The selection of locations for human habitation is completely based on natural factors (availability of resources like water, land, and forest) and the magnitude of impact on their lives. Human geographers denote human habitation based on nature and magnitude of impact as 'human establishments' (Gibson, 2009; Seymour, 2016). The human establishment reveals the history of human progress and the rise or fall of human enterprises. It tells about the mobility and settlements of people, their capabilities and capacity to superimpose cultural landscape, and displacement – either due to nature or invasion (people got interested in the region and its settlements). The present distribution of settlement is a cumulative outcome of struggles with external forces (nature or people) and the process of occupation that took place in the block.

In this context, figure 4.2 represents the population size of the settlement in the block from 1941 to 2011. The absolute population of the block increased in the last seven censuses. The Gini coefficient shows that the population in the area is not distributed evenly, but this uneven distribution is showing a declining trend, in general, by 0.01 points across the censuses. However, the 2011 census, showed a 0.005-point increase. It clearly explained that the population distribution, except for the annual increment, had not changed significantly, and this might be attributed to the stagnation stage of population growth (Ola, 2021). The connectivity of settlements with the road gradually increased between 2001 and 2011 due to centrally sponsored schemes (figure 4.3). By 2011 average road connectivity increased to 83.4 percent, with a reduced variation across the different sizes of settlements (Ola, 2021).

Fig. 4.1 Surface Elevation and Physiographic of Block, Salumber

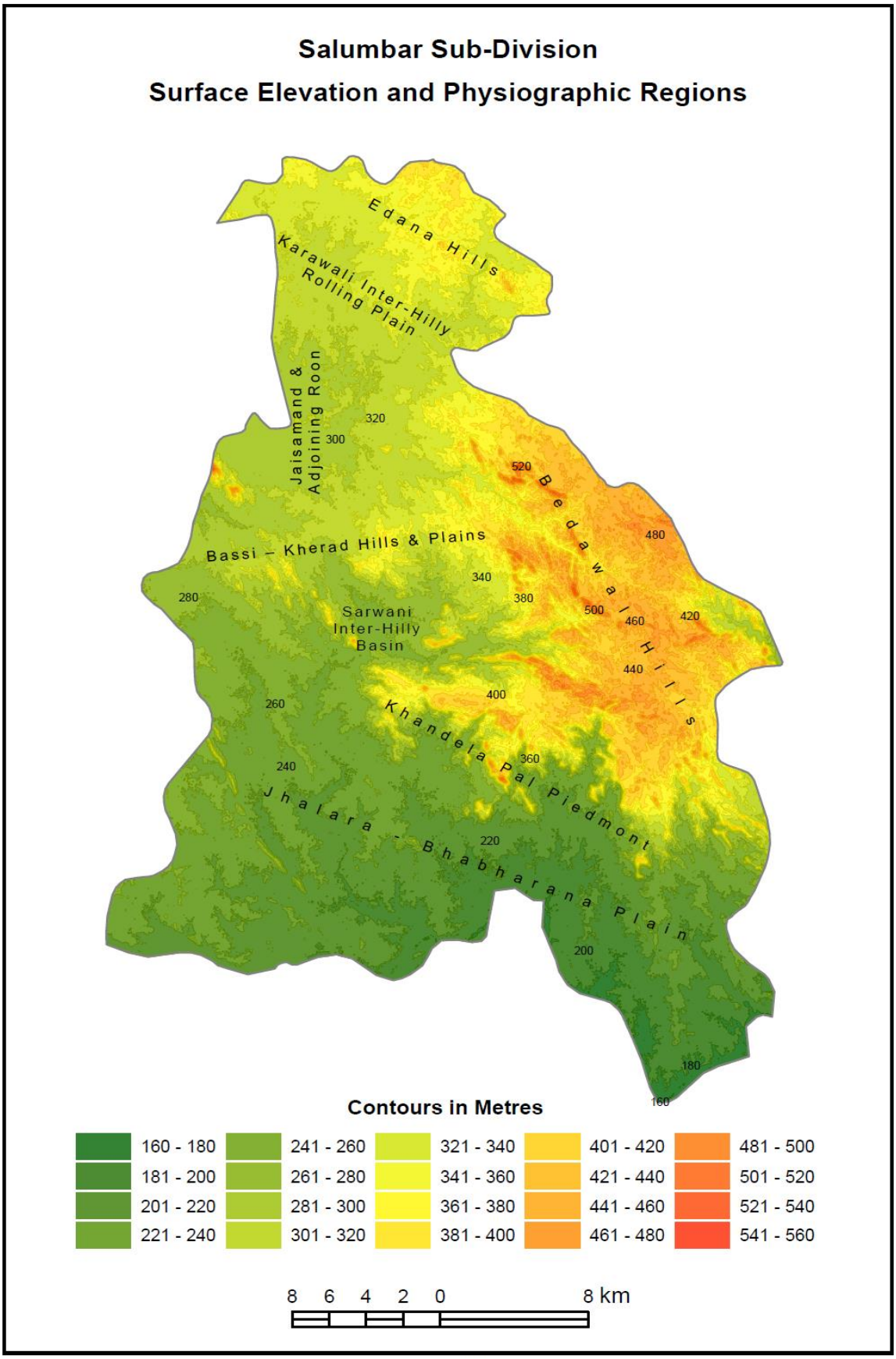


Fig. 4.2 Trends in Population Size and Settlements

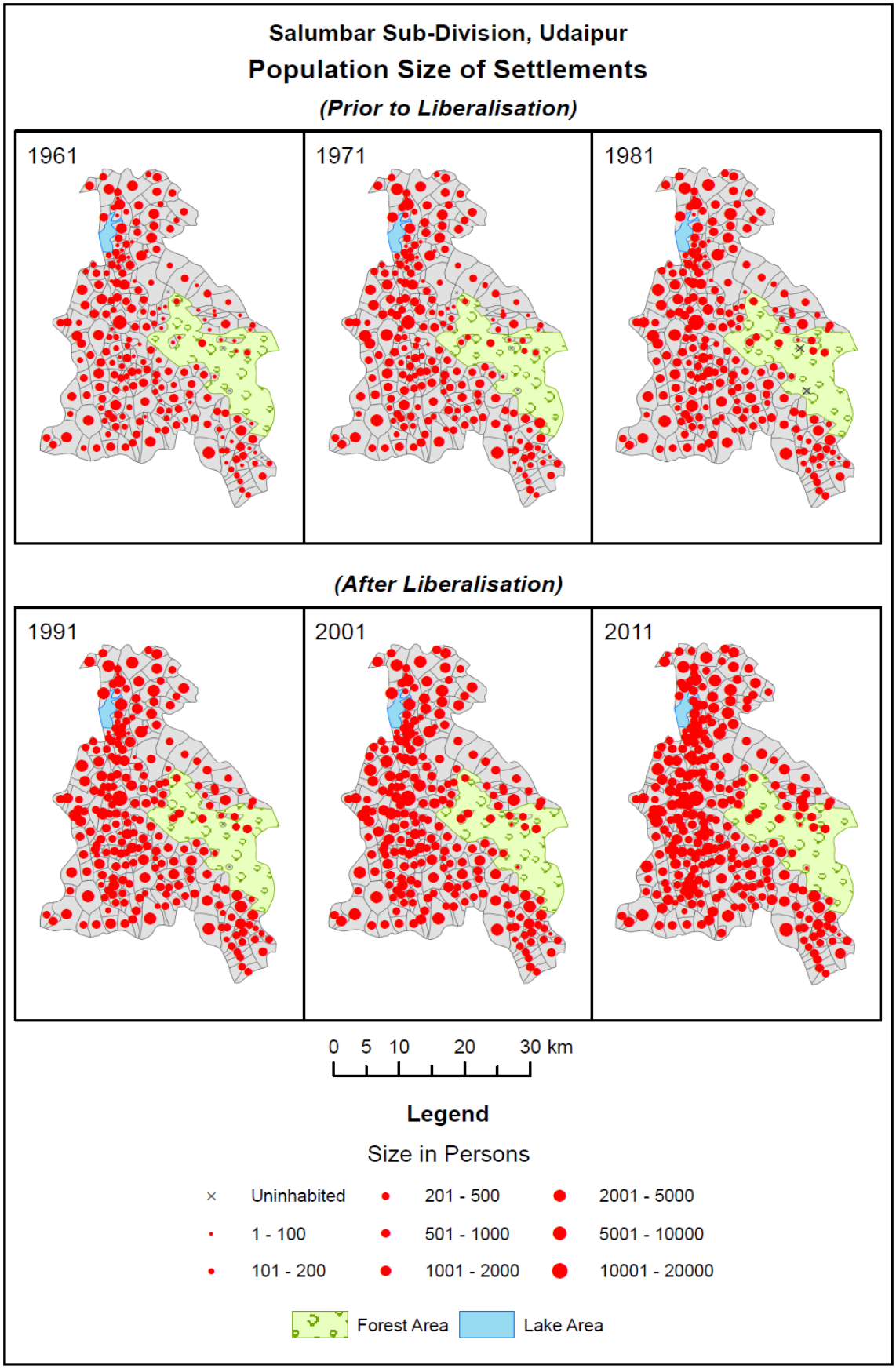
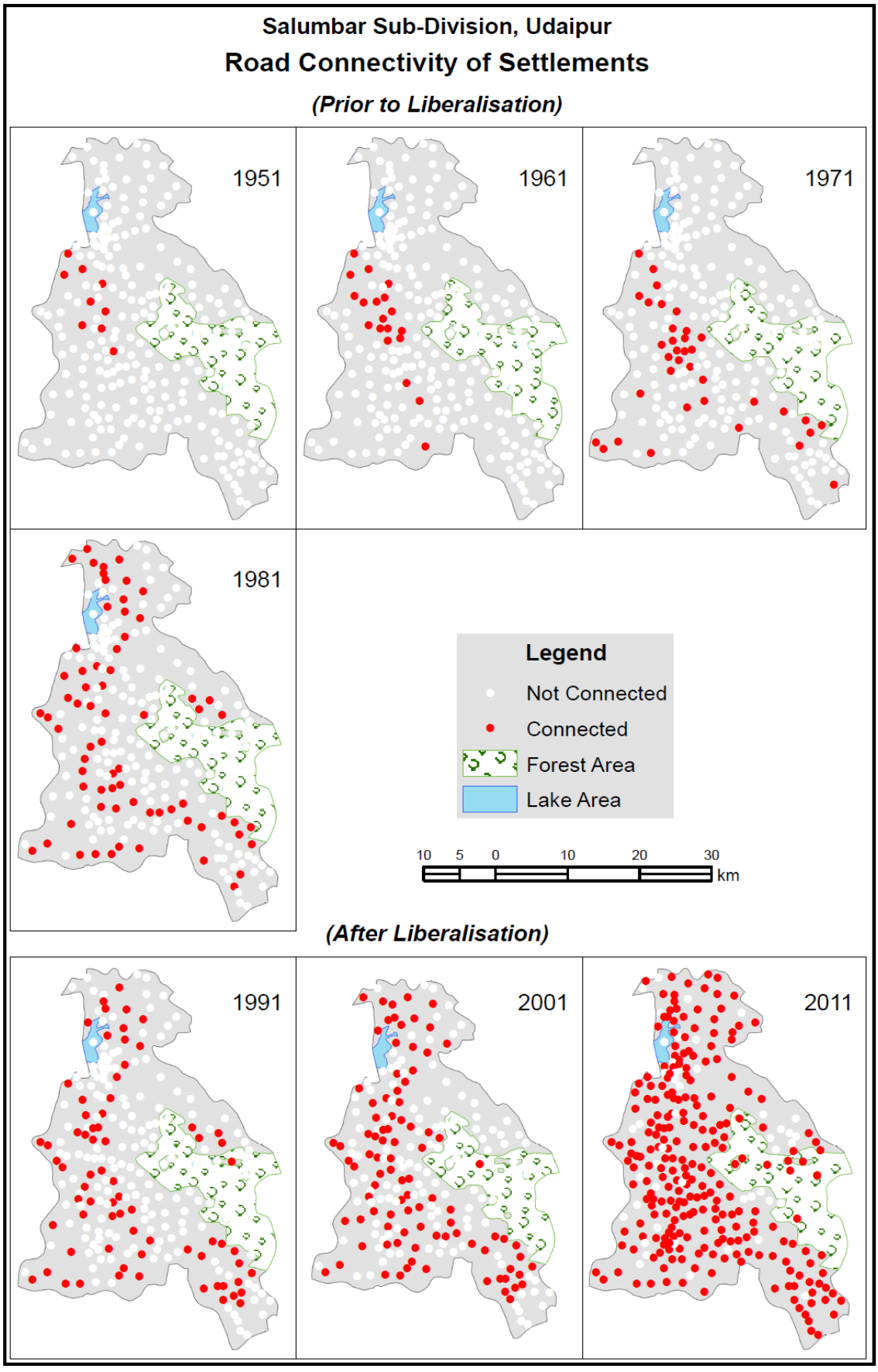


Fig. 4.3 Trends in Road Connectivity with Settlements



All studied villages are mostly situated on the rivers' banks. The reasons behind it were the availability and accessibility of water for drinking, agricultural and allied purposes. A study by Bhattacharya and Vyas (1979) also explained that Dangi/Patel community was settled in the central axis of the Udaipur basin formed by the Ahar River, where fertile agricultural land was available. Geographically, the distribution of habitation seems to be based on the *Varna* model of the Hindu religion. The centre portion of the village was occupied by the upper caste, such as Brahmin, Jain, and Rajput; then Patel, blacksmith, goldsmith, and *Teli*, among other communities; and households of all Dalit communities such as *Salvi*, *Ghaccha, Khatik*, and Meghwal were located near the fringes of the village. Dalits can accept food and water from the Brahmin, Rajput, Patel, Jain and other caste groups, but they can not reciprocate. As village populations expanded, agrarian communities like Rajput and Patels moved on to their agricultural field and settled down there. The Rajput and Patel residing in the village went to their fields for agricultural purposes every morning and then returned home in the evening. Agricultural fields of Rajput and Patel were situated within one to two kilometres radius of the village axis. Rajputs are always greeted with the word *Bapu* from other communities.

4.2 Housing

The number of households in the colonies of the studied caste group varies from village to village –ranging from 10 to 300 households. The pattern of households neither fall within well-defined types (fixed numbers) nor any linear pattern can be observed in the villages. Households of Meghwal and Salvi communities are less than the other communities.

An upward linear change (from kuccha to semi-pukka and pukka houses) is reported in the structure of houses among all communities. However, it varied from class to class within and between the communities. In the 1960s, the house structure of Patel and Rajput was reported to be similar. The house was made with a mud wall and tiled roof. However, the economically weaker section (around 10-20 percent) had thatched roofs instead of tiles. Meghwal and Salvi's houses during that period had mud walls and thatched roofs. Around the 1970s and 1980s, probably the mud wall was replaced with stone and mud. The tile roof was still maintained among the Patel and Rajput communities, while the house structure of Meghwal and Salvi had mud walls and tile roofs. Among the economically well off among the studied communities, the house roofs were replaced with sandstone slabs. The Reinforced Cement Concrete (RCC) roof is a newer phenomenon. In fact, RCC roofs and cement walls were used first during the beginning of the current century, as reported. The bricks/stone wall with cement plaster and

tiled roof was observed in the house structure of more than half of the studied population at the end of data collection. However, during the data collection, no one house in the Salvi community was observed to be a *kuccha* house. Almost all houses of the Patels have double portions separated by a wall, inner part of the house was used for storage and keeping all household stuff, while the outer part was used as a kitchen and living room. In the *aangan,* they also have a kitchen, and this space was used for drying food grain, sitting, and children playing, among other things. The inner part of the house was horizontally divided and used for keeping extra household stuff. Houses of the Rajput community were surrounded by a boundary wall with single door entry (in local terminology, they called *poll*), and every *poll* was used as a living area. Mostly older men of a house sit in that area, and all guests will also sit and stay there during their conversation. The *poll* system was not observed in other studied communities.

The housing schemes started by the state and central government also contributed to the housing structure among the below-poverty line (BPL) households. The Indira Awaas Yojana (IAY) was the prime housing scheme with the aim of providing assistance to rural households in creating and upgrading their dwelling. IAY was started in 1985, and in 2015 it was restructured as Pradhan Mantri Gramin Awaas Yojana (PMGAY). As per the Ministry of Rural Development, 4727 houses were constructed in the study area under IAY/PMGAY in between 2016 to 2019[35]. However, the community-wise data were not separately available at the Panchayat Samitee, Salumber. During the fieldwork, I observed that many of the houses which were constructed under such schemes did not have completely usable rooms. Either it lacked construction or plastering of the walls. Around 30 percent of such houses still have bricks/stone walls and stone slab roofs without plaster, as people reported. The construction of houses also took more time due to delays in the financial transaction by the panchayat samiti. The sanctioned amounts for house building were about 120,000 rupees, which was insufficient to construct a complete house, and it was also given in instalments. Furthermore, it would eventually lead to delays in construction. In this sanctioned amount, only one room could be constructed. The house owner mostly did other work such as plastering of walls of the house if they had money, otherwise, the house structure remained incomplete.

[35] Ministry of Rural Development, Government of India retrieved from https://rhreporting.nic.in/netiay/PhysicalProgressReport/YearWiseHousesCompPhaseWiseDistReport.aspx accessed on dated 11/12/19

4.3 Water and Sanitation

During the 1950s, the nearby rivers and open wells were the primary source of drinking water for all the communities. The census of Mewar mapped 82 wells in the study area for drinking purposes, on average covering around 73 households per well across villages. The distance between the river and the household varies from village to village, and the range was about 1-4 km. During the sixth decade of the twentieth century, agrarian communities such as Patel and Rajput started digging uncovered well with the previous lining and installed *Rahat*[36]system for agricultural and drinking purposes. Indeed, the numbers of *Rahat* were less reported because the wells were dug by only economically better-off families. Some families who could not afford they dug well jointly, and it was used on a rotation basis for irrigation. After the installation of *Rahat*, the distance between the source of drinking water and the house decreased among those communities who dug well. The distance still varied between 1-2 kms because the uncovered well was dug on the agricultural field, and the habitation colony was in the nearby village.

By the 1970s and 80s, the number of open-wells increased and *Rahat* system for agriculture was found in every well owned by Rajput and Patel. At the end of the 1980s, *Rahat* system was slowly replaced by the diesel pump set. The use of bore-well for irrigation purposes started in the 1990s when the electrification process was started in these villages. In recent times, every household of Rajput and Patel communities have its own bore-well for drinking and agricultural purpose, and *Rahat* and diesel pump-set completely vanished. The hand pumps established by the gram panchayat were one of the sources of drinking water. The hand pumps were dug up in the prime locations of villages purely for drinking purposes from 1995 to 2010. The piped water supply was lacking in the colony due to the distance between the village and their colony. Those who are currently residing in the village have piped water supply.

The wells of Patel and Rajput communities were used as an alternative source of drinking water by the Meghwal and Salvi communities, while the nearby rivers, pond and lake fulfilled their daily requirement for water till the end of the 1990s. After that period, hand pumps were the prime source of drinking water for the Meghwals and Salvis. Very few households (one or two in the village) have bore-well for the fulfilment of drinking water requirements. However, the

[36]*Rahat* was a primary traditional tool used for irrigation in these villages. *Rahat* was the type of system of irrigation that used in earlier times as a way to draw water from a well by using oxen. In *Rahat*, a wheel was turned by oxen, which would fill up the attached iron baskets with water, and this process will continue.

bore well was available in those houses with members in government services or retired from the government service. Both the Meghwal and the Salvi faced many difficulties in fetching drinking water from the Patel's and Rajput's well due to their social identity. While collecting social history, a group of women narrated-

> *"In recent times, we are fetching water from the hand pump dug by the gram panchayat and also getting from the piped water supply. While earlier, we were supposed to go early morning to Patel's uncovered well to fetch water. The Patel community members many a times broke our pots. They humiliated us very often by abusive words and slang. We never dared to respond because the well was their private property and it belonged to the upper caste. During the daytime, if we ever needed water, then we preferred taking water from the nearby river. Sometimes woman of the Patel community poured water in our pots after our requests."*

The Salvi community was economically better off than Meghwal. As people reported, many of the households dug their own hand pump for the fulfilment of water requirements in the house. Later, the hand pumps were replaced with bore-wells when rural household electrification was started. Those who were economically backwards used government hand pumps. In recent times, almost 90 per cent of households had their own bore-well in the house for the fulfilment of water requirements while the rest of the households used piped water supply from the government.

Women having two or three vessels of water on their head and to fetch water walking for 2-4 km are not often seen nowadays, while earlier it was a common phenomenon. Recently, the accessibility of drinking water was improved in the study villages and the availability of hand pumps contributed to about more than 50-60 percent of water requirement of the Dalit community, as reported. Water fetching work was exclusively performed by women members in society and difficulties in water fetching made a higher impact on the health of women (Kaur, 2019).

The four walls and roof concept of bathrooms emerged purely as a newer phenomenon. Earlier, they used some clothes shaded walls when they bathed. However, this cloth-covered bathroom was mostly used by women and girls those who are at a young age. Rest took a bath at the nearby river, pond, lake, open-well under the sky. Sometimes among Patel and Rajput, the

bathing and washing activities were performed at the field where open wells exist. Because of the early morning, they went to their field for their daily activity. So, they carried clothes for washing and also performed bathing activities. In-house bathrooms were started building around the beginning of the current century. It is also following the economic strata rules, for example, those who were economically healthier they have covered bathrooms while those who could not afford they used cloth-shaded and open bathing at river/pond/lake.

The mountain, riverside and Westland were used for open defecation purposes for all community members till the previous century, as reported. However, economically prevailing households have in-house toilet facilities since 1970s. The concept of an in-house toilet was mostly associated with purity and availability of space for defecation. The expansion of the agricultural field, deforestation, increasing in the village population led to a decrease in the open defecation area, and people felt that they needed an in-house toilet. Indeed, when they felt they needed an in-house toilet, they rejected the concept of purity and pollution associated with the availability of toilets in the house.

In the previous and current decades, the availability of the structure of in-house toiled was increased due to government assistance under the Total Sanitation Campaign (TSC) and Swachh Barat Mission (SBM). Under both schemes, all scheduled caste and Scheduled tribe and BPL category households were eligible for cash assistance for a toilet building. As I observed in the field, before the initiation of the Swachh Bharat Mission (SBM), many of the toilets built under the TSC were in dilapidated condition. After SBM, many of the toilets were built for those who did not have toilets earlier, as reported by the SBM coordinator. The sanctioned amount for toilet construction was 4600, covered by the government in TSC. In recent, beneficiaries received about 12000 rupees for toilet construction under SBM. The actual cost of toilet construction was higher than the government-sanctioned amount. Therefore, they invested extra money for the building of the toilet along with government-provided money for the toilet.

Mass campaigning of SBM does not increase using of the in-house toilet as it propagated, as villagers explained, while felt needs pressure to use the in-house toilet because nowadays, open defecation areas are completely extinct. During the fieldwork, I observed that some of the members from the Dalit community still go for open defecation. Because the government built toilets, but there was no water facility, for using in-house toilets, they needed at least one bucket of water (four to five litres of water), while when they go for open defecation, they required

only 500 to 1000 ml water per use. Without a water supply or alternative source of water, water fetching for the toilet was not feasible, as reported by villagers.

4.4 Cooking Fuel

Firewood were the primary component of cooking fuel among all community members till the last century. The nearby hills, rivers bank and forests were major sources of firewood. The *Dhawada* (Anogeissus latifolia), *Sagwan* (Tectona grandis), *Babul* (Prosopis juliflora) were popular trees that were used as firewood in the study area. Women members of the house went to the nearby area every day or on the alternative day where they could get firewood. Sometimes male members also accompany them. The cutting of firewood was a most time-consuming activity as the women group reported that they spent 3-6 hours on alternative days for the collection of firewood. The slow and steady expansion of the agricultural fields, the decline in grazing land, and deforestation, availability of firewood were reported to decline. Declining firewood availability lead to the discovery of an alternative source of cooking fuel, such as dunk cake and Liquid Petroleum Gas (LPG). However, dunk cake was used as cooking fuel from an ancient time when firewood were unavailable, for example, during the monsoon when firewood was wet, and it became non-flammable.

The agrarian communities like Rajput and Patel took care of cattle in their house because they were part of their household economy, and their excreta was being used for manuring purposes. The chemical fertilizers like urea (CH_4N_2O) and DAP (Di-Ammonium Phosphate) were started using as a substitute of cattle manure around the 1990s. On the contrary, the cow-dung cake was given precedence as cooking fuel.

Social history of Dalits community shows similar trends about the firewood while it differed in use of dung cake. This community in the absence of fodder they mostly did not take care of animals. Therefore, people make dung cake by preferring to collect cattle excreta of the stray animals in the morning and these tasks are exclusively done by the women in households. However, those households which had cattle and buffalos they did not go for the collection of cattle excreta.

Recently, they started using LPG as cooking fuel. During fieldwork, I observed that around 20-30 per cent get LPG connection under the Ujjwala scheme, launched in the year 2016. The Bharat Petroleum Corporation Limited was the only gas distributor in the block until date. As people reported that approximately all households have LPG connections. Among the Dalits,

LPG is a primary source of cooking fuel, while among the Rajput and Patel it's a secondary source of cooking fuel, as reported.

4.5 Institutions in Colonies

A functioning Anganwadi centre is available in every Rajput and Patel hamlet. Some of the Rajput and Patels colonies have schools. Some of the Meghwal colonies also have functioning Anganwadi centres. However, it is in those villages where the population of scheduled caste were in large number. All gram panchayats level has at least a secondary school, and some have a senior secondary school. PDS shop was established in the centre of the village or area where the accessibility of transportation was easily reached. The sub-centre was mostly established nearby the gram panchayat building or schools or the outer part of the village where the government land was available.

Fig. 4.4 Road Condition in the Meghwal, Rajput and Patels Colonies

Source- These pictures were captured by the researcher during the data collection.

Figure 4.4 is a vibrant explanation of the road conditions in the colonies of Rajput, Patel and Dalit communities. The cement roads were observed in the Rajput's and Patel's colonies while the Meghwal's and Salvi's colonies were deficient in the cemented road. Open drainage systems were observed in the Rajput's colonies. There was no wastewater flow on the road. However, the open drainages are ending out of the colonies, and wastewater flow is spreading on the road. Due to improper drainage facilities, the wastewater flows on the road with cattle urine in the Patel's colonies. The cattle urine smell surrounded in the environment of Patel

colony, because they built a pukka shelter for cattle so, the urine was not absorbed by the sand, and it flowed on the road mixed with wastewater. Indeed, these cement roads and open drainage were constructed during the beginning of the current century.

The conditions of roads in the Meghwal colonies were in dismal status. Unlike many villages, this community was forced to use mud roads. The wastewater flows through road meant for walking. The condition of roads get worsen during the monsoon period. In the village level, I never observed proper drainage system. The small canals are available in colony which carries wastewater while it ends with colony, which results in backwater and stagnancy of the filthy water and therefore, it can creating an opportunity for water borne diseases.

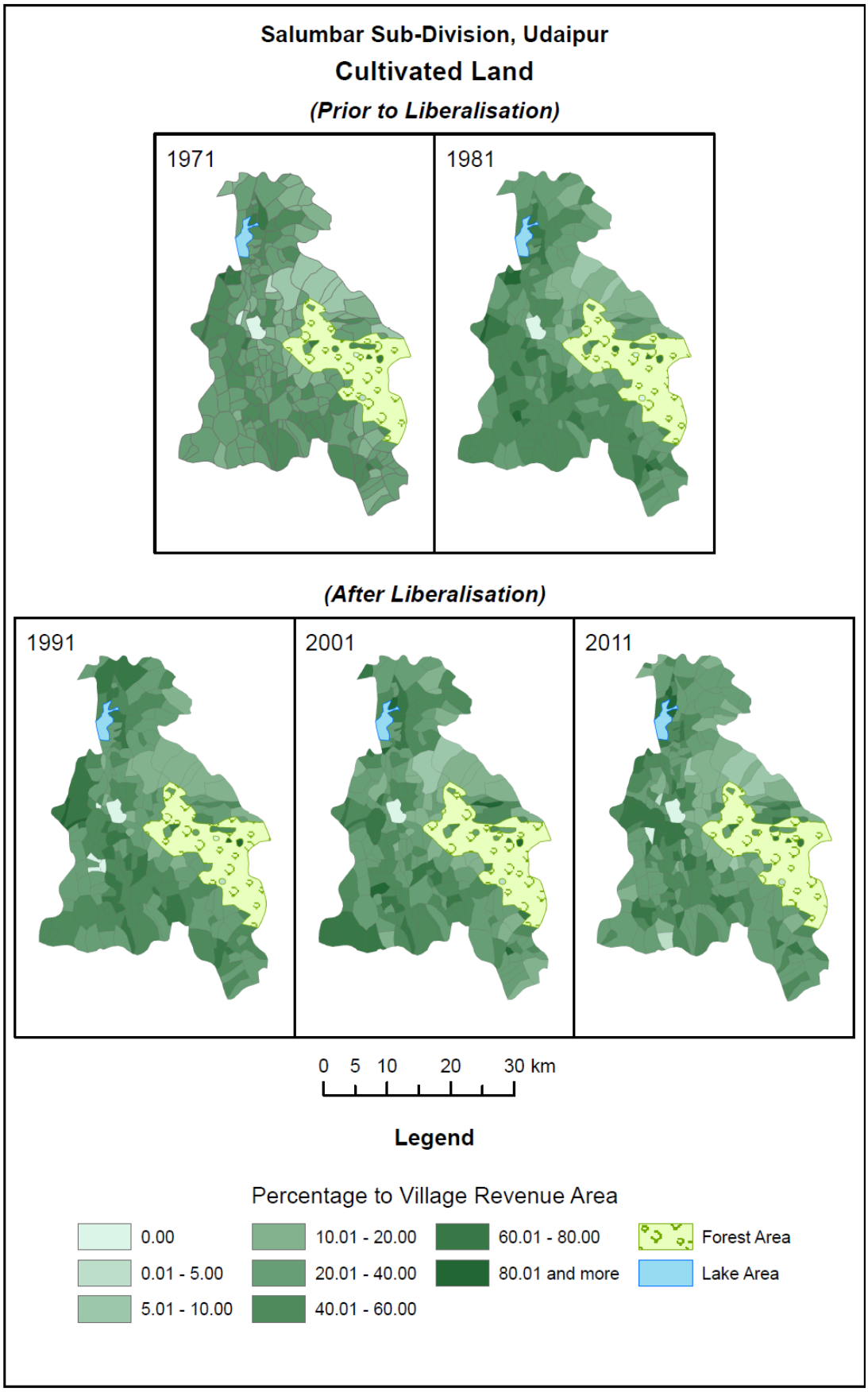
4.6 Landholding

Land used for the growing of crops on a cyclical basis or a permanent basis[37], called cultivated land. As per the census data (Figure 4.5) the share of cultivated land slightly come down by 3.5 percent (Ola, 2021). Around 12 bigha land with irrigation facility could be sufficient to produces enough food grain were required for the family round the years (Choudhary,2017). As people reported that most of the land owned by the Patel and the Rajput community were cultivable and irrigated land, a little area of their land fall in the category of the unirrigated and culturable wasteland. The quality of Patel land was fertile and good for cropping.

The average landholding by the Rajput households was 3.20 hectors (table 4.1), While Patel owned 2.80 hectors. Dalit community do not have sufficient agricultural land to produce sufficient amount of food grains for its members to meet annual needs. The average landholding of the Meghwal household is 0.36 hector, which mean 39000 Square feet and similar amount owned by the Salvi. Which can be used as residential purpose but not for agriculture. So, the involvement in own farm for agriculture was very less reported among the Meghwal and Salvi. The small amount of land availability accounts neither in the household economy nor in food grain production. However, if they produce food grain from the small land, it can support to the family for one or two months. Alternative irrigation facilities were not available at any of the agricultural fields of Meghwal and Salvi; all crops were irrigated by rain. The cropping pattern was similar across the region.

[37]United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank , 2005, Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003, Studies in Methods, Series F, No.61, Rev.1, Glossary, United Nations, New York, para. 7.65.

Fig. 4.5 Distribution of Cultivated Land, from 1971 to 2011



The Rajput and Patel both are agrarian communities, and farm products and livestock income were the pillars of their household economic status. They have sufficient agricultural land. Previous generations or forefathers among the Dalits had the possibility of agriculture in their own farms, because the agricultural lands were distributed among siblings and the amount per head decreased with every generation. At that time land were available, but the alternative source of irrigation was completely unavailable.

Table 4.1 Average Landholding of the Communities in the Salumber Block, 2019-20

	Rajput		**Patel**		**Meghwal**		**Salvi**	
Units	**Hectors**	**Bighas**	**Hectors**	**Bighas**	**Hectors**	**Bighas**	**Hectors**	**Bighas**
Mean	3.20	14.82	2.80	12.96	0.36	1.68	0.30	1.40
SD	0.91	4.23	0.89	4.13	0.49	2.26	0.27	1.23
Sample	60		56		32		32	

Unit conversion: 1 hector = 4.63 bigha [(100/21.61) bigha =1 Hector]
Source- Revenue records of the village. Department of revenue, Salumber
Note: The number of samples of land records was selected randomly. First took the land record book of the villages, and then randomly pages were flipped through it to collect recorded data of the measured lands.

The crops were mostly dependent on the monsoon as people reported that very few households around 1-2 HHs in each village had 5-10 bigha agricultural land. While the majority, of households, had small piece of land or no land for agriculture. Dalit communities majorly depended on rain for irrigation. Those who were living in the down part of the block benefited through canal irrigation. However, the majority of the Meghwal population resided in the upper part of the block. Since people had, small land holding, they preferred to do agricultural work in their own land. Those who had larger land holdings; they preferred to give their land to Patel Community for cultivation on a tenant basis. The tenant conditions were similar across the block and it will discuss in the next section.

As reported, from the current generation, no one is involved in the cultivation. They engaged in other works such as teaching, painting (wall, household paint, ect.). Many of them were migrated for work at Ahmedabad, Mumbai, Surat and Udaipur city. The older family members were still doing the cultivation work because their traditional work was completely vanished due to the introduction and mass expansion of handloom industries. Dalit communities mostly purchased food grain from the market or from the Patel and Rajput communities by doing work during the time of harvesting. Many of them also received food grain from the PDS shops.

There was no common property resource available for a particular caste group, while the wasteland *or Gochar* was available for all communities for common purposes such as grazing, cemetery and cremation, and no one was allowed to do cultivation on the common land.

4.7 Irrigation

Due to the uncertainty of annual rainfall, as the average rainfall varies from year to year, alternative irrigation facility(s) become most significant for agricultural production. Approximately 95 per cent of rainfall happened in between the last week of June to end of September while the rest of the months remains almost without rain. Sometimes, during the November or December, the *mawath* (sudden rainfall due to Western Disturbance) occurs, and it is important for the better production of Rabi crops, mainly wheat.

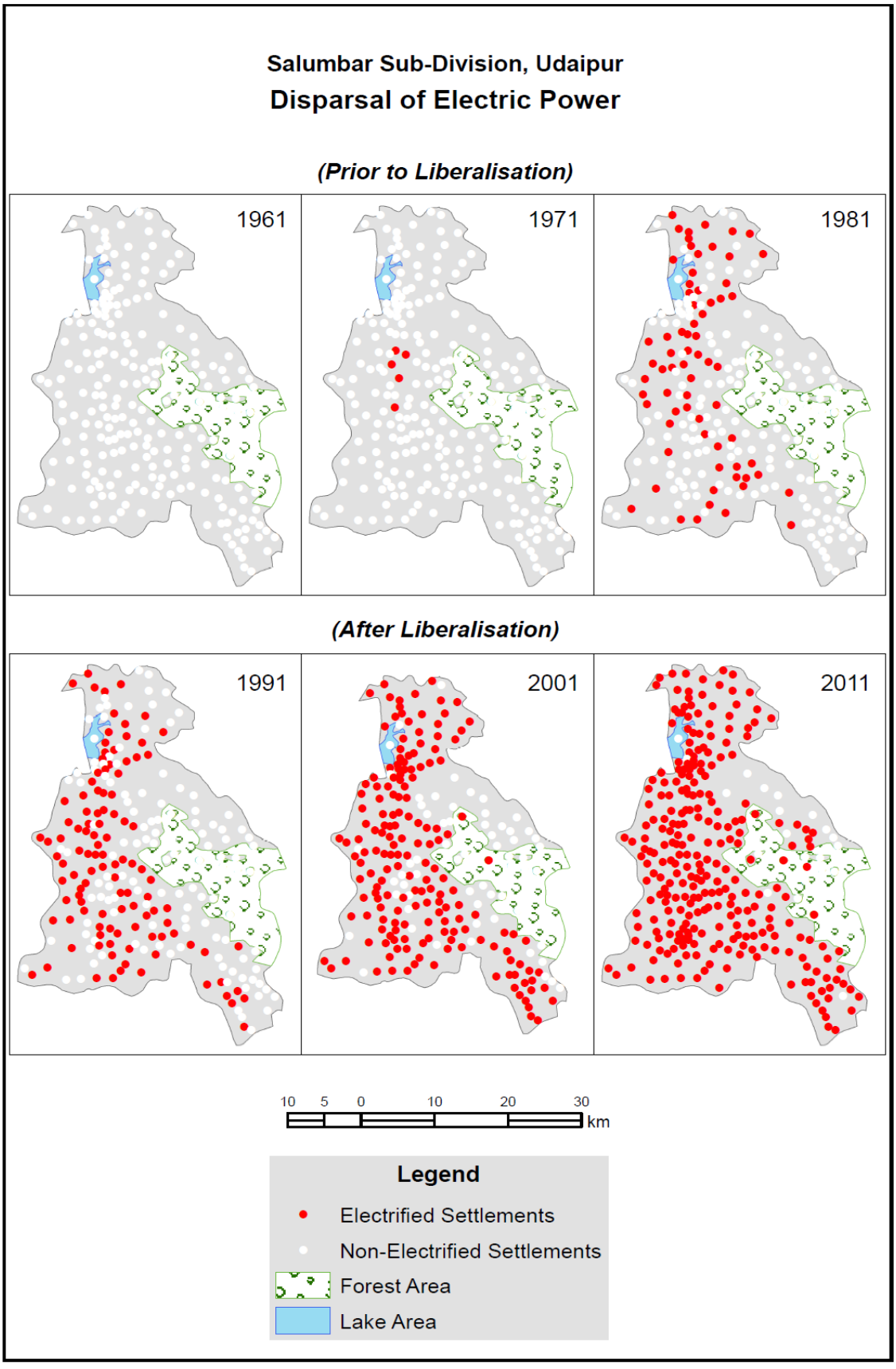
There were two major sources of irrigation reported in the study village, namely, uncovered wells and canals. The uncovered wells were the oldest and most important source of irrigation. The digging of the well occurs mainly in those areas where groundwater are shallow. Initially, the number of wells in the villages were very less. The *Rahat* was exclusively machinery that used for water pulling. The use of other types of machinery such as diesel engine pump set for irrigation was started during the 1980s, that time, diesel and crude oil were used as fuel for the machinery.

As per the census 1961, none of the villages was electrified, including Salumber town, in between 1961 and 1971 electricity reached in Salumber town and three nearby villages. As per 2011 census, 93% of villages were electrified (figure 4.6). With time, the use of the diesel pump set was increasing, and electricity also reached to villages. Then, the diesel pump was replaced by the electric motor. *Rehat* water pulling went completely out of usage by the end of the twentieth century.

As per the census data of Mewar-1941 (Dashora, 1942), there are 815 well were available that were used for irrigation purpose across 148 villages, after that there are no recorded data available about well. 357 well were found in the study villages[38] during the same period. Number of wells have been continuously increased, whereas the groundwater level was continuously decreasing due to less rainfall, and excessive use of water, as reported.

[38]19 villages out of 30 villages matched in the 1941 census of Mewar.

Fig. 4.6 Dispersal of Electric Power from 1961 to 2011, Salumber Block



Initially, the groundwater level was available under the 20-30 feet from the surface, and those villages located on the bank of the river, groundwater was available at lower than 20 feet from the surface. When the time elapsed, the groundwater levels were continuously decreasing and has now reached at 150-200 feet under the surface. Earlier, rivers were continuous flowing till the end of 2010-11. After this period it was found that the duration of water flow in the rivers decreased and the flow lasted only eight months (monsoon and winter) in a year.

In the summer, the river completely dried. Currently, that was, last two years, it was only in the monsoon that water flows in the river while during the rest of the months it becomes dry. The major reason behind drying of the river was excessive gravel mining (sand pulling). Even after the ban by Supreme Court, it was illegally to continue to date of data collection. When the river starts to dry completely, groundwater in the well also started decreasing. As a result of this, no water is available for agriculture in the uncovered well. Whereas earlier, water in the well was available round the year.

As per the topography of the block, the northern part of the block (above the Salumber town) was completely dependent on rain and open-well for irrigation, while the lower part (southern) were benefited from canal irrigation from the 1950s onwards. The web of canal irrigation was continuously increased and reached with all villages of the southern part of the block. The no major dam situated in this block. However, this block was benefited from two major dam: one is the Jaisamand irrigation Project, which is situated in the Sarada block of the Udaipur district, and another is the Som-Kamla-Amba Project, which is situated in the Aspur block of Dungarpur district. The som river making the border of Dungarpur and Udaipur district. The Left Canal of the Jaisamand Lake is the major irrigation canal with the length of 51.09 km. The total 14400 hectors area irrigated by the Jaisamand irrigation project annually and more than 70 per cent area fall under the Salumber block (Pravin, Singh, Kothari, & Gharde, 2015). The left canal of the Som-Kamala-Amba project with a length of 3.15 km irrigated 167 hectors area of the block.

4.8 Cultivation and Cropping Patten

Efficiency in farming was not just merely determined by the quantity and quality of land owned by the farmer, but it was determined by productivity and different agricultural practices including the cropping pattern and agricultural products used by the farmers. For example, the Rajput farmers have higher landholding, but they did not go ahead with the Patel in farm productivity. As discussion with Revenue Inspector of the Salumber block, he told that in

general, the Patel community had become an expert farmer compare to other agrarian communities. They not only involved innovation in farming but also they use their traditional knowledge in farming for higher production. They spent their whole day at their farms even during the hot summers when the temperature reached its maximum level (nearly 113-122^{o}F). Their traditional farming techniques included double cropping, crop rotation, irrigation and manuring and use of proper farming methods, among other things.

Double cropping refers to the harvesting of more than one crop in one field in a year. Double cropping was a traditional method that was practised by almost all community members of the Patel. The reason behind that when the one crops fail due to reasons like insects destroyed the crops, uneven Monson. In that case, other crops might not fail due to its resistance power, and therefore, it ensured compensation for the expenses. The major crops of *Kharif* season were maize, sesame and soybean in the study area. However, they started harvesting soybean after the 1980-90s onwards as a cash crop. Earlier, they harvested *Moong* along with Maize, While Wheat, Chickpea and Mustard were the major *Rabi* crops. They started harvesting of wheat around the 1980s. The double cropping was varying from year to year and it′s depending on climate conditions, mainly rainfall. As Bhattacharya & Vyas (1979) noted that in the Udaipur basin, in 1971-72, the extent of double cropping among the Patel was as great as 80 per cent, while in 1972-73, it was reduced and reached about 40-60 per cent due to widespread drought and unfavourable climatic conditions. In this unfavourable condition of nature, crop needs alternative irrigation. So, those who have a facility for alternative irrigation, they mostly used a double-cropping pattern. With time, as alternative irrigation facilities increased, the percentage of double cropping also increased.

Crop rotation was another traditional practice that supported the retaining of soil fertility. The crop rotation practice involved the production of different types of crops in specific order combined with leaving the land for rejuvenation. Such practice included leaving land for a year, changing crops sowing, tillage during summer and leaving for a few months or a year. This practice also prevented soil erosion. The rotation of crops practised by the Patel community can be categorised into two types. One was the half-year rotation basis- Wheat or chickpea or mustard was sown during the winter season, followed by leaving the land for four months of summer after that, maize or soybean was sown. Another was the one-year rotation basis- wheat-chickpea (winter to winter) or maize-soybean (season to season). The use of this type of rotation might help in the regaining fertility of the land.

Manuring was described as food for crops that enhanced agricultural production and maintained the productivity of crops and the fertility of the soil. The requirement of manures differed from crop to crop. People reported that they provide manure once a year during the pre-monsoon. Manuring was done before monsoon because manuring was effective when it was associated with irrigation. Pre-monsoon manuring is done during the month of June. First, they put small heaps, then they spread heaps in the field and plough the field with the help of a pair of bullocks and a tractor. Earlier the ploughing was done by the bullocks, but in recent times, it was done by the tractor. The sowing of seeds was mostly done with the help of a pair of bullocks.

The major non-food crop was sugarcane, and it was completely stopped by the end of the last century. The reasons behind were the long duration of the crop cycle (11-14 months, the same crop can be harvested two times). Long crop cycles reduce soil fertility, and land is divided with the generation, so the long cycle crop leads to overall lower agricultural outputs. Second, there was no nearby sugar mill where they could sell their crop. At that time, the nearest sugar mill, named Mewar Sugar Mill Limited, was located in Bhupalsagar, Chittorgarh district, which was 100 km from the block headquarter. This mill was shut down in 1999, and they cited the decline in sugarcane production. After that, sugarcane production eventually declined in the area. Most of the sugarcane produced by the Patel and Rajput communities was used in the making of jaggery.

In recent times, the major cash crop was soybean. They also sell wheat, maize, and mustard at the market if they produce excess than required for the consumption of the family. As people reported, in recent times, the Patels have been suffering losses in agriculture because the input value for agricultural production cost was much higher than the profits they could make out of selling their harvest. Bhattacharya calculated that during the period 1972-73, the average profit from agriculture was about 41.6 per cent (Rs. 3570 input value while Rs. 6070 was the output value) (Bhattacharya & Vyas, 1979). While in recent, there have been no profit-and-loss games, as reported.

The Rajput and the Patel produced sufficient food grains that required family consumption over the years because of they had vast amounts of cultivable land. They kept the required food grain at home while the rest of the food grains and other products were sold in the market. Chemical fertilisers were first introduced in the 1960s in the Udaipur basin (an area surrounded by Udaipur Urban) (A. N. Bhattacharya & Vyas, 1979). However, people reported that they

started using chemical fertilisers around the seventh and eighth decade of the twentieth century. Chemical fertilisers became more popular when the advice for using them was given by the *Panchayat Samiti* as well as the government agriculture department. People also seemed to respond well to the advice because the members of the agrarian community did not know the consequences of the chemical fertiliser. At that time, the major chemical fertilisers were phosphate, Di-ammonium-phosphate and Urea. However, in recent times, the use of fertilisers has declined. They did not use chemical fertilisers for food crops that were used for their consumption. While for those crops they want to sell in the market, they use additional fertiliser for higher production.

Tenant cultivation was not much prevalent among both Rajput and Patel. Those who had more agricultural land gave their land to other people on a tenant basis. The tenant cultivators mainly came from a lower economic background and did not have enough agricultural land. As per the responses by community members, before the 1990s the, tenant cultivation was less. Because household members were involved in the cultivation after that, out-migration for other professions started, and the members required for farm cultivation were deficient. Therefore, the phenomenon of sharecropping increased, and people who had a lack of irrigation fafacilities and less amount of land started sharecropping. Recently, sharecropping decreased because agriculture was a business of loss, as reported. Among the Rajput community, no one reported sharecropping on other′s agricultural fields. For tenant cultivation, both parties have to pay equal payment were needed for cultivation, and the farm produce will be distributed equally. The tenant conditions were not changed since it started.

4.9 Agricultural Labour Wages Structure

Earlier, the household members mostly work in the agricultural field. If they needed more persons during the harvesting and weeding time, the neighbours from the same community would be helped to each other. Children from the family also started work in the agricultural field from the age of 8-10 years. People belonging to Scheduled Tribes and Scheduled castes were prime agricultural labourers that worked in the Patel and the Rajput's fields during harvesting time. The daily wage rate per day during the 1960s was about 3 kg of food grain for males and 2 kg of food grain for females. In Cash, the daily wages were 0.50 rupees for males, and women got 0.30 rupees for their work. In the 70s, the daily wage price rose, and it was about 1 rupee. In recent times, the daily wage rate reached 300 rupees per person a day, and the gender dichotomy was not observed in the wage structure.

4.10 Livestock and Availability of Milk and its Products.

Livestock was an integrated part of the farm economy, and it assists in various farm operations like ploughing, irrigation, threshing, transportation, organic manure, and supplementing in the household economy through the selling of milk and milk products. The Rajput and the Patel's took care of milch cattle (buffaloes and cows) and pairs of a bullock as their ancestral occupation. In the study villages, not even one household of these communities was found without animals. Livestock in the household was a symbol of social-economic status. Earlier, almost all households owned pairs of a bullock. The major purpose of taking care of bullock was ploughing, irrigation, threshing, and transportation. Recently, some of the households, (around 5-10 per cent) who can afford to have a tractor, they doing agricultural work by the help of a tractor. Women members of the household are involved in taking care of animals, and male members assist in that work. However, the milking of cattle was exclusively done by women members in the study villages. Around the 1960-70s, almost sixty to seventy per cent of households of the Dalit community had animals such as buffalos, cows and goats. The number of animals was limited to one or two due to less availability of fodder. However, households that could not take care of buffaloes and cows had goats. During that period, they had at least some landholding. Goats were taken care by those families who could not afford the fodder for buffalos and cows. There was no need to collect fodder for goats because one member of the family took goats in nearby grazing areas and riverside for grazing. Moreover, goats did not need much fodder as required for the buffalos and cows. Earlier, there was a large amount of wasteland and forestland available in the region, in that case, fodder for goats was easily available; therefore, people took care of goats. As people reported, the situation of milk animals in households has decreased due to fodder issues and avoidance of taking care of the animal by the current generation. Bheru Lal Salvi from the Randela village told that-

> *"Earlier, women members from the household mostly took care of the animals. They worked hard to get green fodder. Every day, they went to the Patel's, Rajput's and other community's fields for green fodder. The grass and weed were used as fodder for animals. They also took these animals to the pond and river for drinking and grazing purpose. Indeed, all work related to animal care was done by the women while men were involved in the weaving and other works. The current generation feels shy about taking care of animals. No one from the house wants to go to the field for green fodder. The current generation is lazier than the previous generation."*

The milk products were easily available in the Patel and Rajput's households, as people reported. Buttermilk was the primary milk product that were freely available in the villages till the 1990s, and those households did not have milch cattle, they took buttermilk from the Patel and Rajput's households.

The milk and milk products were available in the Rajput's and Patel's households from earlier. Until the 1960-70s, other people (those who belonged to lower social groups) were also involved in taking care of animals of the head of the Rajput community, while Patel did not report about the hiring of a person for animal taking care. Every household built a separate concrete/brick/stone wall with tin shed shelter house for their animals. Some of the households in the village approx. 5 to 10 per cent have kuccha houses (thatched roofs) for animals.
As observed that the surface of the animal shelters was concrete based across the study area. The concrete surface of animals' shelter was responsible for the reduction in milk production because, during the lactation period, the udder was filled up with milk, if they sit on the concrete surface, it may have a higher possibility of milk clotting and loss of teats which is resulted in the less milk production. Other studies also suggest that sand bedding surfaces are associated with higher milk production than other surfaces or bedding (S. K. Gupta et al., 2016; Kara et al., 2011). Indeed, the study area is part of the Aravalli Ranges, and the sand of this area is a mixture of small, soft and sharp stones. Therefore, if the caretaker fastens their milk cattle in that area, it may also be the possibility of cut on the udder and teats.

During the study, as observed that in southern Rajasthan, the feeding practices of milk cattle were different from those in the northern, western and Eastern parts of Rajasthan. They feed the animal hey without cutting it in small pieces. Therefore, much of it was wasted. While other parts of the state, people feed the animal with hey and green grass cut in small pieces then feed to the animal, this practice was useful for cattle taking care and reducing to waste of fodder, and it also increased milk productivity. As per the NDDB report, two indigenous breeds of buffalo (Shurti) and cow (Malvi) were commonly found in southern Rajasthan, and the average milk yields of a cow were 2.99 kg/day and 5.85 kg/day for buffalo in the 2013-14 survey (National Dairy Development Board, 2016). However, some households also have Jersey crossbreed (ibid). The Malvi breed yielded 627 to 1200 kg of milk per lactation period, which means 2.28-3.8 kg/day. Shurti breed yields 4.31-5.45 kg of milk per day. Which was much lesser than other breeds in Rajasthan (Nivasarkar et al., 2000).

People reported that they did not have much time to cook different types of vegetables, and they also faced scarcity of vegetables because they grow food grain in their agricultural fields. Therefore, in the absence of vegetables, they consumed milk, curd, ghee and buttermilk as a substitute for vegetables, as reported. Another reason for taking care of animals was for fertilisers. Without fertilisers, agricultural productivity goes down. However, after the introduction of chemical fertilizer, they also used cattle excreta along with UREA and DAP. The buttermilk was freely available in the village for those who did not have milch cattle. Even sometimes, milk was available for tea or another purpose. Hammir Singh (75-year-old) told that

> *"In our time, every household have access to milk and buttermilk, but in recent time forget about the milk, even buttermilk was not available in the villages."*

Every household produced buttermilk on alternative days on a rotation basis with neighbouring households. For example, if the first household's milk is churned today, then the next day, the second neighbour household will churn milk, and the day after tomorrow will be the turn of the first household. Therefore, in sharing the churning milk process, they got fresh buttermilk daily. More or less, all households followed this process and had daily availability of fresh buttermilk in the household. While in recent times, alternative churning of curd was not reported because all milk went to dairy or market.

The availability of milk product in Dalit households for those who have milch animal were not observed throughout the year and was available for 3 to 6 months. Goat milk has a higher possibility of availability in the household because she gives two-time birth in the year. However, goat milk was mostly used for making tea. The taking cared of sheep was not reported by any of the respondents; taking care of goats was beneficial for household income because the male goat was sold into the market.

4.11 Introduction of Dairy and its Impact

As discussed, the milch cattle were an integral part of the household economy through the selling of their milk and milk products, mainly ghee. Earlier, ghee was sold in the market, while selling milk to other people started after the 1980s. The first dairy plant, called the Udaipur Milk Union, affiliated with the Rajasthan Co-operative Dairy Federation Limited, was established in 1972 in Udaipur. By the establishment of the dairy plant, they expanded village-

level milk collection booths. After the establishment of dairy booths at the village level, people directly sold their milk to dairy booths, which led to lower production of ghee in the village. So, earlier, ghee was the major source of income in the household, while, in recent times, milk was the major source of income. When they started selling milk to dairy and saw the profit in milk selling, they started taking care of milch cattle more. The number of milch cattle increased over a period of time, but not in the proportion of the population, as reported.

The milk collection booths reached the majority of villages between 1995 and 2005, as people reported. The other communities that were not taking care of animals due to various reasons were affected by a higher economic burden. As Bhera Ram from Bamaniya village said-

> *"Ten years ago, if we needed ghee, then we easily get in the Rajput's house. The buttermilk was freely available in the village for all communities, and no one denied buttermilk. The milk was available at 12-15 rupees per litre, while ghee was available at 200-250 rupees per kg. In recent times, buttermilk was not available in the village because the milk was sold to the nearest dairy booths. The price of milk was about 30-40 rupees per litre, and ghee was about 700 to 1000 rupees per kg. The number of milch cattle was increased in the village, but the milk products were not available for the villagers."*

The current generation is mostly buying milk and milk products from the market. In every household, women collected cream from the milk that was purchased from the market. They converted them into butter and then they made ghee. However, this ghee was not sufficient for family members, and the quantity purchased from the market was reduced from the earlier requirement of the family. The average price of ghee was also less during 1990s (in 1990s (10-20 Rs/kg, 1995, 20-50 Rs/kg, in 2000 100-150 Rs/kg, 2010 – 300-350 Rs/kg, in 2018 700-1000 Rs/kg)[39], and the price of ghee continuously increasing. The milk price also increased by a third to four-folds.

Some households (nearly five or ten HH) from nearby villages of town sell milk door to door to those who were residing in the city. People also started dairy shops in the nearby town. They collected milk from villages and sold it from their shop's counter in the town. In recent times, all dairy shops in Salumber town were owned by Rajput and Patel.

[39]Average calculation based on the respondent's answer.

The numbers of milch cattle were more or less similar among the Rajput and Patel. They reported that they are taking care of the animal for milk and fertiliser. The number of animals in the household depends on the feeding capacity household. Because a higher proportion of animals on agricultural land may cause insufficient fodder, as reported.

4.12 Food and Nutrition

4.12.1 Among the Rajput and Patel

The major source of food grains among the Patel and the Rajput was their farm cultivation, and among Patel, some of (around 2-5 per cent) get food grain from sharecropping. Almost all households from the Rajput and the Patel community-produced sufficient food grain that were required for the family throughout the year from their agricultural fields. As Jaswant Singh (60-year-old), reported -

> *"I own 5-acre agricultural land, and due to being short of family members for agricultural work, we are unable to work on my agricultural field. My son is a school teacher, and his wife does not like to work in the field. Therefore, we are doing sharecropping. We gave our land to one of the members of the Patel community in the villages. The conditions of sharecropping, that is, all expenses such as seed, sowing, weeding, tilling, electricity bill, threshing etc. are borne by both tenant and myself, and all physical labour that is needed for cultivation and agricultural process done by the tenant. The final output, such as grain, husks and straw, are distributed equally between myself and the tenant."*

No one from the Patel and Rajput communities reported buying food grain from the market. However, those who are in the BPL category and have food security ration cards, they purchased food grain from the PDS shop. The food grain received from PDS shop was used as cattle feed.

The major changes were reported in diet patterns, and it was changed in the fourth quarter of the twentieth century. As reported, before the 1970s -80s, major food grains were Maize (*Makka*), Sorghum (*Jowar*) and *Kuri* (Browntop millet/Brachiaria ramosa), *Kagani* (Foxtail/Italian millet), *China* (Proso millet). Nowadays, wheat is the primary food grain consumed in all households. The young generation, those who are 20-30 years, no one knows about *Kuri, Kagani, and Chinna;* they never eat anywhere, even they never eat sorghum also. The *Kuri, Kagani, and Chinna* plants were also missing in the study area. While earlier, being

a type of grass, it was easily available in the area or boundary wall of the field. Maize was consumed in the winter season in all households from earlier to the present. In the winter season, they used *Makke ki roti* (Maize Chapati), *Rabadi* (made with split maize seed and buttermilk) and *Paniya* (a type of steam-cooked food made from Maize flour) across the region. While in other seasons, wheat was the staple diet. As people reported that *channa dal* and *mung dal* were primary pulses frequently consumed round the year because people grow these pulses in this region.

Mustard oil and sesame oil was used as cooking oil in all households till the end of the previous century. Because they grow mustard recently, due to the low productivity of mustard, they have grown wheat instead of mustard. The production of sesame was never observed during the fieldwork. Earlier, the sowing of sesame was mostly part of inter-culture agriculture. Inter-cultural agricultural is the system in which more than one crop is sown in one field in a particular season. They retained some oilseed for oil extraction, and the rest were sold into the market. In recent times, people who did not grow mustard used refined mustard or soybean oil for cooking. However, the consumption of Soybean oil was less observed among the agrarian community,

In recent times, most people have been growing *Soybean*, but the consumption of *soybean dal* and oil was not seen in this area because it needed to go through the refining process to be edible. Therefore, they directly sell *soybean* seeds into the market. People also reported that those who have Mahua (Madhuca longifolia) trees also consumed the oil of Mahua seed. However, consumption of Mahua seed oil was less reported among the current generation. In tribal communities, people still use Mahua seed oil in cooking.

As reported, they also prepared jaggery during the winter season. With the help of ox, they extracted juice from the sugarcane, and then it was left in a container to settle down the residue and sediment and then strained and started boiling. They boiled that juice until that was taking the form of jaggery. They like to eat jaggery when it is in the making process. In the local language, they called *tor* (second last step of jaggery making process). Generally, they sell jaggery into the market, and most of the jaggery was used for tradition liquor making along with *Mahua.* In the winter season, they also consumed jaggery along with roasted chickpeas and *Mahua*. In recent times, no one has eaten jaggery and roasted chickpeas. Earlier, jaggery was used in all sweet dishes such as *Halwa,* rice, *churma,* and among other things. While in

recent times, sugar has been the primary contains all sweet dishes. Therefore, the consumption of sugar in households increased.

Changes in the pattern of milk consumption were also reported among the Rajput and the Patel. Earlier, people did not sell their milk in the market, they processed milk in the house to make ghee, and then ghee was sold in the market. In this process, the availability of milk was more in the household, and people also consumed milk two to three times a day.

Earlier, milk, buttermilk and curd were the major substitutes for a vegetable because access to vegetables was very less. In the rainy season time, they sowed some vegetables such as bottle gourd, the flower of chickpea and board bean, while bitter gourd was naturally grown during this period. Therefore, the consumption of vegetables was in the later part of monsoon until mid of winter reported. Another, everyone like the test of buttermilk curry and it was frequently consumed in the household from earlier to till date.

The grown of vegetable for domestic consumption purpose were observed to increase. Generally, people started growing some vegetables such as tomato, brinjal, ladyfinger, cauliflower, cabbage, green chilli, cluster bean, bottle gourd, and board bean in their fields. Therefore, in recent times, the consumption of vegetables was increased, and milk with lunch and dinner mostly decreased. However, milk secured its place in the morning breakfast of the household members. The consumption of ghee and buttermilk in the household also decreased among the current generation. The installation of village-level milk collection booths affected the milk consumption pattern in the household because selling milk was one of the income sources for the household. Another reason is that they purchase cattle feed from the market, mainly dairy shops, so they need money to buy that. If they sell our milk to the dairy owner, then they can be borrowed cattle feed from the dairy owner. The consumption of ghee was also higher in earlier times because the availability of milk in the household increased ghee production. Selling milk to the dairy affected ghee production in the household. People reported that earlier, those who did not have milch cattle could easily get ghee from the villages at a nominal price, while in recent times, shortage of ghee led to an increase in the price of ghee, and people were unable to get ghee from the villages.

Earlier, *Temru* or *Kendu* (*Diospyros melanoxylon Roxb*.), Mango, Mahua, and palm date fruits were available in different seasons. Temaru was available from the end of the winter to starting of the summer season (March to May), Mahua available from February to April, and Mango

in the summer season, which started in mid of June and continued to the first half of July. Palm date was also available in during May to June. So, all fruits available for this reason are available between February to the first half of July. *Temru* fruit contained a higher amount of Potassium (1540 mg/100g), Calcium (1200 mg/100g), Phosphorus (69 mg/100g), Magnesium (960 mg/100g), Iron (fe)(46 gm/100g), and has 93.78 kcal/100 gm energy value (Murthy et al., 2022). This fruit is frequently available in this region. However, with deforestation, this tree was also reduced. However, earlier *Temru* was the favourite fruit of all people because its taste was sweet, like Chiku (nose berry). Mahua fruit is generally consumed in the rainy season. During the flowering of Mahua, collect Mahua fruit and dry it in the sunlight. In the rainy season, they roasted it and added salt to it and consumed it. Its roasted taste was like peanuts. The consumption of Mahua fruit was higher in the tribal community than in others. Palm date was very frequently available in this area from earlier to the present. They also eat dried palm dates in the rainy season. In recent times, the consumption of *Temru* and Mahua fruits was comparatively less reported in the current generation. The consumption of mango was similarly seen in both generations.

The consumption of *gond laddu* during the winter was reported in both generations. Every year in winter, almost every household prepares *gond laddu.* Young people of the family consume this special diet for 15-30 days in a calendar year. They believed that this *gond laddu* would help to better bodily functioning and resistance against disease.

A history of hunger, malnutrition, death, and skipping meals was not reported among the Rajput and Patel. The prevalence of malnutrition among the Rajput and Patel was very less, as reported by respective Anganwadi workers, and both communities did not report any type of history of skipping a meal. The dependency of food grain on other wages was not reported.

Food-grain preservation techniques among the Rajput and the Patel were similar. Moreover, the Rajput community member believed in fresh meat consumption, while the Patels were a pure vegetarian community; therefore, the preserving of meat and fish were not in consideration. As discussed earlier, maize, sorghum and Kuri were major contributors of the staple diet. In the rainy season, they produced all food grain due to the lack of irrigation facilities. After the monsoon, they cut down the crop and leaves for drying in direct sunlight. The dried crops are stored in round shape pyramid along with food grains for a longer period. When they needed it, they trashed food grain from the stored pyramid; another practice was they segregate maize corn and left for drying in direct sunlight. Then they make a bundle of 6-

10 corns and hang or put it in a cool and dried place. As they needed, they grind and use it. The extraction of Kuri and sorghum grain from their plants was a tricky process. During the harvesting time, after sundry, they segregated flower part from the stem. The flower part was collected on plan surface. In local terminology, the plan surface where food grain was extracted from the flower/husk called *Varada.* For the preparation of *varada*, first, they clean the surface, level and filled with water, then they daubed with cattle excreta mixed with clay. In *varada* oxen walked many rounds on flower/husk, by this activity, food grains were extracted from the flower/husk but this was mixed with small parts of flower/husk. When slow wind arises, they clean their food grain.

The clean food grain was preserved by the community in the clay drum the before the 1970s. The clay drum was made from clay taken from the pond, and it was mixed with shuck/chaff. *Neem leaves* were used to prevent food grains from insects. They mixed *Neem leaves* with food grain and stored them in the clay drum, and when it was needed, they pulled out food grain and grind with a hand miller (now using electric flour meal almost available in every household).

The storage of pickles was a recent phenomenon, while *chatani* (made from red chilli and garlic) was a common diet ingredient. They crashed red chilli and garlic on stone and consumed directly. The *chatani* was made every day in the household. Some of them may fry chatani with ghee and consume it for 2-3 days. Many times in the absence of vegetables, they consumed chapatti with *chatani.*

They preserved ghee for 7 to 8 months because, in the family function or society function, they need ghee. People also came to the Rajput and Patel's houses to purchase ghee during societal functions such as death, marriage, birth celebration, god ceremony and among other things. When the churning was done, they boiled butter until the buttermilk inside the ghee was burned, then they left for few times when it comes to normal temperature. Then it will stored in clay pot or tin and kept it in cool and dry place with a tightening of the container. The major stimuli of changes in food culture were not different from the Rajput and the Patel community, but different was that Patels were vegetarian community while the Rajput was non-vegetarian community. However, some of young generation, those who work outside, they consumed liquor and non-veg, but the consumption of non-veg in the household was strictly prohibited by a family member and the community also among the Patel.

Earlier, the Thakur of the village mostly practised the feudal relationship. People from the lower caste mostly worked in Thakur's fields for food grain. Thakurs have created a system for a levy that was imposed on other communities, excluding the Rajput community. They took a share in crops produced by the farmer. During the weeding time, one or two members nominated by the Thakur went into the field and collected food grain as a tax or levy. After the 1960-70s, the traditional levy structure was completely abolished from the community side; however, after the independent government also abolished this feudal system.

The major changes were reported in food culture that food grain (from sorghum, *Kuri* to wheat, maize, rice) oil (sesame to mustard and Soyabean), consumption of dairy products, mainly milk, buttermilk, ghee were decreased in the household due to introduction of dairy collection both.

Most of the children less than three years of Rajput and Patel continuously visited the Anganwadi centre. The school mid-day meal program was earlier known as the school lunch program. People reported that they got milk in their school time during the interval until 1992 and then it closed. From July 2002, the state government started mid-day meal program after the Supreme Court order on the petition of PUCL, Rajasthan. Initially, the state government provided 0.50 rupees per student and in food menu; they included *Ghoghari* (a mixture of boiled wheat and jaggery). In 2005, the government increased the cooking conversion cost three times (1.50 rupees) per student (Kaushal, 2009). In recent time, the cooking conversion cost was increased. Now government spent 4.13 and 6.18 rupees per student for primary and upper primary, respectively. From 2 July 2018, the state government started new schemes *Annpurna Dugdh Yojana*, under these schemes they provided milk to school children from 1 to 8 standards (Government of Rajasthan, 2019).

4.12.2 Among Dalit Communities

Among the Meghwal and Salvi communities, barter arrangement (*sukadi)* was one of the source of food grain for the previous generation. However, it was not enough for the family consumption round the year. In this situation, market was another source of food grain. Now barter system is not in practice among the Meghwal. The Meghwal community is traditionally involved in the tanning of hides from dead animals. They cleaned dead animals from the village and skinning of dead animals. For that work they got food grains from the respective households. The community member divided houses where they worked or they did pulling their dead animals. People were allowed only in their allocated houses for work of tanning of

hides and food grain for their work as a part of barter arrangement. The barter arrangement also existed still among Salvi community. However, those who are economically well off or in government services; they did not involve in the traditional practices of barter system. Earlier, Salvi received food grain by the weaving of cloths of the agrarian community and invitation work that was doing when any of function in the family happened of the other communities. Higher caste community did not go for giving an invitation for villagers and their relatives during the function.

As people reported that we got food grain (in local terminology they called it *sukadi)* from our selected house during the harvesting time. Harvesting used to happen twice a year therefore; they received *sukadi* twice in lieu of their labour. They received 5 kg of food grain of each household. Every, household of Meghwal and Salvi communities had ~20-40 households in their territory where they were allowed to receive food grain. The number of households were varying based on the household of the Meghwal and Salvi communities in the village. Every household got ~200-300 kg food grain in a year from the other community as a part of barter arrangement. Therefore, earlier this was the major source of food grain. While in recent time, as discussed, market is the primary source of food grain. Among Salvi community, people from older generations also received food grain as barter arrangements for invitation work.

The instances of hunger was not reported by any of the community members among recent generation. In contrast, the previous generation had a taste of hunger. Many times people went to bed on an empty stomach. Mogaji (50 years) from Karawali villages reported that-

> *"Today we have access to food grain much easier than earlier. Earlier, food grain and money were not available in the household, without money, Baniya (merchant) never gave us food grain. Food grain received, as Sukadi (barter) were not sufficient for family. In the absence of money, we went to the Patel and Rajput households for work and we got some food grain. Many of them went to Salumber town for work. The wages were much lesser compared to today's wage, we got 3-5 rupees during the 1970 for whole day work in Salumber town and 5 kg food grain for whole day work in agricultural farm of the Patel and Rajput. Almost more than 90 percent households are involved in our traditional leatherwork. Whole member of the family involved in this work. One member of the family, mostly elder son went on daily wages from households, because leatherwork alone was not sufficient to maintained household expenses. Now our community dropped leatherwork and*

started going to daily wages, many of them migrated to work in other cities, some of them got government jobs and others. The economy of household increased compared to earlier we had."

When the animal in the village died, the owner of the animal sent a message to the allocated family of Meghwal community. The family member of the Meghwal community carried dead animal on bullocks and went to land where they performed skinning of animal. During this process, they also collect fresh portion of the meat of that animal. This meat was dried in direct sunlight. In rainy season, this meat was steamed dried in the household. They just hang meat with thatched or tiled ceiling on the upper of their hearth (*Chullah).* By this process, when they cook their food every day and the meat was drying through smog and steam. Mostly they consumed dried meat during the winter and rainy season due to the heat property of this. The consumption of chilli was higher in this community than other studied communities because the amount of vegetable were very less and many times, it was unavailable, in that case, the *chatani* (made from red chilli and garlic) was the major substitute of the vegetable. However, in the recent generation, the scarcity of vegetables were less reported because they have money in their hand, so, they can purchase vegetables from the market.

This community reported major changes in the diet. Earlier, the consumed food grains were similar to the Patel and Rajput. The dried meat, pulses, and *chutani* distinct them from other communities. Because the Rajput and Patel had milch cattle, so they have possibility of consumption of milk and milk product while in the diet of Meghwal Roti, *Daal* and *chatuni* occupied place. Dried meat generally consumes in winter and on the occasion or function in the family in both communities. In recent generation, the concept of dried meat was completely off, because as collective decision of the caste panchayat. The carrying of dead animals were stopped. Moreover, recent generation have access to other fresh meat, food grain, vegetables, and among others.

The consumption of non-vegetarians diet was decreased over a period. In recent time, those who eat non-vegetarians diet were treated as lower strata in the community. Because the people from higher economic strata were preferred vegetarians diet. While earlier, this type of behaviour was not reported. Tea was the favourite beverage of the Salvi and Meghwal. They also consumed alcohol occasionally. However, in the public function or caste panchayat meeting place consumption of alcohol is forbidden. As people reported, earlier, the sweets diet had their own importance. During the festivals such as Holi, Diwali, *Raksha-Bandhan* and

Makar-shakranti, sweets were made in the house. Earlier, *Churma,* sweet rice, and *Halwa* were the primary sweet dishes in the household. In recent time, the craze about sweet dishes was not reported, because the affordability and accessibility of sweets dishes were high compared to earlier.

Exclusively mustard oil was used as cooking oil earlier. They purchased mustard oil from the market. Those who grow mustard they extract oil at nearby oil extraction small mill. In recent time, both soybean and mustard oils used for cooking food. The oil was completely purchased from the market, as reported. Special food supplement was consumed in the previous generation because the pure ghee was easily available in the village. Previous generational people have craze about *gond laddu,* and they wait for winter for this supplementation while current generation paid less attention to this traditional supplementation diet. As people reported, around 60-70 per cent of households among Salvi and 30-40 per cent among the Meghwal still prepared *gond laddu* during the winter for their family. Pickles was used in almost all households of the Salvi. However, preservation of pickles was a recent phenomenon.

4.13 Economic Activities Other than Agriculture

The non-farm economic activities were also higher among the current generations of all studied communities. The older generation among the Rajput and Patel mostly depends on farm products, animal selling and milk and milk products selling while among the Meghwal and Salvi involved in the leather extraction, waving and daily wages.

As people reported around less than one per cent from previous generation among the Rajput community-owned coal production business. In recent time, around less than one per cent members from the Rajput and the Patel owned dairy shop in nearby town or villages or migrated place. Similar numbers selling their milk door to door in the nearby city. In trader's line, people reported that one or two small *Kirana, cloths, hardware, etc.* shops were owed by the Rajput in the villages. In whole block there are three contractors those who are involved in the construction line such as road, house, took tenders of gram panchayat for supply of cement, iron metal, sand etc.

Two members from the Kharka, one from Gurel, one from Utharda, one person from the Loda, one person from Saradi, and four persons from the Bassi Samchot among the Rajput are involved in the sand trading. In recent time, the excavation of sand from the river was banned by government. However, they sell sand at their own risk. If they were caught by police then they have to pay heavy fine or penalty imposed by the government.

The income from other sources such as employment in the government sector was very less observed among both Patel and Rajput because the literacy level was very low than the Meghwal and Salvi. In recent time, another major source of income was a migrant person from the household.

As people reported that in some social event, they got income such as dowry, marriage (in the form of *Nuter/Not/Notra),* birth occasion (*Dudhotshav).* While the most expensive social events were feast for dead (*Mrityubhoj),* marriage, first birth occasion, *Gangot,* housing, medical, clothing, penalty imposed by caste Panchayat, etc. The caste panchayat imposed penalty in case of work done against societal norms such as abduction of girls for marriage from the caste without her parent's consent, refusing to marry after the engagement, and refusing to the girls after marriage.

All studied communities follows the endogamy marriage system; they also divided into the sub-groups or *gotra,* marrying the same *gotra* was not permitted. Dowry was second the major expenditure during the marriage than food for the community. The overall expenditure on marriage was varying by the socio-economic status of the household.

From 1970-1972, Udaipur based study of Patel revealed that expenditure in marriage was varying from 220-6000 rupees (in other words, 4.4 to 42.2 per cent of the total income). The marriage expenditure in terms of percentage was higher in the lower economic group while in absolute expenditure was higher in the upper income group. The expenditure on death rituals varying from the 2 to 12 per cent, this expenditure was higher (700 rupees) in the 5000 to 15000 annual income group while lower in the higher-income group about 375 rupees. Expenses on the making of house were varying from 20 to 350 rupees in 1972, and which was higher in the upper-income groups (those who were salaried employee) around 350 rupees, while in the lower-income group it was about 20 rupees. The expenditure on education was also higher in upper quantile compare to the lower-income group. The annual medical expenditure was also higher in the higher income group compared to the lower-income group. The reason behind less medical expenditure among lower income group was they does not have money to buy modern medicine, so, they use home remedies and follow the traditional healing practices (Bhattacharya & Vyas, 1979).

In recent times, the expenditure on marriage, deaths, birth celebration, education, health also increased. In the marriage, higher expenditure was represented higher social attitude and status.

So, the cost of food and dowry increased much higher than earlier, as people reported. Earlier, in the marriage, they make *dal-bati-churma* (one the famous food of the Rajasthan) in marriage, birth celebration, and other functions. The wheat, ghee, jaggery and dal were available in the household. There was no need to purchase from the market. While in recent time, a different type of sweets and other dishes were observed in the study area and all the raw material for food items need to be purchased from the market. In the death ritual earlier, the *gangot* ceremony was not prevalent; it was started after 1970s, as people reported. So, the expenditure on deaths rituals also increased. Education and health care were the major fields there the expenditure increased rapidly. Earlier, the farmers did not want their children to be away from the farm, and thus they did not encourage their children to attend schools. Only higher economic class's children went to school because other people were available to work in their field. However, in recent time all children from the community went to school. Most of the children of the Patel community studying in the private school. In the bigger village of the block have private school up to 8^{th} standard. The expenditure on education for other communities such as Rajput, Meghwal and Salvi could be assumed similar during the above mentioned periods.

The traditional occupation of the Meghwal and Salvi was completely changed, while other caste groups remain their traditional occupation along with other occupations. Weaving was the traditional occupation of Salvi, and it was completed shut down due to the boom in the textile industry. Therefore, they were chosen different occupations such painting, constructions worker, cooking, and small shopkeeper. Leatherwork constitutes major proportion of household income in the previous generations among the Meghwal. The Salvis was a good artist. All works related to painting such as house, wall, board, etc. were performed by Salvis, as reported by the respondents. The economic stability of all households depends on daily wages except those were in government services and self-employment.

The death feast (*Mrityubhoj*) is the most expensive event in Meghwal community compared to Salvi. Society members and family members decide the date of death feast on the twelfth day of death. Next day family members seed barley in pot and go to Haridwar for the last rituals, where they, immerse the ashes in the Ganga River. The belief behind that is that if we immerse ashes in the Ganga River than he/she get salvation and he/she will be free from the cycle of birth and death.

After the return from the Haridwar, they performed a function, which is called *Gangot*. *Gangot* is known as death feast in this community and all members were supposed to perform this duty due to social pressure and avoiding the comments by the other community members. If someone who could not go to Haridwar, had the similar obligation to practice death feast in the community which, was similar to *gangot.* On the day of *gangot*, women members who were kin of the family carried grown barley pot on their head and immerse in the nearby pond, river, or Lake. This ritual was celebrated happily with pomp and show. During this ritual, caste Panchayat nominated elder son of the family as head of the family. After the completion of all rituals, members of the family served food to the community members. Around 500 to 800 people participate in the *gangot* program. The community members decide food items for the feast or *gangot.* The quantity of food grain or sugar used to be in quintal. This generally depends on the number of people participating in the program. Three hundred kg food grain or sugar was compulsory to make the food items in this program. The quantity of food served during the *gangot* was also decided by caste Panchayat. Recently, they decided, two-bundi *laddu,* each of 300 gm that would be served to every member of society who participated in the *gangot* program irrespective of their age and gender. All male members those who participated in the ceremony had to consume all food items which was served while women and children could take food at their home. If male member takes food item to their home, they had to pay 3000 rupees fine to the society. Curry, Daal and Puri were also served along with the *bundi laddu.* The concept of *bundi-Laddu* was introduced during the onset of the current century. Earlier, all of them were making *Malapua* (dumpling) and curry in the death feast instead of *bundi-laddu*. As Mana Ram from the Gurel village reported that-

> *"An average three to four lac expenses take place in performing of gangot ceremony. Some time it reaches five to six lac. The expenditure of gangot depends on the members who participate in the program. The performing of death feast or gangot is not mandatory by the society. If someone does not want to perform this ceremony they may not. However, caste panchayat never force to do this ceremony but they did not ban this either. There are social pressure to do this, because people comment on the family members where death happened, they told that member is still alive, he/she was not died, and they are still in cemetery. Therefore, to avoiding of these type of comments, people do the death feast and gangot."*

The caste panchayat imposes penalty, if someone gives divorced or breaks an engagement, abducts women or girl for marriage, and breaking of social laws made by the caste panchayat. As Dinesh reported that-

> *"I was married in 2010, soon after the one year of marriage some dispute happened between us. Therefore, I sent her back to her parental house. After two months, they called caste Panchayat for the settlement of divorce. In this settlement, caste Panchayat impose 30000 rupees penalty on my family. After paying the fine to the panchayat, my divorce was socially acceptable."*

The amount, which was collected by caste panchayat through the settlement of dispute, would be given to the victims. However, most of the share of the amount was kept by the caste panchayat, and victims got around 30 percent of the amount received from the accused party as compensation. People also reported that if some from the accused party is powerful and have liaisoning with caste panchayat members, mostly paid lower fine. Because he used to give bribe to the caste panch and panchayat give their verdict in favour of him. Before the onset of current century most of the disputes handled by the caste panchayat while in recent times, it is settled through Indian judiciary system, because the bias settlement by caste panchayat.

As people reported that in recent times, education was major expenditure in the household, especially higher education. The higher education institutions were available at the district level, and living and tuition fee in private institutions were very high. The annual living cost at district level is varying from 60000 to 100000 per student, as reported by the respondents. Health expenditure becomes catastrophic when disease goes severe because they preferred private health facility during the severe case of disease.

4.14 Occupation and Employment Activities

As discussed, the traditional occupation of the Rajput and the Patel was cultivation and animal husbandry. The older generation (41-60 years) of the community was completely involved in cultivations and animal husbandra work. As per local people's reporting that around 60-70 percent members of the current generation (20-40 years) were involved in different kind of work from their traditional occupation, for example as labourer in shop in the nearby cities, migrated for work, some of having small business such as tea stall, cloths shop, and mobile shop, among other things. Rest of the members from current generation were involved in milk trading, agricultural work along with his family members. The female members of the

community involved in agricultural and domestic work. As observed that only seven women from 29 study villages were working as Anganwadi worker (3), ASHA (1), and Anganwadi Sahahika (3) among the Rajput and two ASHA worker from the Patel. As reported, female members mostly working only in their home such as doing domestic, agricultural work, taking care of animal, and caring of children in house. The major changes in traditional occupation were observed among current generation while previous generation did not change their traditional occupation. The major reason given behind a distance of current generation from traditional occupation was loss in agriculture. The input value is higher than they get from agriculture. People reported that expenses such as seed value, fertiliser, harvesting, sowing coast, and weeding cost are increasing continuously while product price was stagnated. *Nahar Singh* from Bassi village reported that-

> *"Fifteen years ago, we sold wheat at 13 rupees per kg. In 150 rupees we got UREA beg, and 350 rupees pay for DAP beg. Tractor owner charged 350 per hours for tillage. During weeding and harvest time we need extra labourers, and we pay 50 rupees to labour per day. We got diesel at 30 rupees per litter even less few years ago. While now we got UREA 500 rupees per beg and 1000 rupees for DAP. Tractor owner charged 1000 rupees for one hour. The labour cost reached 300 per person per day. Now we sell our wheat at 17-19 rupees per kg. So, the overall input price increased double and triple time while return on agriculture was very less compared to earlier."*

Another reason they reported that other expenses such as schooling, transportation, fuelling, and health care were increased while the income from agricultural was stagnated. Therefore, quitting the traditional occupation was a necessity; therefore, the current generation migrated to other cities for their work, and by this they get additional income, which would help for maintaining day-to-day life.

As reported, by the early 1980s, women from the Rajput community did not work in agricultural farm, they involved only in domestic work and milking of cows and buffaloes. Male members of the community worked in the agricultural field along with the labourers. The agricultural labourers belong to the scheduled tribe and scheduled caste community. They paid their daily wages in terms of food grain because the money was not in much circulation that time. Generally, they started work at morning after sunrise; they take rest in afternoon followed by lunch for one to two hours then start work and continue till the evening. The agricultural labourers were mainly landless people or had a small piece of land that was not enough to produce sufficient food grain for the family at least for two to three months. After the 1980s,

when the wages started increasing and also unavailability of agriculture labourer, women members of the Rajput started work in agricultural field along with male members of the family. In recent time, every household was doing their work by self, if there were sufficient members (4-5 members) in household. During the harvesting time, they also hired the labours for agricultural work.

The prevalent of *Halies* (bonded labour) continued until the onset of 21st century. Generally, *Halies* come from the tribal community and very few numbers from schedule caste community. One to three members from eachcommunity in every village practising money lending. They gave money to those who needed on the compound interest basis with 2-4 rupees per hundred per month. In the absence of other economic sources, the borrower was unable to pay that money and with the high and compound interest rate the money increased day and night. Mostly they paid higher value of interest than they have taken money from money lenders. In that case one or two members from the borrower family worked in the field and domestic work of the money lender's house. However, in recent time the concept of *Halies* was not seen in the study area in any community. The money lending practice was also prevalent with similar compound interest rate. Currently, people mortgage gold or silver ornaments equivalent to the current value of money. If they are unable to return money, then money lander keeps the ornaments. Among the Patel community they hired agricultural labour during the harvesting time and concept of bonded labour was not reported.

The number of government employees was less among the Rajput because they have higher volume of land compared to others. So, they think who will do stupid *Nokari* (Job) under another person. They felt that we are the ruler; we cannot work under any person. That was the philosophy of older generation of the community who are more than the age of 60 years. As I recorded that, in 29 study villages only 22 persons (70% from the current generation) are currently employed in government jobs, which constitute around one per cent of total population of the community in the village. As per the study data, only 58 persons have self-employment such as a dairy shop, cloth shop, etc.

The percentage of a government employee among Patel was very low, because the literacy level was very less, even in the younger generation also. Among 20-40 years age group, 13 per cent were illiterate, while 52 per cent below the level of 8th standards. Only 6 per cent of people completed their Senior Secondary exam, which was equal to 12 standards. Eight per cent acquired graduation degree, while only 4 per cent studied a higher degree, which was more

than graduate level. In sum, only 11 per cent member of the current generation completed their higher studies, while 67 per cent did not reach 12th standard (table 4.2). In the private sector, no one reported being a permanent employee. Of the 417 persons, only one person has permanent government service. While those who are migrated among them many are working as a labour in the shop of the Baniya at immigrating place.

Table 4.2. Education of Status of the Patel Community Among the Age Group of 20-40 years

Education Category	Freq.	Per cent
Graduate and above	16	3.84
Graduates	33	7.91
Senior Secondary	26	6.24
Secondary	64	15.35
Upper primary	94	22.54
Primary	129	30.94
Illiterate	55	13.19
Total	417	100

Source- Fieldwork data.

The workload pattern was observed very closely among the Rajput and the Patel. If we go through the work cycle of both communities, according to the months then, the first period of work began from the last week of June when monsoon arrived, and it continues till mid of the November. In between this period the *Kharif* crops were sowing and harvesting and *rabi* sowing. In this period major works were, ploughing of field, sowing of the seeds (earlier maize only, while in recent maize and soybean), weeding and digging of the crops. From the end of October to mid-November, the harvesting of crops, threshing, winnowing, and transportation of grain was the work completed. After completing this, preparation of *rabi* crops started, then again followed all these processes of sowing, weeding, digging on the onset of November and, then harvesting, trashing, winnowing, transportation for stocking or selling of grain work are mostly done in the April to May. In the beginning of June, the manuring process was started, and it will take around 5-10 days for whole field included spread of small heaps of cattle excreta. Finally, end of the June monsoon arrived, and this cycle was continuing for next near and so on. The sowing, weeding and digging, and harvesting time was the peak time of work when farmers spent more than 10-12 hours in their field, which was about 5-6 months in a year.

While in rest of months they were going to the field and watched and safeguarded of growing crop, and irrigate them.

As people reported that, they started work in their agricultural field from their childhood along with elderly family members. The major tasks were done by younger children like irrigation, grazing, help during the tillage and harvesting time. The nature of work was very hard, they started work in early morning with taking care of milch animal, milking, then went to the field for agricultural work. They consumed breakfast in their field and return to home in afternoon for lunch then again 3 pm they went into their field and return in evening with green fodder for their animals. In agricultural field similar work done by both men and women, while domestic work was exclusively done by the women. During entire fieldwork, I had observed that most of respondents have slim body, In data analysis part we will analysis BMI of studied population group.

The traditional occupation of the Meghwal community was different kind of leatherwork such as skinning, dyeing, tanning, shoe making, shoe repairing and among others. By their occupation, they were treated as untouchable category. They were deprived from all social privileges such as entering into the temple, and fetching water from the ponds where the higher social strata people get their water, among others. The socio-economic conditions of this community were lowest standard from all respects. After Independence, some affirmative actions were taken by the government in respect to SC/ST such as provision of reservation, welfare measures adopted in the eight five-year plan, the socio-economic condition of SC/ST in the Rajasthan were improved (Sharma, 1996). However, the atrocities against this caste have their strong existence in society till now. The major and significant changes were observed in their traditional occupation, while other caste groups had normal changes in their traditional occupations. The changes in their occupations happened due to the pressure of the caste panchayat. In1988 and again 1989, the historic decision was taken by the caste panchayat about total ban on leather tanning and dyeing work. If someone resist to quit traditional work they faced expulsion from the caste (A. N. Bhattacharya & Vyas, 1979).

The process of making leather from dead animal skin to fine product such as *mojari*, beg, and among others are very tricky and lengthy process. As Mangni Ram 58 years form Gurel villages explain that-

"First they removed the skin from the dead animal, then after soaking them into the solution of sodium sulphate or lime (chuna) for 15-20 days. Lime solution removes hair from the skin. Soon after the raw leather were put into the salt water along with Saccharum Munja (local grass) until the leather or hide become stable and watertight, salt solution make them more stable. Then, it was left for drying under direct sunlight. During the drying process, it is protected from water. After that, it was polish with oil and some scraping. Now the hide was ready for dyeing. This community used natural plant of leather dyeing and Awal (Senna auriculata (L.) Roxb.)[40] was major plant that were used. The Bark along with cambium layer of awal plant stem was removed by using wooden hammer. This Bark were put in the boiled water and left for a while. By this process they make red dye and polished leather dyeing with this nature dye. After going through this process the hide becomes ready for making leather based products."

As people reported that the skinning of dead animal was completely quit by the community members after the caste panchayat decision. While many of the members are still engaged in leather work such as shoe making and repairing work. Most of the community members' choses different jobs. In current generation (20-40 years), as per the current study data; seven per cent of the respondents were in government jobs while 17 percent were in private sector on contractual basis. Thirty-two percent respondents depended on daily wages while 14 percent involved in agriculture along with daily wages. Four percent people involved in shoe rearing work. In earlier generation (41-60 years), 40 percent respondent involved in leather work such as shoe making, repairing and other work. Twelve percent involved in farming and similar proportions were daily wagers while 22 percent in the farming along with daily wages. Ten percent had permanent job. There is a reduction in leatherwork from 40 to 5 percent.

As discussed these communities are landless or have small piece of land, which was insufficient to meet day to day expenses. People from the previous generation worked as agricultural labourers in the Rajput and Patel field. While in current generation less than 5 percent people involved in agricultural work. Many of the community members went for daily wages in construction and other wage related work. In current generation, around 70 percent people migrated to other cities for work, as people reported. The wages structure for labour

[40] The state flower of Telangana State.

was similar as discussed in the social history of the Rajput and Patel community. The community members did not report the description about bonded labour.

The weaving of cloth was the traditional occupation of the Salvi community. They weaved *dhoti,* turban, quilt cover, and mats. All these material was made with the raw cotton which was mostly brought from the nearby districts (Bhilwara, Chittorgarh) and state (Gujarat). They first made the cotton thread, and from that, they made cloths. The weaving work was completely vanished due to higher input value (hard work, cotton price) and lower output. A report published in the Rajasthan Patrika (Hindi-Newspaper) (Rajsthan Patrika, 2019)-

> *"Kanku, Bhawari, Savi, Laxmi, Bhawani, Dhuli and Mangi Devi from the study block involved in the cotton thread making process. The Salumber Khadi Bhandar provides raw cotton to these women for making of cotton thread. After making of cotton thread, Khadi bhandar collect thread from their house. They got 35-40 rupees per day by doing this work. Indeed, they got a small wage for their hard work. Therefore, Salvi community started making distancing from the weaving work. The current generation completely away from this work and Hathkarga (thread and cloth-making equipment) has also become useless".*

As Gautam lal from Utharada village reported that-

> *"Earlier, all family members were involved in weaving work. Turban, cloths, saree, dhoti and carpet were made by the community. This process needed very attentive and hard work because every thread should be in the right place. The work was double and extensive when multicolour threads were used for making material. Earlier, the raw materials were very cheap; therefore the fine products were not costly. In recent times, the raw materials were costly, and no one willing to pay actual cost (raw material + weaving wages+ profit) of the fine product. Indeed, the textile mills were established in the rampant ways, and they produced clothes at cheap level because the mostly weaving work was done by the machines and machine produce higher volume of cloths. The ultimate input value for fine products was very low, and despite that, they are in profit. In the modern industrial era who is willing to pay more on hand weaving cloths. Therefore, the weaving work was stopped by the community members and started another work for survival."*

The tools *Charkha, Pajani, Sal, Kunchda, Kunjudi, Pariti, Parita, and Tas* were used for weaving by the Salvi. However, members from the current generation were not knowning even the tools name that were used for weaving because all tools had also disappeared from any use.

Fig. 4.7 The Traditional Weaving Machine

Another traditional work of Salvi was giving an invitation (*nyota)* of the function of the other communities. Salvi traditionally works as inviter of the Rajput, Patel, Brahmin and Jain community during their functions. Earlier, by inviting work they received 5 kg food grain (as a *Sukadi)* from their selected households in every cropping season. In recent time, they also received money along with pre-decided food grain. However, older generation still works as inviter while current generation started making distance from this work.

The employment in government sectors of Salvi was higher than other community in this region. As discussed in the social history of the Rajput that other community have agricultural land so, they work at their own land and response towards government job were less observed.

While in the Dalits (Meghwal and Salvi) do not have the opportunity for cultivation and their traditional occupation completely vanished due to several reasons; therefore, they paid much attention to government job and other work. As people reported that work profile in government sectors among Salvi was teacher, fourth-grade employee and Clerk. Current generation mostly works in teaching occupation while previous generation worked as fourth grade and clerical work. The age of work starting was lower in the previous generation because that time all family members involved in the weaving process and children from family also worked along with elderly members. While in current generation children mostly focus on study and after the completion of education, they started searching for job in public and private sector.

4.15 Migration, and Nature of Work

Migration in the Patel community was higher than the Rajput among the current generation. Age group 41 to 60 years among the Patel reported history of migration while among the Rajput no one reported history of migration in this category. The rampant migration started after the 1990s when other expenses started increasing. Migration was much prevalent in the younger generation among all studied population groups while it was less reported in the previous generation. There were many push factors behind the migration. The prime factors were increasing expenditures such as education fee, electricity charge, loss in agriculture, uncertainty of monsoon, unemployment near residence, and health care expenditure, among other things. The partition of parental land between siblings was one of the reasons for migration because after partition, the amount of land decreased and that was not enough to combat the described expenditures. Therefore, they migrated to support financially to their family. Improved economic conditions also pull other people for migrations. The pull factors also attract to the youngster. Mohabat Singh 30 years reported that-

> *"Many of young people from the community saw the shut and boot and smart mobile phone of the migrant worker means people generally judge the migrant people from their dressing and other things that they have. Other people also feel that, if we also go along with him, then we can afford better clothes and mobile."*

The major destinations of migration were Mumbai, Thane and Ahmedabad. The migrant worker from the Rajput community mainly involved in the metal business, cloths shops, dairy shops, mobile accessories, a supervisor in construction work and among other things. While among the Patel, around 60-70 per cent migrants involved in the tea selling business, as

reported. Vinod from Gurel village (who was migrated) explaining about the involvement of tea selling business that-

> *"In my village, one person from every household was migrated. Some of them first did labouring in tea stall where they sell tea to shopkeepers and labourers. After two or three years of their migration period, they established their shop. I also own tea stall in the Chembur (Mumbai), before my tea stall, I worked at tea stall owned by the one of our community member from the nearby village. After my tea stall, I employ two-person from my village in my tea stall; I paid 8000 rupees per months to each, and other living expenses were born by me. From the tea stall, I earned 10 to 20 thousand rupees profit per months. At migration place, we have facing major problem related to accommodation. The good quality of the room has higher rent, and it varies from 15000 to 30000 per months. The medium quality room was also varying from 10000 to 15000. So, five to eight-person jointly living in the room and the room rent were shared by all person equality. My tea stall rent was 10000 per months which I install outer portion of lodge. Means a single shop shared by the two tenants. Food was easily available in the city like Mumbai while shelter was more difficult"*

The views of Vinod clearly explained the situation of living in metro cities. As discussed, most of the migrant workers were selling tea in the metro cities. Some of them involved in ice cream stall near about chupati and garden. However, Brahmin community occupied the ice-cream selling business in Maharashtra and other states. Everywhere in-country, you can find ice-cream stall with name of Mewar Ice-cream, Mewar Rabadi Gulfi, etc. The Udaipur region is known as Mewar region from the Rajputana rules. Patel community were new in the ice-cream business.

As discussed, the skinning and tanning work was completely banned by the caste panchayat in 1988-89 among the Meghwal. The caste panchayat also advised that the community members should find jobs in other sectors. This was one of the reasons for migration in this community. Another reason, less working opportunities available in the native area might have higher possibility of migration. While migration for work was lower reported among Salvi community, while out-migration for study was higher reported by the respondents. Another, those who work in government or private sector, they migrated along with their family member to their workplace. They would return in their native place if there was function such as

marriage, death and others. There two types of migrant's workers were found among Salvis. First was, those who were economically poor they migrated for work at Ahmedabad, Surat, and Mumbai. Another, those who were economically well off they migrated for cities such Udaipur for better education of their children. The destinations of immigration are Ahmedabad and Mumbai. However, people from these communities mostly preferred Ahmedabad as destination for their migration. The majority of the schedule caste community was working in Ahmedabad. Therefore, it was convenient for them to move there for work. They believed to have additional benefits being in such community which can render support in searching job, social protection on day to day affair, food and boarding arrangements. Study based on different district also support the above argument (Choudhary, 2013).

The major work done by was catering service, sweeper in bungalows, tea stall, worker in steel factory, some of them sell street food or street vendor, and other wage-based work. The working conditions depended on nature of work. The case of Bhabarana village, 30 km away from the block headquarter in terms of migration differed from the other study villages. Both current and previous generation observed migration. The work profile of Bhabarana villager's is different from the other villages. The migrants from this village involved in catering and cooking businesses. They got cooking contract during marriage, party, and other function in Ahmedabad. Cook can easily be found in every household in this village. Cook from Bhabarana village cooks the food in most of the functions in this community such as death feasts or gangot, birth celebration, marriage and others.

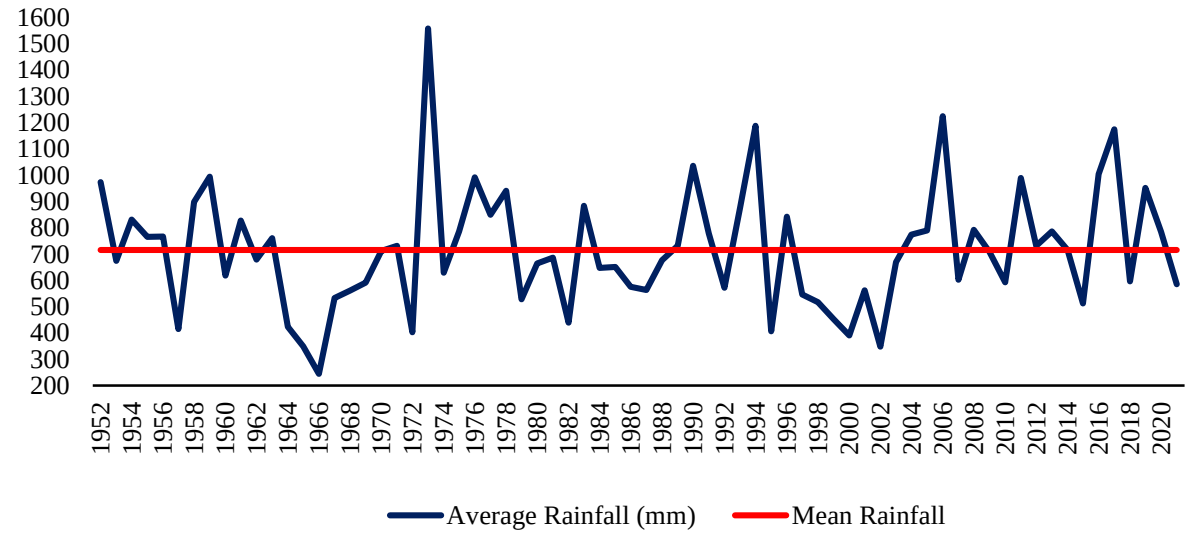
There were no predefined working hours at migrant place, and it depends on the work. Sometimes they work 12-14 hours and when the workload was less, and then they worked for 8-10 hours per day. However, still the working hours were higher than the working capacity of an individual. The wages of migrant workers mainly start with 6000 to 10000, and it varied from the work and experience they had. Sometimes the owner pays living cost such as room rent and food expenses. However, most of them were paid fixed salary with annual increment of 5-10 per cent. The economic status of all studied communities became improved after migration of their children. During my fieldwork, I observed that those who were migrated and had their own shop or had self-business, they were economically well off than others. They have single and double story pukka houses and have their four-vehicle such as Bolero, Car, tractors. Almost all household of the studied communities have motor cycle, as observed.

The age of migrant worker among the Rajput and Patel was varying from the 14-20 years, as reported. While the average age of migrants' workers among Meghwal was varying from 20-25 years. The age of migration among the Meghwal was higher than the Rajputs and Patels. People from this community generally migrated after their 12th standard of education while the Rajput and Patel left their school mostly after the 10th standard.

4.16 Famine, Drought, Flood, and Relief Work

In these villages, there was no history of full-fledged famine and flood reported in the last 65 years. However, many times due to below-average rainfall food grain production would get affected. In the years between 1964 and 1969, continuously, and in 2002 also, Salumber block registered a below-average rainfall. The average rainfall were recorded about 715mm[41] per year. Excessive rain also hampers agricultural production, as happened in 1973, 2006 and 2016 and 2019 (Irrigation Department, 2017).

Fig. 4.8 Average Rainfall (mm) of the Salumber Block



Source – Department of Water Resource and Irrigation, Salumber, Udaipur (Rajasthan); and Monsoon report 2016-21, Water Resource Department, Government of Rajasthan.

As people reported that during the end quarter of the twentieth century, most of the workers were involved in relief work such as canal building, pond maintenance and road construction come from the scheduled tribe and Scheduled caste category. Under this program, they received food grain in the place of money by doing work. They were land less and had no employment opportunities; therefore, they were involved in relief work while the Rajput and Patel communities have sufficient food grain. During 1990s, *"we got 25 kg wheat food grain*

[41] Average of annual rainfall from 1952 to 2021.

for 7 days work and we worked 15 days' in a month". Only one member used to be recruited from each family.

4.17 Health Culture

The games were integral part of the life. In the childhood of previous and current generation, many traditional games such as *Gulli Danda, Kho-Kho, Kabaddi, Hide and Seek* were played for body building and entrainment purpose. Manohar Singh, 60-year-old, from Gurel, reported that-

> *"In our childhood, every day after school, we left house and going into the field, and we play Kabaddi. Sometimes in night after dinner we played Kabaddiin the moonlight till mid-night. When we went for grazing our animal that time, mainly we played gulli-danda and hide and seek. During the festival time such as Holi we played Gair dance along with villagers, volleyball on national festival. While today's children mainly play cricket, they forget traditional games. Moreover, when the smartphone with free unlimited internet data arrived, they always busy with watching videos, cartoon etc. no one going out to play this type of games. It will affect the eyes of our children."*

People often from the Patel community after dinner played *Kusti and Kabbadi. Gulli-danda* was playing at the time of cattle grazing. As people from the all communities reported that, ghee and milk were the best food that helps in the improvement of health and bodybuilding. Generally, people in the household give more milk and ghee to their children because they believe that if they eat ghee and milk than he/she become healthier.

Previous generations of the Rajput people reported that sometime they along with a group of people, went for hunting of wild boar because that time, forest density was high and wild boar also destroy their crops. The hunting of wild boar was done in the daytime. In full of the moonlight, generally they hunted rabbit. The hunting of rabbits was done for passion.

The type and pattern of game changed over a period. As Holi ram from Bamaniya village reported-

> *"Hide and sick, gulli- danda were the major games of our childhood. Often grazing of our goat, we played these games. In the school, mostly we waited for lunchtime, because we had to play kabaddi along with school friend. Those friends, those who were playing with us, belonged to our community. Higher*

caste people avoided playing with us. Today's children are involved in watching TV and mobile phones whole day they will become blind after few years. The cricket is the favourite game of young adult members. They often found playing cricket in school field."

The adult members of the society perform *gair* dance on *Holi* while in rest of time the adult members do arduous work from morning until evening and therefore, they hardly get time for such recreational activity.

People from Salvi reported less attention to games. Whole day they were involved in thread making, weaving of clothes along with their family members. Therefore, they did not have time to do other recreational activity. The weaving work was very attentive and harder. Because first, they have to make thread from raw cotton by using *charka*, then by using the loom frame to organize the thread in the square portion. Then it will put in *Hathkargha* machine. The foot and hand both were used to running machine. For cloth making they have to sit at one place for longer hours. As people reported that making 30-meter clothes took more than one month. Holi Ram, 70 years old from Kharka village reported that-

"Cloth making took a longer period; it is very hard work as it required longer sitting, which caused back and knee pain in later stage. At older age people those who worked on Hathkargha, the posture of backbone was changed. This affect the body structure, and people become hunchback. Even people cannot sleep due the pain in their lower and upper back. The slip-disk was a common problem in weavers."

4.18 Health Seeking Preference

In the previous generation, during the illness, they used home remedies, e.g. during the cough, consume milk with turmeric at bedtime, and the next morning it will be cured. Sometimes when disease becomes severe, they visited the healer, *Vaid* or those who know of *Ayurvedic* medicine. They believe that healer has some spiritual power and by using this, they completely cured of the disease. Oil body massage was commonly practiced among the Savlis, because they continuously work on *Hathkargha* machine and by oil body massage they get some relief. Earlier there was a common belief about modern medicine that if we took single-time medicine then we have to take this whole medicine life. When disease get its severed form then they visit the modern health system.

Dai was the most respectable person in the community, even if they came from the lower caste. However, if Dai comes from the upper caste, that was not performed delivery of lower caste people. Most of the deliveries in the village were performed by Dai. If there were complications observed during the delivery, they visited the nearest health facility. People also reported that accessing of modern medicine was difficult in our time because village-level health facilities were not available that time, they have to go to the Salumber for treatment, and some time even to Udaipur district hospital (census data also showed the less medical facilities and how it had increased over a period of time (Figure- 4,9). The transportation was not frequently available at that time, therefore, they used bullock to carry a patient to the hospital, and sometimes four to eight people carried patient on their shoulder.

In recent times, the resort to modern medicine was higher than the earlier because improvement in the transportation facilities and availability of health care facilities. The people reported that

> *"Now the health facility is easily available and accessible so why should we go for other systems of medicine. Modern medicine cured illness in a shorter period of time while traditional healing takes longer time; therefore, we preferred modern medicine."*

Among the Meghwal community, they first preferred to visit nearest PHC and CHC during their illness. In case their disease was not cured then they visited Private health centres at Udaipur or Ahmedabad for better health care. In case of children, mostly all communities preferred the private health institution for health services at Salumber or Udaipur district level. They reported that they would not be taking any kind of risk regarding their children's health.

They believed that doctors in the government hospital did not give right medicine; they generally write those medicines that were available in the hospital. The medicines available in the hospital were not working properly.

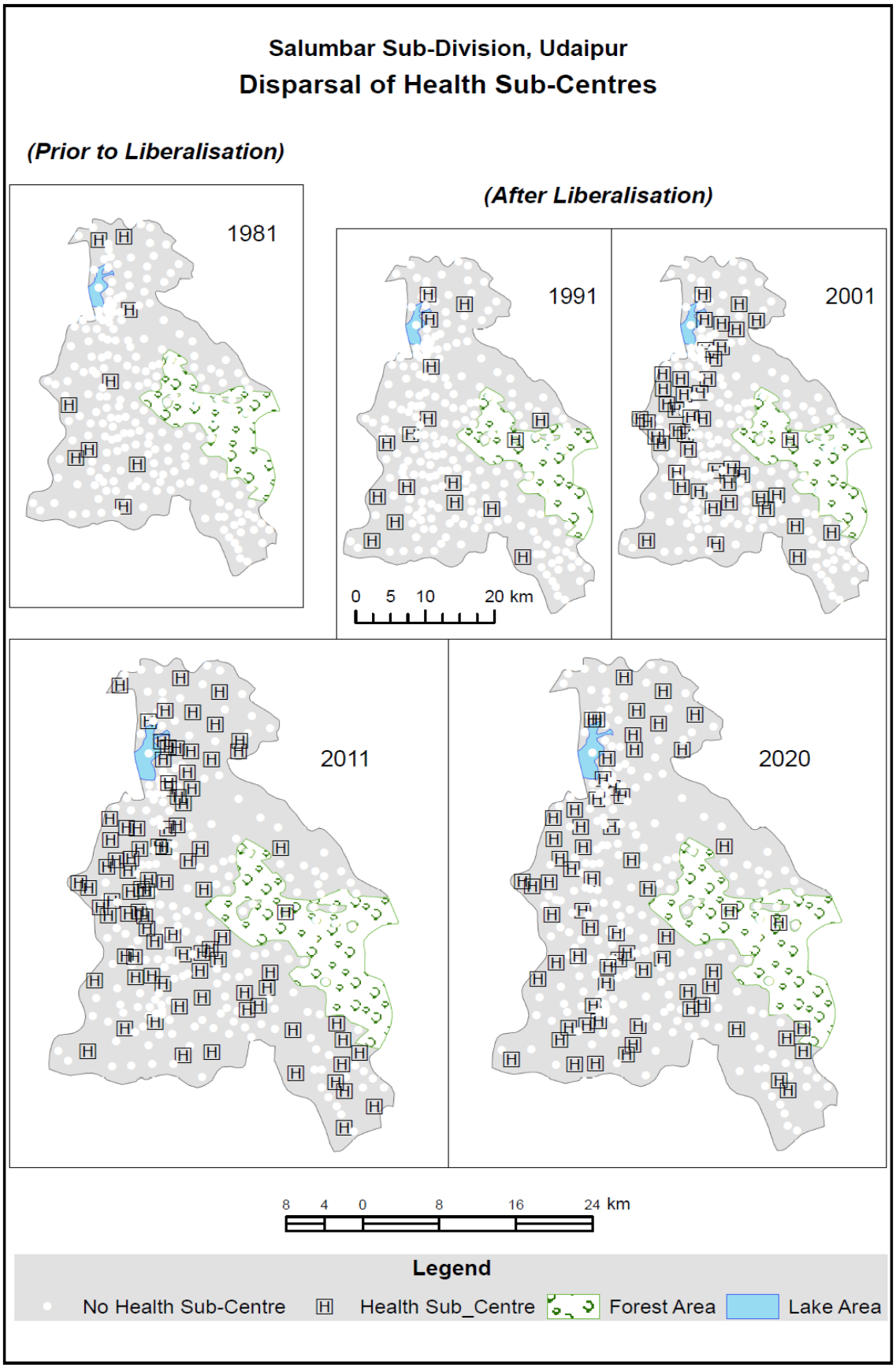
4.19 Institutions and their Accessibility

Earlier, health institutions were not available at the village level. Only three villages have PHC during 1971 out of 29 villages, while sub-centre was available in all study villages from 1991 onwards. The private health facility was unavailable. In recent time, all villages have sub-centre and better connectivity with the PHC and CHC. As discussed, the Anganwadi centres were available in all the villages.

The accessibility of availing services from the institutions such as AWC, Sub-centre, and PHC was higher among the Meghwal compared to the other communities studied. Anganwadi centre were attended mostly by children from the scheduled caste and scheduled tribe category. As Anganwadi workers reported and previous study done in this area showed that women from the scheduled caste category have highest coverage of immunization and ANC (Choudhary, 2015). The Rajputs have good linkage with health professionals at the village level. The professionals also greet the community members during the meeting because they belong to the upper strata in the social hierarchy. Regarding the behaviour of health professionals towards Patel did not have favourable response. During the field work, I often heard from the health profession that, *"this community was behaving like animals, they did not understand, they are living without cleanness and hygiene, they did not bathe daily, when they come to the centre, they small like animals".*

The Meghwal community also experienced discriminatory behaviour from the professionals who work in the institutions. Presence of children at Anganwadi was observed higher among the Meghwal and the Salvi. Indeed, those who belong to lower economic strata mostly used Anganwadi services, while upper class took only immunization services from Anganwadi centre, as reported by Anganwadi worker. The community members also reported discriminatory behaviour of Anganwadi worker during ANC and PNC services. However, this type of behaviour was higher reported in those villages where the worker and ASHA belong to upper caste groups. The behaviour of ANM was also reported as discriminatory in some villages. Most of ANMs belongs to upper caste and class, and often a different district also, probably reasons responsible for the discrimination practiced. In the study area, many of ANMs belonged to the other more developed regions such as Sikar, Jhunjhunu, Churu, and Jaipur. These districts are more educationally forward than other districts of the state. So, they often comment referring to local people that '*they are illiterate person, they did not understand*'. In every village, the PDS shop was available. Those who in BPL category or under food security they get wheat from PDS shops, while rest of items were not available at PDS shops. Among the Meghwal accessibility of PDS has higher reported. Because most of the community member comes under the 'below poverty line'. Therefore, they get wheat, kerosene, rice and sugar from the PDS shop, which indicates higher accessibility and utilization of PDS services by this community. The official data according to the caste level of BPL is not available at Panchayat Samiti, they have village wise list of BPL beneficiaries. However, this data is available online.

Fig. 4.9 Distribution of Health Sub-Centre from 1981 to 2020, Salumber Block



In the field of schooling, the Rajput and Patel was far behind than the Meghwal and Salvi community. The literacy level was very low among the previous generation, while in the current generation, the schooling level was increased. The Meghwal and Salvi's attitude towards formal education was positive. As per the field data, the literacy level among Salvi was higher than other caste groups in both generations. The percentage of higher studies were also higher in Salvi than study groups. The school dropout was also lower in this community.

The school enrolment does not make a difference among the caste group but graduation and above level study percent of Meghwal is fourth time higher than the Rajput and Patel community. The Meghwal and Salvi community are serious towards education compared to the Rajput and Patel. Because, they know we do not have traditional occupation. Therefore, we study hard and get good job while the Patel and Rajput community member have their traditional occupation.

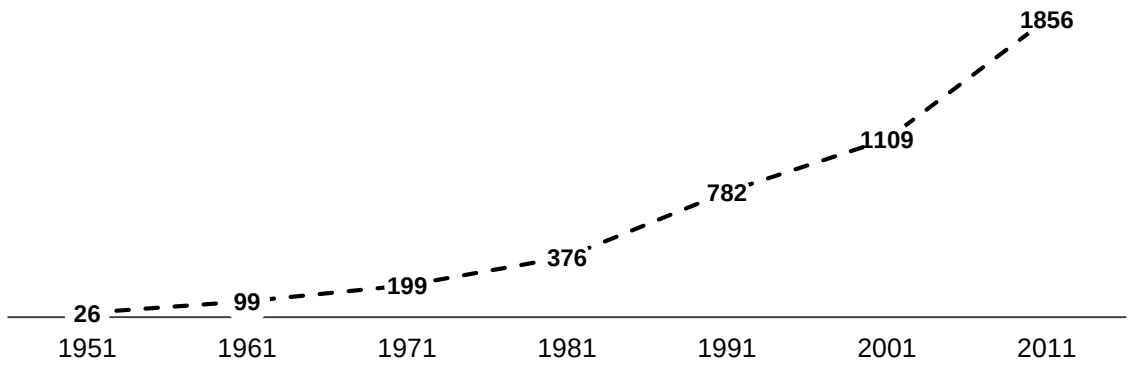
Children from the Rajput community did not face any difficulties in accessing the school, but they did not want to study. They feel that what they will do after study, they have huge land and they will be doing cultivation. People also reported some time they left school because of teacher beat them with the stick, so, they have a fear of the teacher's stick. However, in recent time, the punishment in schools was completely eliminated. As Mohan Singh 50 years reported that-

> *"Our parents respect the teacher, if teacher beat us then our parents were happy, and they also blame us that we must have done something wrong. When our parents meet with teacher then they request our teacher to beat us more because they say we never study at home."*

The behaviour of teacher towards children of the Meghwal and Salvi community reported to have discriminatory approach among previous generation. People reported that last rows in class were allotted for them while front rows used to be for the children of the upper caste. They used to clean the classrooms regularly. They generally carry a plastic bag for siting in classrooms while student belonged to upper caste have accessibility to mats, as reported. The discrimination by teachers in the classroom observed have decreased over time due to enforcement of law and most of the children from this community studying in the private school and if they feel any discriminatory behaviour

towards them then there is a possibility of quitting school and take transfer to another school. Because they also pay similar fee as paid by the other community.

Fig. 4.10 No of Education Facility, Salumber



Authors calculation from Census of India data

Earlier, the Rajput community have strong political influence in the village and assembly elections. Even in recent time, the Sarpanch of the village was decided by the community members, because they have been benefited by social power. All the village membersgreet the Rajput community member, with the respected word *Bapu.* The community member who was eligible took most of the benefit out of welfare schemes. Patels remain distant from village level politics. They did not interfere in affair of those who were not related to them.

As people from the Meghwal community reported that, we are excluded from the main stream politics due to Tribal Sub Plan. In addition, earlier we did not have any right to participate in the gram panchayat activities due to lower caste. As group of people report that –

> *"In recent mainstream political activities, we are the just vote bank of the political parties. Some of our community members are actively involved in politics they use caste as tools, because they got some seats in the Panchayat body such as ward punch, political position at village level. By this, they get some money and they influence people of our community. When the election is near then the leader of the community pay attention to the community members, because they receive some money and attention from the MP and MLA. After the election, they even did not recognize us."*

The political affiliation was also reported among Salvi. Some of the households actively involved in mainstreaming politics, and these households also benefited in the local governing body or Panchayat election due to mainstreaming political affiliation. Majority of households

are busy with their daily activities to survive, so they become voters only. The legislative and Sarpanch (head of the village council) seats were reserved for tribals only due to TSP notifications. Other communities can contest election of vice Sarpanch, Ward members, etc. In the village panchayat (excluding the electoral politics) Salvi community was also excluded. The decision related to village affairs was mostly taken by the Rajput and other higher caste groups.

4.20 Cultural Activities

All studied communities following endogamy marriage practice and no marriage in the same *gotra* was permitted. Older persons and relatives fix the engagement of their children. The average age of marriage among the Patel community was 15 years during 1972 (Bhattacharya & Vyas, 1979). However, the age of marriage was lower among the female than male members of society (ibid.). As people reported, children by 20 years of age or girls at 16 to 17 years are socially required to participate in marriage ceremony. Because in case if girls left with another person for marriage than the reputation in the society will go down. So, they performed early marriage.

They worship Ganesh a week before marriage. The marriage was performed at bride's place. They also follow the patrilocal practice after marriage. In case of child marriage the *gona* ceremony was performed after the girl reaches her puberty. After *gona* she went her husband house. The monogamy was common form of the marriage. However, polygamy was also practised among the Salvi. The second wife was done in special case such as when the first wife is unable to deliver baby, or they gave birth only girl child, internal dispute between husband and wife. Earlier, red coloured dress and *chuda* (bangles) was the symbol of married women while in recent red vermillion was also applied by the married women on their head.

The system of remarriage was prevalent among the all studied community except the Rajput. The divorce was also prevalent. Both husband and wife can socially dissolve the marriage and marry afresh. The widow or widower below the age of 35-40 years was not observed in the Patel. Among Meghwal and Salvi which remarriage takes place up to the age 40 years. Divorce cases were settled by the caste panchayat. The women have more power to give divorce and maintaining the marriage. The following cases would help in the understanding the divorce process and women authorities in the Patel community-

"A women from the Intalikheda (one of our study villages) earlier got married with the person, after the one year of marriage she gave birth to a baby girl. Her husband was an alcoholic and always beat her. After the four years of marriage, she left him and returned to her parental home. Soon after the one month of her parental house, she performed another marriage with a guy from same community in the Jaitana village (one of the study village). Her former husband called caste panchayat and caste panchayat took decision in favour of her. She brought her daughter at house of her new husband. The family of her new husband took care of her daughter better than her former husband. Her new husband was given divorce to his former wife also, because he did not like her. He has given three lakh penalty to the society for divorce."

"Another case from the Intalikheda villages, a woman refused to go to her husband's house, because her husband was unable to build their new house under the pressure of his family. Her in-laws told her that she had to reside in this house until they died. After their death, the woman can be build their own house. She was residing with her parent's house from the last two years. The dispute mainly happened between the sisters-in-law (Jaithani) and her*."*

Earlier, the breaking of engagement was not allowed, if someone broke thus then they had to pay fine to the caste panchayat. The fine was varies between Rupees 5000 to 10000. The amount of penalty was varying due the powerful relation with caste *panch*. While in recent times, the fine or penalty regarding breaking of engagement from girl's side is not punishable due the lower gender ratio. Moreover, if boy breaks the engagement then girl's family can call the caste panchayat and caste-panchayat might have impose the penalty.

Marriage was the most expensive cultural activity in the community, particularly girl's marriage. Dowry was common in the Rajput community. Every father of bride has to pay huge dowry to the groom. In dowry, they gave all material or item for household need for better living. The average cost they reported for dowry was about two to three lakh rupees. In marriage groom's family was in profit while bride family was in huge loss. However, dowry was socially accepted in the all studied communities.

Child marriage was still prevalent in the Rajput and Patel. During fieldwork, I found five marriages in which both groom and bride were below the legal age of marriage. No one took

any action against this. The prevalence of child marriage among Meghwal and Salvi was not reported among the current generation.

Earlier, mostly divorce and marriage related disputes are solved by the caste panchayat. The interference of constitutional law in divorce and marriage related disputes was very less reported. In recent times most of the divorce related dispute proceeded through court. Earlier the crime-related dispute were also handled by the caste panchayat while in recent time this dispute settled through the court.

The parental property was divided among the sons, and daughters has no social right to parental property. The women have lower social status among the all studied communities. They have to take care of children and household work. Participation of women in household financial management was less reported. In case of son was not available in the society, then the parental property belongs to the daughter. Earlier the concept of adoption of children was prevalent in cases where there was no son in the house. Generally, they adopted their brother's male child, and this child was the successor of their property. That child was responsible for taking care of their adopted-parents and sisters.

Chapter -5 Intergenerational Changes in Adult Height: The Study Results

5.1 Sample Descriptions

As per the census 2011, Salumber block consists of 268 villages and 46 Gram Panchayats. Salumber town is considered as an urban area which has 20 wards. In this study, 29 villages and Salumber town were included as described in the methodology section. Table 5.1 shows 26 villages, in which two villages were combined in Bassi (Bassi Jhunjhawat, Bassi Singhawat and Bassi Samchod), and one clipped in Isharwas (Isharwas Tapran and Dangiyan) due to the topography of the village. Inclusion of Salumber town in the study would be able to explain the difference in adult height between the rural and urban strata.

The study area is covered by 53 Anganwadi centres. In this study, Anganwadi workers and ASHAs played an important role. As they knew each and every household so well, the research could be completed appropriately and within the stipulated timeframe. Their role is acknowledged and appreciated. As per the records of Anganwadi, 32.74 percent population was included in the study of the total eligible population (8020 male aged 20-60 years). 28.93 percent of respondents belongs to Rajput, 31.95 percent belong to the Patel community, 41.77 and 32.75 percent from the Meghwal and Salvi caste, respectively (table-5.1).

During the data collection process, researcher visited all the households of the above caste groups thrice and those who were following the study inclusion criteria and available in the household, their heights were measured. Indeed, many a times some of the respondents were not found in the first or second visits. So, repetition of household have higher possibility of inclusion of sample population. Inclusion of less percent of study sample of total population in each category which indicates that they were not available at home during the visit due to various reasons i.e. migration, daily work etc. The data collection process started in end of the March 2019 post review and approval of methodology and study tools by institutional ethical review board, JNU. March onwards there is a temperature rise which peaks by the end of May[42]. At the end of March and first week of April all the crops are ready for harvesting and most of the family members are involved in this. All agrarian families used to go to the field early morning and return by afternoon, therefore, I visited all the households of the Patels and

[42] https://weatherspark.com/y/107665/Average-Weather-in-Udaipur-India-Year-Round accessed on 06/04/2022

Rajputs in the afternoon while the height of Meghwal and Salvi were measured in the morning time.

Table 5.1 Percent of Sample of Adult Men Across Social Caste/Category and Villages										
	Rajput		**Patel**		**Meghwal**		**Salvi**		**Total**	
Village	**N**	(n%)	**N**	(n%)	**N**	(n%)	**N**	(n%)	**N**	(n%)
Bamaniya	97	49.48		-	78	39.74	4	50	179	45.25
Banoda		-	240	29.58	72	47.22	17	29.41	329	33.43
Bassi	952	35.82		-	81	61.73	53	62.26	1086	39.04
Bhabrana		-		-	104	49.04	60	30	164	42.07
Dagar	0	-	282	35.11	21	42.86	33	24.24	336	34.52
Dal	258	13.95	85	64.71	72	36.11	33	18.18	448	27.46
Deogaon	3	100	155	67.1	12	41.67	35	22.86	205	58.54
Dudar		-		-		-	9	77.78	9	77.78
Geonra-Pal	85	30.59		-	35	60	4	75	124	40.32
Gingla	5	20	365	15.62	53	41.51	12	16.67	435	18.85
Gur	366	16.12		-	58	37.93		-	424	19.1
Gurel	186	17.2	141	24.82	77	75.32	24	4.17	428	29.44
Idana	146	23.97		-	36	33.33	16	6.25	198	24.24
Intalikheda		-	410	29.02	37	32.43	26	30.77	473	29.39
Isharwas	14	78.57	251	14.74	4	75	163	25.77	432	21.53
Jaitana		-	250	43.2	8	62.5	13	23.08	271	42.8
Karawali	89	24.72	369	22.22	8	87.5		-	466	23.82
Kharka	113	16.81		-	57	57.89	4	25	174	30.46
Khirawada	70	20	80	25	15	53.33		-	165	25.45
Kholadi		-	141	34.75	74	35.14		-	215	34.88
Loda	45	46.67		-	58	56.9	11	54.55	114	52.63
Panikotada	43	41.86	66	24.24	40	20		-	149	28.19
Payara	35	40	136	52.21	19	63.16		-	190	51.05
Randela	53	45.28		-	22	50	30	36.67	105	43.81
Salumber (Urban)	85	48.24	124	62.9	135	34.07	88	73.86	432	53.24
Saradi	6	33.33		-	180	14.44	68	11.76	254	14.17
Utharda		-	129	22.48	47	31.91	39	12.82	215	22.79
Total	**2651**	**28.93**	**3224**	**31.95**	**1403**	**41.77**	**742**	**32.75**	**8020**	**32.74**

Every day, I reached at Meghwal and Salvi house around 6.30 in the morning and finish the measurement by 9.30 am. Around 12.30 pm measurement of the Patel or Rajput community used to start and get completed around 4 pm. After 4 pm again agrarian community were go to the field. This process is continuing till the end of Sept 2019. My whole skin was burnout in the heat waves, however, I drink lot of water during the fieldwork for keep myself hydrated.

5.2 Average Height and Intergenerational Changes

5.2.1 Place of Residence

The analysis of urban and rural might have limitations related to a lower sample of the urban area as compared to rural. As per the census of 2011, the urban population constitute 6 percent of the total block population and is located in the municipality area of Salumber. Sample included in the thesis from the urban area, about 10 percent of the total respondents. Since many in the urban sample may be those who grew up to attain an adult height in rural areas and then shifted to the urban location and the following results did not account for this caveat.

Table 5.2 Intergenerational Changes in the Adult Height According to the Place of Residence

Place of residence	20-40 years (n=1240)	41-60 years (n=1386)	Coef.	Std. Err.	[95% Conf. Interval]	
Rural (n=2396)	166.56 ±6.28	163.95 ±6.17	2.61*	0.25	2.11	3.11
Urban (n=230)	167.07 ±6.39	163.76 ±7.05	3.31*	0.89	1.56	5.06
Total	166.62 ±6.29	163.94 ±6.24	2.68*	0.24	2.20	3.16
Changes in mean height over urban to rural						
20-40 years			0.51	0.58	-0.63	1.65
41-60 years			-0.19	0.65	-1.47	1.09

*significant at level of 5 percent, $p<0.05$

In the analysis 20-40 years and 41-60 year age groups denoted as current/recent generation and previous/earlier generation, respectively. Above table 5.2 shows that the average height was significantly improved between two consecutive generations and the improvement was about 2.68 cms [95% CI, 2.20 to 3.16]. Higher improvement was observed in the urban sample among the 20-40 year age group/current generation relative to that in the rural sample with a difference of about 0.51 cm [-0.63 to 1.65]. On the other hand, the previous generation from the rural residents are taller than the urban residents. The average height of rural residents was 166.56

cm [95%CI, 166.19 to 166.93] and 163.95 cm [95%CI, 163.61 to 164.29] among the current and previous generations, respectively. While in the urban residents, the average height of current generation was 167.07 cm [95%CI, 165.97 to 168.17] and the previous generation recorded about 163.76 cm [95%CI, 162.36 to 165.16]. The difference over the urban to rural among both generations were observed both the positives and negatives, however, both the differences were not statistically significant.

Height of the individual varies with the social characteristics such as place of residence, region, urban and rural dwelling. It is better associated with the social advantages that the taller people earn more schooling years and income (Macintyre, 1988). The classification across residence of the respondents is necessary when day to day life activities and means of occupation were completely changed. In other words, as social history of community reveals, many of the respondents who were salaried employees in the public and private setting shifted from rural areas to Salumber town due to the work, education of children, health service availability etc. Furthermore, labourer community, also moved into the urban spaces for daily wages. The life in the urban and rural settings has its own advantage and disadvantage. In the urban setting, the probability of accessing health care services, education years, and employment is higher compared to the rural setting. The basic disadvantage of urban setting is housing, higher prevalence of mosquitos which may lead to increase in vector borne diseases however, the rural areas are also struggling with other water born disease. Another that many of urban residence may grow in the rural area than shifted to urban area.

The average height of Rajputs was higher than other communities among both generations while Patel and Salvi recorded similar average height among the current generation when rural and urban samples were combined (table 5.3). In the rural area, Rajput and Salvi were taller than Patel and Meghwal among the current generation. While in the Urban area, Patel were taller than all other community among both generations. All the communities are showing significant intergenerational improvement in average height across place of residence except Meghwal in Urban setting.

The social privilege of the Rajput community leads to greater average height compared to other studied community. Intergenerational improvement in the average among the Rajput was 2.01cm [95% CI, 1.12 to 2.90]. As social history of the Rajput reveals that they owned greater amount of agricultural land which helped them to get greater production.

Table 5.3 Intergenerational Changes in the Adult Height According to the Caste Group Across Rural and Urban Residence.

	n	20-40 years	n	41-60 years	Coef.	Std. Err.	[95% Conf. Interval]	
Rural								
Rajput	348	167.96 ±6.38	378	166.09 ±5.84	1.87*	0.45	0.98	2.76
Patel	384	166.05 ±6.03	568	163.48 ±5.99	2.57*	0.40	1.79	3.35
Meghwal	302	165.62 ±6.01	238	162.01 ±6.48	3.61*	0.54	2.55	4.67
Salvi	75	166.55 ±7.12	103	163.19 ±5.44	3.37*	0.94	1.51	5.22
Urban								
Rajput	26	167.10 ±6.82	15	160.81 ±9.71	6.29*	2.59	1.06	11.52
Patel	36	169.38 ±6.40	42	165.56 ±7.03	3.81*	1.53	0.76	6.87
Meghwal	28	165.70 ±4.67	18	164.23 ±5.87	1.47	1.56	-1.68	4.62
Salvi	41	165.96 ±6.76	24	162.09 ±5.14	3.86*	1.60	0.67	7.06
Total								
Rajput	374	167.90 ±6.40	393	165.89 ±6.10	2.01*	0.45	1.12	2.90
Patel	420	166.33 ±6.13	610	163.62 ±6.08	2.71*	0.39	1.95	3.47
Meghwal	330	165.63 ±5.91	256	162.17 ±6.46	3.46*	0.51	2.45	4.47
Salvi	116	166.34 ±6.97	127	162.98 ±5.38	3.36*	0.80	1.80	4.93

* significant level at 5 percent, $p<0.05$

The agriculture production was the prime source of consumption in the households of the agrarian community. Higher production will reduce the income related constraints in the household. For example, export of coffee and favourable environment condition for the production leads to the reduction of poverty in the agrarian family of Uganda (Chiputwa et al., 2015; Deininger & Okidi, 2003). The height data from medieval Europe also suggest that land per capita was one of the important determinants of height from 0 to 1800 AD (Koepke & Baten, 2008). As per table 4.1 of the chapter four tilted *Lived Experience: An Exploration of Social History*, average landholding of the Rajput is 15 Bigha (3.2 hectors) per household. The previous study by the researcher suggested that 2.5 hectors/ household land is enough for food production and other needs for the family round the year if the they had irrigation facilities (Choudhary, 2017). As reported that improvement in technologies i.e. irrigation, fertilizer, hybrid seeds, mechanization of labour and others led to increase in the average agricultural production gradually. The current generation get boost in their consumption because, the

agricultural production was increasing gradually. However, one side the production was improved but the input cost increased three to fourth fold, so the profile over the agricultural production declined. Due to this increase in input cost, members of the agrarian community also started moving from their native place to other places for employment. Social history also provided strong evidence about migration among current generation and improvement in their observed economic status (condition of house, agricultural equipment, livestock, etc.). The intergenerational improvement in the average height across generations was not uniform with reference to the place of resident. The average improvement among the urban and rural residents was 6.29cm [95%CI, 1.06 to 11.52] and 1.87 cm [95%CI, 0.98 to 2.76], respectively. As reported, the major trends in residing in the urban setting started in the last quarter of the previous century. Those who have had permanent employment or are economically well-off have lived in urban areas due to availability of cash in hand or the permanent source of income. Therefore, intergenerational improvement in height was higher among urban dwellers.

The average intergenerational improvement in the Patel caste group was 2.71cm [95% CI, 1.95 to 3.47]. This community is the second largest community in the study area that has the greater amount of agricultural land in the study area. The average land holding of the Patel community is 2.80 hectares per household. As quoted in the social history that -

> *"Efficiency in farming was not just merely determined by the quantity and quality of land owned by the farmer, but it was determined by productivity and different agricultural practices including the cropping pattern and agricultural products used by the farmers".*

Patel community has lower landholding per household compared to Rajput while the agricultural production was higher among Patel as compared to Rajput because the working efficacy on the farm was higher among Patels. Similarly, the current generation of the Patel caste also benefited from other income sources through migration at different points of location. The improvement in the average height across generations was observed higher (about 3.81 cm) [95%CI, 0.76 to 6.87 for the urban residents] as compared to 2.57 cm [95%CI, 1.79 to 3.35] in rural residents. Similar to Rajputs, those who have permanent employment and are economically well off are residing in the Salumber's urban pocket.

Meghwal community is the backward community among studied communities. The overall highest intergenerational improvement in mean height was observed among Meghwal [3.46

cm, 95% CI, 2.45 to 4.47]. However, despite, higher intergeneration improvement the average height current and previous generation among Meghwal was 165.63 ±5.91 and 162.17 ±6.46, respectively. As social history reveals, the Meghwal caste group is almost a landless community. The average landholding of the Meghwal is 1.68 bigha (0.36 hectors), in another word this amount of land could be used for dwelling purposes not for agricultural production. So, household consumption completely depends on the market and that could be one of the reasons for the shorter stature of the community. Improved economic conditions due to an increase in education level and migration led to greater intergenerational improvement in the average height. It appears that it may require another couple of generations to come up to the genetic potential.

Table 5.4 Rural Urban Difference in Adult Height of Men According to the Caste and Age Group

Caste	Rural	Urban	Coef.	Std. Err.	[95% Conf. Interval]	
20-40 Years						
Rajput	167.95 ±6.38	167.10 ±6.82	-0.85	1.30	-3.41	1.71
Patel	166.05 ±6.03	169.38 ±6.40	3.33*	1.06	1.25	5.41
Meghwal	165.62 ±6.01	165.70 ±4.67	0.08	1.17	-2.22	2.38
Salvi	166.55 ±7.12	165.96 ±6.76	-0.60	1.36	-3.29	2.10
41-60 Years						
Rajput	166.09 ±5.84	160.81 ±9.71	-5.28*	1.59	-8.39	-2.16
Patel	163.48 ±5.99	165.56 ±7.03	2.09*	0.97	0.18	3.99
Meghwal	162.01 ±6.48	164.23 ±5.87	2.22	1.58	-0.88	5.32
Salvi	163.19 ±5.44	162.09 ±5.14	-1.09	1.22	-3.51	1.32

* significant level at 5 percent, $p<0.05$

Salvi community is also included as a landless community in the study area. The average landholding of the Salvi caste is 1.40 bigha (0.30 hectares), which could not be used for traditional agricultural purposes. The average height of the current generation of the Salvi caste group was 166.34 ±6.97 among the current generation and 162.98 ±5.38 in the previous generation. Intergeneration improvement was also higher among Salvi after the Meghwal and it was 3.86cm [95% CI, 0.67 to 7.06].

The current generation of Patel from an urban resident is about 3.33 cm [95% CI, 1.25 to 5.41] significantly taller than rural residents while the previous generation from an urban setting was 2.09 cm [95% CI, 0.18 to 3.99] significantly taller than rural residents (Table 5.4). Among the previous generation, Meghwal from urban residents were 2.22 cm [95% CI, -0.88 to 5.32] taller than rural residents while among the current generation not much difference in average height was observed between rural and urban pockets. Among the previous generation, Rajputs from urban areas were significantly shorter about 5.28 cm [95%CI, -8.39 to -2.16] than rural residents while among the current generation the difference in average height between rural and urban was 0.85 cm [95 %CI, -3.41 to 1.71]. Among the Salvi community, rural residents were taller than urban in the previous generation while the current generation observed less than one centimeter difference between the rural and urban. The previous generation those who measured among them many of spent their growing age in the rural area, and they moved to the urban place for their job. Social history also reveals that those who had permanent income sources were moved into the urban place, therefore, the gap between the rural and urban is higher among the previous generation. Similarly, the current generation is mostly born and growing in the urban place, as reported in the social and life history. Among the Patel community, those who resided in the urban area had agricultural land and house in their native place (rural area) and they collect food grain from their field. Another reason is that all studied communities in the urban pocket reside near the pond which is located adjoining the city, and the possibility of mosquito breeding is higher than in other parts. While collecting the life history many of the respondents from these communities reported episodes of water-born diseases such as Malaria, dengue, and diarrhoea among others, that might lead to lower height in the urban pocket compared to rural residents.

5.2.2 As per Means of Irrigation

The intergenerational changes in height were observed significantly and positively by all means of irrigation, except Salvi with canal irrigation facilities (table 5.5). Among the Rajput, both generations showed that those who have canal irrigation facilities in addition to well and rain feed were taller than those who had only well and rain-fed irrigation. The average height of current generation those who have canal irrigation facilities was 168.05 ±6.33 [95%CI, 167.27 to 168.84] compare to the average height of current generation about 167.69 ±6.53 [95%CI, 166.39 to 169.01] who depends on well and rain-fed for irrigation. The previous generation also reported similar kind of results. A similar result was also observed in the Salvi community among the previous generation. The average height among Patel and Meghwal observed that

in both generations those who depend on a rainfed well for irrigation were taller than those who have additional irrigation facilities.

Table 5.5 Intergenerational Changes in Mean Height According to the Caste Group and Means of Irrigation Facilities

Caste	N	20-40 Years	N	41-60 Years	Coef.	Std. Err.	[95% Conf. Interval]	
Well and Rain fed irrigation								
Rajput	96	167.69 ±6.53	91	165.61 ±6.41	2.08*	0.95	0.22	3.95
Patel	122	166.54 ±5.65	134	164.34 ±6.02	2.20*	0.73	0.76	3.64
Meghwal	136	166.53 ±6.15	102	163.39 ±6.29	3.14*	0.81	1.54	4.74
Salvi	34	167.05 ±5.26	35	162.43 ±5.09	4.62*	1.25	2.13	7.11
Total	388	166.87 ±6.02	362	164.21 ±6.17	2.66*	0.45	1.79	3.53
Canal irrigation in addition to well and rain fed								
Rajput	252	168.05 ±6.33	287	166.24 ±5.66	1.81*	0.52	0.80	2.83
Patel	262	165.82 ±6.20	434	163.21 ±5.96	2.61*	0.47	1.68	3.54
Meghwal	166	164.87 ±5.82	136	160.97 ±6.45	3.90*	0.71	2.51	5.29
Salvi	41	166.13 ±8.40	68	163.57 ±5.60	2.56	1.34	-0.10	5.22
Total	721	166.40 ±6.42	925	163.85 ±6.17	2.34*	0.30	1.74	2.94

*significant at 5 percent level, p-<0.05

The above table no 5.6 showed not much difference between means of irrigation. Those who have only well and rain-fed irrigation are taller than those who have carnal irrigation facilities in addition to well and rain-fed among both generations. However, the difference was less than 0.50 cm and not significant.

In the current generation, those who benefited from canal irrigation in addition to well and rain-fed Rajput were 0.36 cm taller than those who depend on well and rain-fed irrigation while in the previous generation they are 0.63 cm taller. However, these differences were not significant. Salvi community showed the higher benefit of canal irrigation on their average height of about 1.13 cm among the previous generation despite they did not have enough agricultural land. Meghwal among both generations showed that those who depend on well and rain-fed irrigation were significantly taller than those who benefited from canal irrigation

facilities. The difference in the average height of the Patel community as per the means of irrigation followed an akin pattern to Meghwal followed.

Table 5.6 Impact of Additional Irrigation Facilities on Height

Caste	Well and rain fed	Canal irrigation	Coef.	Std. Err.	[95% Conf. Interval]	
20-40 Years						
Rajput	167.69 ±6.53	168.05 ±6.33	-0.36	0.77	-1.86	1.15
Patel	166.54 ±5.65	165.82 ±6.20	0.72	0.66	-0.58	2.02
Meghwal	166.53 ±6.15	164.875.82	1.66*	0.69	0.30	3.02
Salvi	167.05 ±5.26	166.13 ±8.40	0.92	1.66	-2.39	4.23
Total	166.87 ±6.02	166.40 ±6.42	0.47	0.40	-0.31	1.25
41-60 Years						
Rajput	165.61 ±6.41	166.24 ±5.66	-0.63	0.70	-2.01	0.76
Patel	164.34 ±6.02	163.21 ±5.96	1.13	0.59	-0.03	2.28
Meghwal	163.39 ±6.29	160.97 ±6.45	2.42*	0.84	0.77	4.07
Salvi	162.43 ±5.09	163.57 ±5.60	-1.13	1.13	-3.38	1.11
Total	164.21 ±6.17	163.85 ±6.17	0.36	0.38	-0.39	1.11

*significant at 5 percent level, p-<0.05

As per the topography, the South, and South-East part of the Salumber block benefited from Canal irrigation facilities for over a hundred years, while the North, North-East, and East-West part of the block completely depended on the open/uncovered well and rain fed for irrigation. The drainage: stream order map of the block also showed that the South and South-East parts of the block have higher streams and rivers compared to the other part of the block. North, West-North, and North-East part are uneven areas due to the higher range of hills. Therefore, the water storage capacity of these part are very less and rainwater flow into the river and stored in the Jaisamand lake, and the South and South-West part is taking benefit from this water. The South and South-West part of the block have higher water retention capacity and in the season time water often flow on the road and alongside. The prevalence of water born disease are often higher in the South-East area due to higher numbers of streams, ponds, lakes, and canals. In the discussion with the Sanitary Inspector of Slumber block, he said that during the monsoon we especially focus on this area, because this area every time reported a higher number of Malaria and dengue cases and in every pond and lake we harvest Gambusia fish because that

she eat mosquito larva. Anganwadi workers from this area also reported that the prevalence of diarrhea is higher in this area.

As social history reported that agricultural production was higher in the South and South-East regions compared to other parts of the block because of the frequent availability of irrigation sources. However, time this region shows lower monsoon production in case of excess rain. The reason for the lower average height in the canal irrigation area might be the higher morbidity of water born disease. Sanitary Inspector at the Block Medical office of the block also confirm that most of Malaria, Dengue, and diarrhea cases reported from the southern part of the block where canal irrigation higher. Another study also reported that infestation of water born disease is one of the major adverse impacts of canal irrigation (S. Bhattacharya, 2012; Chambers, 1986; Joshi & Agnihotri, 1984; Vishwakarma et al., 2001).

5.2.3 Father's Occupation

Table 5.7 Intergenerational Changes in Height According to the Father's Occupation

Occupation of Father	N	20-40 Years	N	41-60 Years	Total	Coef.	Std. Err.	[95% Conf. Interval]	
Permanent Employee	108	166.14 ±7.35	32	164.41 ±7.88	165.75 ±7.48	1.74	1.50	-1.24	4.71
Temporary worker	65	167.34 ±6.69	9	161.30 ±8.58	166.60 ±7.16	6.04*	2.46	1.12	10.95
Daily Wages	126	166.89 ±6.30	44	162.73 ±6.61	165.81 ±6.62	4.16*	1.12	1.95	6.36
Farmer	726	166.86 ±6.22	990	164.45 ±6.11	165.47 ±6.27	2.41*	0.30	1.82	3.00
Farmer and Daily Wages	113	165.20 ±5.79	81	163.43 ±5.24	164.46 ±5.62	1.77*	0.81	0.17	3.37
Leather Work	61	164.75 ±5.97	170	161.93 ±6.52	162.67 ±6.49	2.83*	0.95	0.95	4.70
Self-Employment	36	168.64 ±4.62	5	163.64 ±5.95	168.03 ±4.99	5.00*	2.28	0.39	9.60
Weaving	4	165.35 ±1.94	55	162.74 ±5.79	162.92 ±5.64	2.61*	2.93	-3.25	8.47

*significant at 5 percent level, p-<0.05

The average height of respondents whose fathers were self-employed was about 168.64 ±4.62 [95%CI, 167.13 to 170.15] was higher among the current generation (table 5.7). In temporary worker category also recorded well average height of about 167.34 ±6.69 [95%CI, 165.71 to

168.96]. Respondent's fathers those involved in daily wages [166.89 ±6.30, 95%CI, 165.79 to 167.99] or farmers [166.86 ±6.22, 95%CI, 166.41 to 167.32] observed almost no difference in their average height. Similarly, those fathers involved in the farmer and daily wages [165.20 ±5.79, 95%CI, 164.13 to 166.27]; and weaving [165.35 ±1.94, 95%CI, 163.45 to 167.25] occupation reported less difference in their average height about 0.15 cm. Respondents of those fathers involving in the leather work showed less average height about 164.75 ±5.97 [95% CI, 163.25 to 166.25].

Among the previous generation, those fathers have permanent employment or government service [164.41 ±7.88, 95%CI, 161.67 to 167.14] and farming [164.45 ±6.11, 95%CI, 164.07 to 164.83] occupations were taller than others. Offspring of farmer and Daily wager; and the self-employed person observed similar average height of about 163.43 ±5.24 [95%CI, 162.29 to 164.57] compared to 163.64 ±5.95 [95%CI, 158.42 to 168.86]. For those fathers involved in leather work and temporary work their average height was about 161.93 ±6.52 [95%CI, 160.95 to 164.57] and 161.30 ±8.58 [95%CI, 155.69 to 166.91], respectively. There was no difference observed among those fathers who worked as daily wager and weaver and their average height were about 162.73 ±6.61 [95%CI, 160.78 to 164.69] and 162.74 ±5.79 [95%CI, 161.21 to 164.27], respectively.

A higher intergenerational improvement was observed among those fathers involved in temporary work about 6.04 cm [95%CI, 1.12 to 10.95]. Offspring of self-employed persons and daily wager were also observed higher and significant improvement in the average height across generation about 5 cm [95%CI, 0.39 to 9.60] and 4.16 cm [1.95 to 6.36], respectively. Farmers, weavers, and leather worker's offspring showed akin intergenerational improvement in their average height about 2.41 cm [95%CI, 1.82 to 3.00], 2.61 cm [95%CI, -3.25 to 8.47] and 2.83cm [95%CI, 0.95 to 4.70], respectively. Less intergenerational improvement was observed among those father's were permanent workers and the improvement was about 1.74 [95%CI, -1.24 to 4.71]. Intergenerational improvement in average height across generations was significant except permanent employee category.

A permanent source of income or food grain has a significant impact on height. Table 5.7 suggested that the average height of the person is mostly correlated with the occupation of the father. Among the previous generation, permanent employees and farmers recorded higher average height compared to those who depend on daily wages and have no fixed income.

As defined temporary workers also have fixed incomes and their average height was greatest among the current generation. Permeant, Farmer and self-employed person's offspring also showed higher average height. Farmer's and Permanent employee offspring already have higher average height among both generations and that was one of the reasons for the lower record in intergeneration changes in average height, while temporary workers have lower average height in the previous generation and have higher in the current generation, therefore, it showed higher intergenerational changes in the average height.

Table 5.8 Intergenerational Changes in Height According to the Father's Occupation Across Caste Groups

Occupation of Father	N	20-40 Years	N	41-60 Years	Total	Coef.	Std. Err.	[95% Conf.	
Rajput									
Permanent Employee	21	166.64 ±6.76	15	163.13 ±8.35	165.18 ±7.55	3.51	2.52	-1.61	8.63
Temporary worker	18	170.79 ±6.92	1	169	170.69 ±6.74	1.79	7.11	-13.22	16.8
Daily Wages	16	164.89 ±6.57	3	160.91 ±15.18	164.26 ±7.99	3.99	5.08	-6.73	14.71
Farmer	307	167.95 ±6.39	370	166.01 ±5.89	166.89 ±6.19	1.94*	0.47	1.01	2.87
Farmer and Daily Wages	2	169.80 ±2.12	4	168.05 ±6.56	168.63 ±5.24	1.75	5	-12.14	15.64
Self-Employment	9	168.53 ±3.18		.	168.53 ±3.18				
Patel									
Permanent Employee	10	171.46 ±6.08	12	167.42 ±6.23	169.25 ±6.36	4.04	2.64	-1.46	9.55
Temporary worker	6	161.50 ±3.65	4	162.00 ±12.08	161.70 ±7.49	-0.5	5.13	-12.32	11.32
Daily Wages	12	170.32 ±5.06	8	167.06 ±6.15	169.02 ±5.61	3.26	2.52	-2.02	8.55
Farmer	378	166.04 ±6.08	580	163.50 ±6.01	164.50 ±6.16	2.54*	0.4	1.76	3.32
Farmer and Daily Wages	1	163.1	1	169.2	166.15 ±4.31				
Self-Employment	13	169.76 ±5.03	5	163.64 ±5.95	168.06 ±5.84	6.12*	2.78	0.24	12.01
Meghwal									
Permanent Employee	55	166.37 ±6.18	1	175	166.52 ±6.23	-8.63	6.24	-21.14	3.88
Temporary worker	19	165.67 ±5.20	1	154.5	165.12 ±5.65	11.17*	5.34	-0.04	22.39
Daily Wages	58	166.40 ±6.30	11	160.28 ±5.14	165.43 ±6.50	6.12*	2.02	2.09	10.15
Farmer	39	166.39 ±5.14	31	163.81 ±7.37	165.25 ±6.32	2.59	1.5	-0.4	5.58
Farmer and Daily Wages	92	164.78 ±5.94	42	162.31 ±5.39	164.01 ±5.87	2.47*	1.08	0.35	4.6
Leather Work	61	164.75 ±5.97	170	161.93 ±6.52	162.67 ±6.49	2.83*	0.95	0.95	4.7
Self-Employment	6	168.12 ±3.69	1	-	168.12 ±3.69	-	-	-	-
Salvi									
Permanent Employee	22	162.68 ±9.55	4	157.50 ±5.35	161.88 ±9.15	5.18	4.96	-5.07	15.42
Temporary worker	22	167.54 ±6.99	3	160.07 ±4.42	166.64 ±7.11	7.47	4.19	-1.19	16.13
Daily Wages	40	167.37 ±6.28	22	162.63 ±5.62	165.69 ±6.43	4.73*	1.61	1.52	7.95
Farmer	2	165.90 ±4.95	9	164.49 ±4.24	164.75 ±4.14	1.41	3.38	-6.24	9.06
Farmer and Daily Wages	18	166.92 ±5.02	34	164.09 ±4.57	165.07 ±4.87	2.83*	1.38	0.06	5.59
Self-Employment	8	167.31 ±6.11	55		167.31 ±6.11				
Weaving	4	165.35 ±1.94	4	162.74 ±5.79	162.92 ±5.64	2.61	2.93	-3.25	8.47

*significant at 5 percent level, p-<0.05

Leather work is completely performed by the Meghwal community and forms of work were changed entirely. Earlier, they pulled the skin of the dead animal and made leather items such as footwear, beg, and rope among others, while recently they repaired footwear near the bus stand and their involvement in the leather work was also less. Around 4 to 5 percent[43] of people

[43] Author's calculation from field data

from the Meghwal community are currently involved in leather work. The caste-wise distribution of each occupation might give a possible explanation that how the occupation of the father helps in the increase in the average height because, in India, the hierarchal distribution of population groups (caste) was based on their occupation.

Intra-caste analysis of respondent height according to father's occupation (table 5.8) showed that among Rajput fathers who have permanent employment their offspring showed the greatest inter-generational changes in average height about 3.51 cm [95%CI, -1.61 to 8.63]. Similarly, offspring of daily wagers also recorded the highest intergenerational changes in the adult height about 3.99 cm [95%CI, -6.73 to 14.71]. However, the number of permanent employees and daily wager were very less about 21 and 16, respectively. The average height of respondents whose fathers have permanent employment was about 2 cm higher than the daily wager. Those fathers having an occupation in farming showed significant improvement in the height of the current generation about 1.94 cm [95% CI, 1.01 to 2.87]. The average height of Farmer's and daily wager offspring was higher among both generations. Respondent numbers among remaining occupations were very less, so, that was not enough to produce a meaningful conclusion.

As discussed, the Rajput is an agrarian community, and involvement in the other occupation is very less. And the average height of the farmer was greatest among the previous generation, while among the current generation temporary worker's children included a higher average height, which indicates that those who were out for work or migrated started extra earning because there were no changes or reduction in agriculture recorded. Therefore, the average height of temporary workers was higher among the current generation across the category.

The offspring of self-employed persons showed the highest and most significant intergenerational improvement in the average height of about 6.12 cm [95%CI, 0.24 to 12.01] among the Patel community. Respondents of those fathers involved in farming also showed significant intergenerational improvement in average height about 2.54 [95%CI, 1.76 to 3.32]. The permanent employment category showed the second largest intergenerational improvement in average height about 4.04 cm [95%CI, -1.46 to 9.55]. However, the improvement was not significant. Offspring of Permanent employees were taller than other occupations of a father among both generations by about 167.42 ±6.23 [95%CI, 163.88 to 170.95] and 171.46 ±6.08 [95%CI, 167.78 to 175.25], respectively. Those parents involved as daily wager their offspring also gain higher average height among both generations (167.06

±6.15, 95%CI, 162.79 to 171.33 compared to 170.32±5.06, 95%CI, 167.45 to 173.20). There were very few differences observed in (after point digit) the previous generation among farmer and Self-employment category (163.50 ±6.01, 95%CI, 163.01 to 163.99 compared with 163.64 ±5.95, 95%CI, 158.41 to 168.87) while among current generation the difference was increased and it was about 2.7 cm (166.04 ±6.08, 95%CI, 165.42 to 166.65 compared to 169.76 ±5.03, 95%CI, 167.02 to 172.50). However, there was a much larger difference in the sample of both categories. All the permanent employee from the Patel community recorded from Salumber town, while the number of permanent employees' offspring in the rural was almost null and all the members in this category were belongs to the upper-income group compared to other members of the society.

Temporary workers (those who were involved as a driver, mechanics, domestic workers, labour, etc. on a monthly salary basis but did not have job security) offspring showed the highest and most significant intergenerational improvement in the average height across generation than other occupations categories among Meghwal about 11.17 cm [95%CI, -0.04 to 22.39]. Indeed, the number of respondents is a limited single among the previous generation, therefore, the interpretation of higher improvement is not much meaningful. Daily wager's offspring also recorded significant improvement in average across generations about 6.12 cm [95%CI, 2.09 to 10.15]. Leather work is the traditional occupation of Meghwal community and it was mostly shut down at the end of the last century. The average intergenerational changes in the average height of adults in the leather work occupation category showed about 2.83 cm [95%CI, 0.95 to 4.70] while in Farmer and daily wager category also showed significant improvement about 2.47 cm [95%CI, 0.35 to 4.60]. Permanent employed offspring showing negative improvement in average height across generations, about 8 cm [95%CI, -21.14 to 3.88]. However, the number of permanent employees in the previous generation category was single, therefore, it is not feasible to say that the improvement was larger. The average height of farmer's offspring [163.81 ±7.37, 95%CI, 161.20 to 166.41] was higher among the previous generation while the current generation offspring of self-employed persons was higher about 168.12 ±3.69 [95%CI, 165.16 to 171.08]. No differences were recorded in the average height of the current generation among Permanent employment, Daily wages, and farming categories.

In the daily wager; and farmer and daily wages category, the Salvi community showed significant intergenerational improvement in average height about 4.37 cm [95%CI, 1.52 to 7.95] and 2.83 cm [95%CI, 0.06 to 5.59], respectively. In the category of the temporary worker,

Salvi showed the highest intergenerational improvement in the average height about 7.47 cm [95%CI, -1.19 to 16.13]. Permanent employees' offspring showed 5.18 cm [95%CI, -5.07 to 15.42] across generations. The category of their traditional occupation (weaving) showed a 2.61 cm [95%CI, -3.25 to 8.47] improvement in average height across generations. The average height of farmer's offspring was higher among the previous generation about 164.49 ±4.24 [95%CI, 161.69 to 167.29] while among current generation Temporary worker's sons have a higher average height about 167.54 ±6.99 [95CI%, 164.58 to 170.49]. The average height of daily wages and the Self-employment category are also similar to the temporary worker category, very less differences were observed.

In the traditional occupation category, all studied communities showed significant intergenerational improvement in the average height except Salvi, because the involvement of the current generation in their traditional occupation was minimal, countable on fingers. Daily wages was the primary occupation of the Meghwal and Salvi community in the absence of their traditional occupation. In the daily wages category, Meghwal and Salvi communities showed significant improvement in the average height across generations.

5.2.4 Respondent's Occupations

Table 5.9 showed that respondents who have permanent employment are taller than the current generation and their average height was about 169.21 ±5.22 [95%CI, 167.34 to 171.08] while Temporary worker and Self-employed respondents were taller among the previous generation and their average height was 165.06 ±6.50 [95%CI, 163.66 to 166.46] and 165.04 ±6.43 [95%CI, 163.27 to 166.81], respectively. Respondents those who were involved in leather work [163.76 ±4.55, 95%CI, 159.77 to 167.75] among the current generation were shorter than other occupations while among the previous generation, leather workers [164.69 ±6.42, 95%CI, 162.06 to 167.31] were taller than Permanent employee [164.18 ±6.84, 95%CI, 162.62 to 165.74] and farmer [164.29 ±6.00, 95%CI, 163.89 to 164.68]. In the current generation, there was less difference which is less than 0.50 cm observed among Daily wages, farmer; and farmer and daily wages category about 165.49 ±5.37 [95%CI, 164.74 to 166.23], 165.95 ±5.89 [95%CI, 165.31 to 166.60] and 165.86 ±7.32 [95%CI, 163.56 to 168.16], respectively. Those who were students recorded the greatest average height about 168.00 ±7.76 [95%CI, 166.90 to 169.10]. Respondents who have farmer and daily wages occupation were the shortest among the previous generation and their average height was about 160.71 ±6.28 [95%CI, 159.45 to 161.97].

Table 5.9 Intergenerational Changes in Height According to the Occupation of Respondents

Occupation of respondents	N	20-40 Years	N	41-60 Years	Total	Coef.	Std. Err.	[95% Conf. Interval]	
Permanent Employee	30	169.21 ±5.22	74	164.18 ±6.84	165.63 ±6.79	5.03*	1.39	2.27	7.79
Temporary worker	308	166.54 ±6.19	83	165.06 ±6.50	166.23 ±6.28	1.48	0.77	-0.04	3.00
Daily Wages	199	165.49 ±5.37	167	162.77 ±6.34	164.25 ±5.98	2.72*	0.61	1.51	3.92
Farmer	318	165.95 ±5.89	892	164.29 ±6.00	164.73 ±6.02	1.66*	0.39	0.90	2.43
Farmer and Daily Wages	39	165.86 ±7.32	95	160.71 ±6.28	162.21 ±6.97	5.15*	1.25	2.67	7.63
Leather Work	5	163.76 ±4.55	23	164.69 ±6.42	164.52 ±6.06	-0.93	3.04	-7.18	5.33
Self-Employment	147	167.77 ±5.73	51	165.04 ±6.43	167.07 ±6.02	2.73*	0.96	0.83	4.63
Student	192	168.00 ±7.76							

*significant at 5 percent level, p-<0.05

Those who have farmer and daily wages occupation showed the significant and highest improvement in average height across generation about 5.15 cm [95%CI, 2.67 to 7.63]. Those who were permanent employees also showed the second most significant intergenerational improvement in average height about 5.03 cm [95%CI, 2.27 to 7.79]. Daily wagers and self-employed persons recorded similar digits of average height across generations about 2.7 cm. Leatherworkers showed a decline in their average height across generations about -0.93 cm [95%CI, -7.18 to 5.33]. The temporary worker also showed improvement in average height across a generation of about 1.48 cm [95%CI, -0.04 to 3.00]. The above table can be interpreted as an implication of height, because as observed that those who were taller might have a higher chance of getting permeant employment, while those who were shorter involved in the daily wages. Many other studies also suggest that taller people get a good jobs compared to shorter stature (Case & Paxson, 2008; Ibragimova & Salahodjaev, 2020; Judge & Cable, 2004). Study based on coalminers in India suggests that worker with above average height of the sample 9-17% more than their shorter counterparts (Dinda et al., 2006).

Increasing consumption was the prime reason behind the higher intergenerational improvement in the height among the permanent employee and farmer and daily wager category because

increasing in income directly affects your consumption. Another reason could be, as cited that taller people have more probability of getting a job compared to shorter stature, because taller people have higher numbers of schooling years, and in growing age, they were free from malnutrition which would help in better cognitive development. The competition for permanent employees was very high among the current generation and those who qualified for state or national level completion exam they can get a permanent job while in the previous generation there was not much competition reported. Those who are taller have better cognitive development and a higher chance of getting a permanent job. Similarly, those who are taller have more productivity in the open labour market.

Table 5.10 Intergenerational Changes in Height According to the Occupation of Respondents Across Caste Groups

Occupation of respondents	N	20-40 Years	N	41-60 Years	Total	Coef.	Std. Err.	[95% Conf.	Interval]
Rajput									
Permanent Employee	6	171.33 ±4.14	15	164.63 ±7.64	166.55 ±7.40	6.7	3.33	-0.27	13.67
Temporary worker	97	167.51 ±6.29	24	169.22 ±5.63	167.85 ±6.18	-1.71	1.41	-4.5	1.07
Daily Wages	47	166.08 ±5.60	19	162.08 ±7.79	164.93 ±6.51	4.00*	1.71	0.59	7.42
Farmer	112	166.61 ±6.01	314	165.95 ±5.67	166.13 ±5.76	0.66	0.63	-0.59	1.9
Farmer and Daily Wages	11	169.81 ±5.30	5	164.54 ±9.09	168.16 ±6.86	5.27	3.56	-2.37	12.91
Self-Employment	41	168.83 ±5.29	16	165.67 ±8.08	167.94 ±6.29	3.16	1.82	-0.49	6.81
Student	60	171.01 ±7.67			171.01 ±7.67				
Patel									
Permanent Employee	4	168.32 ±7.25	10	166.94 ±5.18	167.34 ±5.58	1.39	3.41	-6.05	8.82
Temporary worker	92	166.72 ±6.67	12	163.60 ±9.04	166.36 ±7.01	3.12	2.14	-1.12	7.36
Daily Wages	17	167.17 ±5.99	12	166.69 ±6.60	166.97 ±6.14	0.48	2.36	-4.35	5.31
Farmer	201	165.56 ±5.80	554	163.43 ±5.98	163.99 ± 6.00	2.13*	0.49	1.17	3.09
Farmer and Daily Wages	12	165.83 ±4.83							
Self-Employment	62	168.09 ±5.91	22	165.28 ±6.31	167.36 ±.10	2.82	1.49	-0.15	5.78
Student	32	166.13 ±6.85							
Meghwal									
Permanent Employee	15	168.57 ±5.03	26	163.19 ±7.88	165.16 ±7.38	5.38*	2.27	0.8	9.97
Temporary worker	81	165.14 ±5.81	23	162.32 ±5.00	164.52 ±5.74	2.82*	1.33	0.18	5.47
Daily Wages	100	164.70 ±5.07	89	162.30 ±6.54	163.57 ±5.91	2.40*	0.85	0.73	4.07
Farmer	6	166.75 ±6.32	22	162.43 ±6.44	163.36 ±6.55	4.32	2.95	-1.75	10.39
Farmer and Daily Wages	14	162.69 ±9.01	66	160.46 ±6.16	160.85 ±6.73	2.22	1.98	-1.71	6.16
Leather Work	5	163.76 ±4.55	23	164.69 ±6.42	164.52 ±6.06	-0.93	3.04	-7.18	5.33
Self-Employment	34	165.92 ±5.37	6	162.67 ±5.13	165.44 ±5.40	3.26	2.37	-1.53	8.05
Student	74	167.41 ±6.27							
Salvi									
Permanent Employee	5	169.28 ±6.25	23	163.8 ±5.63	164.78 ±6.02	5.48	2.83	-0.34	11.29
Temporary worker	38	166.65 ±5.13	24	164.26 ±5.34	165.73 ±5.30	2.39	1.36	-0.33	5.11
Daily Wages	35	166.12 ±5.43	47	162.94 ±4.93	164.30 ±5.36	3.18*	1.15	0.9	5.47
Farmer			2	161.00 ±6.36					
Farmer and Daily Wages	2	166.5 ±11.31	24	160.59 ±5.98	161.05 ±6.38	5.91	4.63	-3.66	15.47
Self-Employment	10	167.73 ±6.88	7	164.90 ±3.70	166.56 ±5.82	2.83	2.87	-3.29	8.95
Student	26	165.07 10.57							

*significant at 5 percent level, p-<0.05

Intra-caste group analysis also showed that permanent employees were taller than other occupation categories among the current generation in Rajput (table-5.10). The average height of permanent employees was 171.33 ±4.14 [95%CI, 168.01 to 174.66], while self-employed respondents recorded their average height as about 168.83 ±5.29 [95%CI, 167.2 to 170.45]. The average height of farmer was 166.61 ±6.01 [95%CI, 165.49 to 167.73] while those who were involved in farming along with daily wage recorded their average height as about 169.81 ±5.30 [95%CI, 166.67 to 172.95]. The average height of daily wages was 166.08 ±5.60

[95%CI, 164.48 to 167.69]. In the previous generation, Temporary workers [169.22 ±5.63, 95%CI, 166.96 to 171.49] were taller than other occupations. Farmer [165.95 ±5.67, 95%CI, 165.33 to 166.58] and self-employed [165.67 ±8.08, 95%CI, 161.70 to 169.64] person recorded similar average height while Permanent employee [164.63 ±7.64, 95%CI, 160.76 to 168.51]; and farmer and daily wager [164.54 ±9.09, 95%CI 156.55 to 172.53] both were on the same track in terms of average height. Permanent employees recorded the highest intergeneration improvement in the average height about 6.70 cm [95%CI, -0.27 to 13.67] while temporary workers showed a decline in average height across generation about 1.71 cm [95%CI, -4.50 to 1.07]. All daily wagers who have small landholdings and they depend on other daily wages-based occupations recorded an intergeneration improvement in the average height of about 4 cm [95%CI, 0.59 to 7.42]. However, all daily wager belongs to the Slumber Urban pocket. Farmers recorded very low intergenerational height growth among Rajput and it was about 0.66 cm [95%CI, -0.59 to 1.90]. However, farming is the traditional occupation of Rajput but the improvement in this category was very less. The improvement in agricultural production did not have much impact on intergenerational improvement in the average height of Rajput.

The higher intergenerational improvement among the permanent occupation category was not significant because the overall inclusion of Rajputs in the permanent job was less than 3 percent (Refer to chapter-4 *Lived Experiences: An Exploration of Social History)* due to lower education. The primary occupation of Rajput is agriculture and animal husbandry and among both generations, they showed marginal improvement in the average height, more than half (55%) of people reported their primary occupation was farming and 15 percent were temporary workers, which indicates other occupation may help in support their economic status but they cannot be determined. Those who were involved in the other occupation their family also involved in farming activities.

In the Patel caste group, the permanent employee was taller than other occupation categories among both generations (168.32 ±7.25, 95%CI, 161.20 to 175.45 compared with 166.94 ±5.18, 95%CI, 163/170.15). The self-employed person also recorded a great average height of about 168.09 ±5.91 [95%CI, 166.62 to 169.57] among the current generation. Farmer [165.56 ±5.80, 95%CI, 164.76 to 166.37]; and Farmer and daily wager [165.83 ±4.83, 95%CI, 163.09 to 168.58] recorded similar average height. In the previous generation, Daily wager showed the second-greatest average height of about 166.69 ±6.60 [95%CI, 162.95 to 170.43] while Farmers recorded a lower average height of about 163.43 ±5.98 [95%CI, 162.93 to 163.93].

The temporary worker also recorded a lower average height about 163.60 ±9.04 [95%CI, 158.48 to 168.72]. Intergeneration improvement in the average height was higher observed among the temporary worker by about 3.12 cm [95%CI, -1.12 to 7.36] while farmers recorded a significant intergenerational improvement in average height by about 2.13 cm [95%CI, 1.17 to 3.09]. A self-employed person recorded about 2.82 cm [95%CI, -0.15 to 5.78] improvement in average height across generation while a daily wager recorded a lesser improvement in the average height across generation about 0.48 cm [95%CI, -4.35 to 5.31]. Those who were permanent employees also recorded an intergenerational improvement in the average height of about 1.39 cm [95%CI, -6.05 to 8.82]. The traditional occupation of Patel was farming and as reported in the social history the history of migration can be traced to the previous generation of the Patel caste and at immigration place they had their own business. Therefore, intergenerational improvement was higher recorded among the Self-employment category, temporary worker, and farming. All these categories were prime among the Patel community. Indeed, 73 percent of respondents are exclusively involved in farming while 8 percent have their own business and around 10 percent are working as temporary workers. Improvement in agricultural techniques such as irrigation, use of pieces of machinery, electrification, etc. led to higher production which reflected in intergeneration improvement in the average height.

In the current generation, Permanent employees recorded the highest average height and it was about 168.57 ±5.03 [95%CI, 166.02 to 171.13] while students [167.41 ±6.27, 95%CI, 165.97 to 168.84] also recorded a great average height among Meghwal. Leatherworkers recorded 163.76 ±4.55 [95%CI, 159.76 to 167.76] average height while daily wager and temporary workers recorded an average height of about 164.70 ±5.07 [95%CI, 163.70 to 165.70] and 165.14 ±5.81, 95%CI, 163.87 to 166.41], respectively. In the previous generation, those who were involved in leather work [164.69 ±6.42, 95%CI, 162.05 to 167.32] were taller than other occupation categories. Permanent workers [163.19 ±7.88, 95%CI, 160.15 to 166.23] recorded lower height in comparison to a permanent employee from another community. There was very less difference observed among those who worked as temporary workers, daily wages, farmers, and self-employment persons. Those who were involved in farming along with daily wage [160.46 ±6.16, 95%CI, 158.97 to 161.96] were shorter compared to other occupation categories. The significant and highest intergenerational improvement in the average height was observed among permanent employees about 5.38 cm [95%CI, 0.80 to 9.91]. The farmer also recorded a good improvement in the average height of about 4.32 cm [95%CI, -171 to 6.16]. Temporary worker and Daily wager also showed significant improvement in average

height across generation about 2.82 cm [95%CI, 0.18 to 5.47] and 2.40 cm [95%CI, 0.73 to 4.07], respectively. Those who were involved in the leatherwork showed a decline in the average height across generations about 0.93 cm [95%CI, -7.18 to 5.33]. As discussed, after the Panchayat decision about the Meghwal caste quit their traditional leather work and started searching for a new occupation. State affirmative policies such as reservation open the door for education and employment in the public sector and by this, the education level among Meghwal increased drastically compare to Patel and Rajput. In the absence of traditional occupations, they started newer occupations such as daily wages, many of them migrated for work, and some of getting a permanent jobs. Therefore, Permanent employees, temporary workers, and daily wages show significant intergenerational improvement in their height.

In the Salvi caste group, Permanent employees recorded the highest average height of about 169.28 ±6.25 [95%CI, 163.74 to 174.82] while students showed a lesser average height of about 165.07 ±10.57 [95%CI, 160.96 to 169.18] among the current generation. Temporary worker, daily wager; and Farmer & daily wager showed less difference in terms of average height about 166.65 ±5.13 [95%CI, 165.01 to 168.3], 166.12 ±5.43 [95%CI,164.3 to 167.94] and 166.5 ±11.31 [95%CI, 150.65 to 182.35], respectively. In the previous generation, a self-employed person has a higher average height of about 164.90 ±3.70 [95%CI, 162.13 to 167.67]. Farmers and daily wagers recorded lower average heights of about 160.59 ±5.98 [95%CI, 158.17 to 163.01]. The permanent employee also recorded a good average height of about 163.80 ±5.63 [95%CI, 161.48 to 166.13] compared to other occupation categories. Daily wager showed significant intergenerational improvement in the average height of about 3.18 cm [95%CI, 0.90 to 5.47]. Farmer and daily wager; and permanent employee recorded the greatest improvement in the average height across generation about 5.91 cm [95%CI, -3.66 to 15.47] and 5.48cm [95%CI, -0.34 to 11.29]. The traditional occupation (waving) of the Salvi caste has also vanished because this practice needs a lot of effort and costly raw materials to make clothes, therefore the price of clothes would be increased and cheap clothes prepared by textile industries are easily available in the market. So, they shut down their waving work and chose other occupations similar to Meghwal. Recently, daily wages are the primary occupation of the Salvi community, and more than 30 percent of community members are involved in daily wages while 12 percent have a permanent job and more than one-fourth population have a temporary job.

5.2.5 Father's Education

Table 5.11 Distribution of Intergenerational Changes in Height According the Caste and Education of Respondent's Father

Education	N	20-40 Years	N	41-60 Years	Total	Coef.	Std. Err.	[95% Conf.	Interval]
Illiterate	688	165.80 ±6.00	1268	163.81 ±6.19	164.51 ±6.19	2.00*	0.29	1.43	2.56
Primary	285	167.53 ±6.17	100	164.68 ±6.41	166.79 ±6.35	2.86*	0.72	1.43	4.28
Upper Primary	81	168.79 ±5.66	6	167.8 ±8.06	168.72 ±5.80	0.99	2.47	-3.91	5.9
Secondary	85	167.37 ±6.79	5	174.8 ±4.18	167.78 ±6.87	-7.43*	3.08	-13.55	-1.31
Sen. Secondary	35	167.52 ±6.58	3	169.2 ±0.82	167.66 ±6.33	-1.68	3.85	-9.48	6.13
Graduate	26	170.27 ±5.07	1	165.2	170.08 ±5.06	5.07	5.16	-5.57	15.71
Above Graduation	40	164.95 ±9.31	3	162.83 ±6.17	164.8 ±9.09	2.12	5.5	-8.99	13.22
Rajput									
Illiterate	190	167.08 ±5.91	352	165.96 ±5.95	166.35 ±5.95	1.11*	0.53	0.06	2.16
Primary	108	168.47 ±6.73	34	164.68 ±7.20	167.56 ±7.01	3.78*	1.35	1.12	6.45
Upper Primary	30	171.77 ±5.21	2	170.00 ±9.90	171.66 ±5.36	1.77	3.97	-6.33	9.87
Secondary	26	166.73 ±7.44	1	178.2	167.16 ±7.62	-11.47	7.58	-27.07	4.14
Sen. Secondary	9	167.07 ±6.25	1	169	167.26 ±5.92	-1.93	6.58	-17.12	13.25
Graduate	2	171.95 ±7.00		.	.	.	.	.	.
Above Graduation	9	168.71 ±8.83	3	162.83 ±6.17	167.24 ±8.41	5.88	5.58	-6.55	18.3
Patel									
Illiterate	288	165.73 ±6.16	561	163.36 ±5.98	164.16 ±6.14	2.38*	0.44	1.52	3.24
Primary	85	167.72 ±5.77	43	165.84 ±6.34	167.09 ±6.01	1.88	1.12	-0.33	4.08
Upper Primary	20	167.37 ±5.41	1	169	167.45 ±5.29	-1.63	5.55	-13.24	9.98
Secondary	16	165.41 ±6.22	4	173.95 ±4.30	167.12 ±6.76	-8.54*	3.32	-15.52	-1.57
Sen. Secondary	5	175.18 ±5.13	1	168.5	174.07 ±5.34	6.68	5.62	-8.93	22.29
Graduate	4	166.35 ±5.14		.	.	.	.	.	.
Above Graduation	2	168.35 ±1.20		.	.	.	.	.	.
Meghwal									
Illiterate	177	164.47 ±5.71	246	162.04 ±6.47	163.06 ±6.27	2.42*	0.61	1.23	3.62
Primary	48	166.74 ±5.38	8	163.68 ±4.71	166.30 ±5.36	3.06	2.02	-1	7.12
Upper Primary	28	166.58 ±5.27	2	171.40 ±5.09	166.9 ±5.32	-4.82	3.85	-12.72	3.07
Secondary	28	167.44 ±6.07		.	.	.	.	.	.
Sen. Secondary	15	164.90 ±5.19		.	.	.	.	.	.
Graduate	14	171.94 ±4.43		.	.	.	.	.	.
Above Graduation	20	165.52 ±7.31		.	.	.	.	.	.
Salvi									
Illiterate	33	166.22 ±5.08	109	163.12 ±5.42	163.84 ±5.49	3.10*	1.06	1	5.2
Primary	44	165.76 ±5.99	15	161.87 ±4.84	164.77 ±5.93	3.89*	1.71	0.46	7.32
Upper Primary	3	169.13 ±3.59	1	155	165.60 ±7.65	14.13	4.14	-3.68	31.95
Secondary	15	170.43 ±7.09							
Sen. Secondary	6	168.38 ±7.40	1	170.1	168.63 ±6.78	-1.72	7.99	-22.25	18.82
Graduate	6	168.43 ±5.14	1	165.2	167.97 ±4.85	3.23	5.55	-11.03	17.5
Above Graduation	9	159.16±12.7							

*significant at 5 percent level, p-<0.05

Table 5.11, showed that more schooling days for fathers lead to a greater height of their offspring among both generations. Among the current generation, those fathers who have graduated have recorded a height of about 170.27 ±5.07 [95%CI, 168.32 to 172.22]. Those fathers were highly educated their height showed some non-linear results to education qualification which might be due to the lower number of respondents compared to the illiterate category (164.95 ±9.31 [95%CI, 162.06 to 167.84] compared with 165.80 ±6.00 [95%CI, 165.35 to 166.25]). Therefore, we can conclude that those fathers were illiterate because they recorded lower average height. The education status of a father in the previous generation was very less there were more illiterate compared to literate (n=1268 compared with 118),

therefore, the interpretation of this table is limited to the first two rows. The intergenerational improvement was observed among the literate and primary educated categories about 2 cm [95%CI, 1.43 to 2.56] and 2.86 cm [95%CI, 1.43 to 4.28]. A higher intergenerational improvement in height was observed among the respondents their father was literate compared to illiterate.

The intra-caste analysis also showed that as the education of the father increased the average height of respondents increased among the current generation across caste and education categories. In the previous generation, those fathers had at least primary education, they were taller than the illiterate fathers' category and this pattern was followed across caste groups. There was a significant intergenerational improvement in average height was observed in the category of illiterate across caste groups. While in the primary education category Patel and Meghwal not showing significant intergenerational improvement in the average height. However, remaining caste groups such as Rajput and Salvi showed significant improvement in the average height. Among illiterate and literate categories, Salvi showed the greatest improvement in the average height about 3.10 cm [95%CI, 1.00 to 5.20] and 3.89 cm [95%CI, 0.46 to 7.32], respectively. While Rajput showed lower intergenerational improvement in the average height among the illiterate category about 1.11 cm [95%CI, 0.06 to 2.16].

Illiterate fathers' offspring showed significant intergenerational improvement because the illiterate category has a higher number of samples across the social group about 74.49 percent and 14.66 percent qualified primary level education. Around 3 percent obtained a secondary education and around one percent qualified for Sen. Secondary or graduation level education. As per the social group, 3 percent of the respondent father from Meghwal and Salvi have graduated while 0.5 percent of people from Patel and Rajput have a graduation degree.

5.2.6 Respondent's Education

Taller people added more schooling years (table 5.12). Those who had higher education qualifications were taller than those who had an illiterate person and a similar pattern was observed among both generations. The intergenerational improvement in the average height was observed among both generations across all education categories. Those who were qualified post-graduation or above graduate showed significant and higher intergeneration improvement in the average height of about 3.27 cm [95%CI, 0.95 to 5.60]. Indeed, as schooling years added, the intergenerational improvement in height was observed increasing.

However, those who not crossed the fifth standard of the Indian education system showed less improvement in the average height across generations about 0.79 cm [95%CI, -0.08 to 1.66].

Table 5.12 Distribution of Intergenerational Changes in Height According to Caste and Education of Respondents

Education respondents	20-40 Years	41-60 Years	Total	Coef.	Std. Err.	[95% Conf.	Interval]
Illiterate	164.48 ±6.22	163.17 ±6.29	163.36 ±6.29	1.31	0.68	-0.03	2.65
Primary	165.27 ±5.83	164.47 ±6.06	164.79 ±5.98	0.79	0.44	-0.08	1.66
Upper Primary	166.33 ±5.98	164.37 ±6.37	165.49 ±6.22	1.95*	0.63	0.72	3.19
Secondary	166.87 ±5.87	163.84 ±5.89	165.76 ±6.05	3.03*	0.71	1.62	4.43
Sen. Secondary	168.53 ±6.29	165.36 ±7.00	167.84 ±6.57	3.17*	1.2	0.8	5.54
Graduate	168.20 ±7.28	165.87 ±6.46	167.87 ±7.20	2.34	1.37	-0.36	5.03
Above Graduation	167.37 ±5.59	164.10 ±5.97	166.63 ±5.82	3.27*	1.18	0.95	5.6
Rajput							
Illiterate	165.87 ±6.00	166.59 ±5.73	166.47 ±5.76	-0.72	1.24	-3.17	1.74
Primary	165.97 ±5.50	165.59 ±6.07	165.73 ±5.86	0.38	0.72	-1.05	1.8
Upper Primary	167.71 ±5.83	165.06 ±6.56	166.64 ±6.24	2.65*	1.21	0.25	5.05
Secondary	167.01 ±6.13	164.96 ±6.59	166.31 ±6.32	2.05	1.55	-1.04	5.15
Sen. Secondary	169.67 ±6.48	167.36 ±7.17	169.36 ±6.57	2.32	2.36	-2.39	7.03
Graduate	171.01 ±7.11	166.70 ±8.66	170.55 ±7.34	4.31	2.91	-1.5	10.12
Above Graduation	169.32 ±7.12	166.80 ±3.98	168.93 ±6.70	2.53	4.29	-6.53	11.58
Patel							
Illiterate	164.06 ±6.81	162.74 ±5.87	162.94 ±6.03	1.31	0.88	-0.42	3.04
Primary	165.87 ±5.37	164.13 ±6.07	164.86 ±5.84	1.74*	0.67	0.41	3.06
Upper Primary	166.10 ±6.41	165.07 ±5.93	165.65 ±6.21	1.03	0.96	-0.87	2.93
Secondary	167.42 ±6.08	164.95 ±5.43	166.75 ±5.98	2.47	1.41	-0.34	5.28
Sen. Secondary	166.92 ±5.14	163.08 ±9.67	165.85 ±6.78	3.84	2.47	-1.19	8.86
Graduate	168.57 ±6.55	166.79 ±6.99	168.16 ±6.61	1.78	2.39	-3.05	6.6
Above Graduation	169.21 ±5.77	167.24 ±7.30	168.74 ±6.03	1.97	3.14	-4.59	8.54
Meghwal							
Illiterate	163.46 ±4.22	159.93 ±6.21	160.49 ±6.06	3.53*	1.57	0.41	6.64
Primary	163.01 ±6.62	163.34 ±6.33	163.17 ±6.46	-0.33	1.2	-2.7	2.05
Upper Primary	164.96 ±5.10	162.60 ±6.74	163.93 ±5.96	2.36	1.27	-0.16	4.89
Secondary	166.86 ±5.74	163.01 ±6.08	165.19 ±6.16	3.85*	1.23	1.42	6.28
Sen. Secondary	167.85 ±6.06	166.73 ±4.80	167.54 ±5.71	1.12	1.81	-2.51	4.76
Graduate	166.50 ±5.93	166.90 ±6.26	166.54 ±5.92	-0.4	2.36	-5.09	4.29
Above Graduation	166.12 ±4.84	161.07 ±5.45	165.21 ±5.27	5.05*	1.82	1.39	8.71
Salvi							
Illiterate	168.5	162.68 ±6.64	162.90 ±6.61	5.82	6.77	-8.12	19.75
Primary	164.01 ±6.87	162.90 ±4.97	163.09 ±5.30	1.11	1.86	-2.61	4.83
Upper Primary	166.42 ±5.70	163.32 ±6.61	164.93 ±6.23	3.11	2.46	-1.99	8.2
Secondary	164.76 ±4.74	162.61 ±4.74	163.77 ±4.80	2.15	1.56	-1.03	5.33
Sen. Secondary	168.64 ±7.81	161.75 ±3.81	167.02 ±7.59	6.89	4.11	-1.88	15.65
Graduate	166.36 ±9.67	163.07 ±3.50	165.65 ±8.77	3.28	3.51	-3.84	10.4
Above Graduation	167.06 ±5.28	164.36 ±5.75	166.24 ±5.50	2.7	1.8	-0.94	6.33

*significant at 5 percent level, p-<0.05

Among the Rajput caste group, the current generation showed that as the year of schooling improves or those who are taller had more schooling years. While the previous generation did not show a linear pattern of average height with the schooling years. However, intergeneration improvement in the average height was higher among those who added more schooling years. While those who were lacking in the schooling years showed a decline in the average height across generations of about 0.72 cm [95%CI, -3.17 to 1.74].

Both generations of the Patel community showed that those who are taller were more educationally qualified. The average height of respondents those who were illiterate was less recorded compared to who had at least primary education. The intergenerational improvement was higher among those who obtained higher education about 3.84 cm [95%CI, -1.19 to 8.86]. Those who had primary education showed significant improvement in the average height of about 1.74 cm [95%CI, 0.41 to 3.06].

Meghwal who qualified for secondary, Sen. Secondary, and graduate level of education were taller than illiterate respondents among both generations. Illiterate, Secondary, and PG-qualified respondents showed significant improvement in the average height across generation about 2.53 cm [95%CI, 0.41 to 6.64], 3.85cm [95%CI, 1.42 to 6.28] and 5.05cm [95%CI, 1.39 to 8.71], respectively. However, Upper Primary and Sen. Secondary persons also showed intergenerational improvement in the average height. Those who obtained primary and graduation degrees showed a decline in the average height across generations about 0.33 cm [95%CI, -2.70 to 2.05] and 0.40 cm [95%CI, -5.09 to 4.29], respectively.

Salvi community showed a linear pattern of average height with the education of respondents, as the year of schooling increases the average height of the respondents was observed to increase. During the fieldwork, only one respondent was found illiterate in the current generation. This indicates that literacy levels were higher among Salvis in comparison to other communities. Across all education categories, Salvi recorded an intergenerational improvement in the average height. The highest improvement in the average height was observed among those respondents who qualified for Sen. Secondary level education about 6.89 cm [95%CI, -1.88 to 15.65]. While primary educated respondents recorded lower height improvement across generations about 1.11 [95%CI, -2.61 to 4.83]

5.2.7 Nutritional Status of the Respondents

The above table showed the nutritional status of the respondent across the caste group which showed that among Rajput and Meghwal the prevalence of malnutrition was higher in the previous generation while the previous generation of Salvi and Patel were far better than the current generation in terms of nutritional status. The previous generation of the Salvi community showed some prevalence of obesity while the current generation recorded no obesity, while among other community current generation were more obese than other previous generation. In the current generation, the prevalence of being underweight was very less among Patel compared to other caste groups while Salvi recorded the highest prevalence of

being underweight. In the previous generation, Meghwal recorded the highest prevalence of underweight while Rajput have lower underweight people.

Table 5.13 Nutritional Status (BMI) of Caste category (Weight/Height in Meter^2)

Caste	Underweight	Normal	Overweight	Obese	Total (N)
20-40 Years					
Rajput	25.40	58.82	13.90	1.87	374
Patel	19.52	56.19	20.71	3.57	420
Meghwal	26.97	57.58	13.94	1.52	330
Salvi	28.45	60.34	11.21	0.00	116
Total	24.11	57.74	15.97	2.18	1,240
41-60 Years					
Rajput	23.92	57.25	17.56	1.27	393
Patel	27.38	58.85	12.79	0.98	610
Meghwal	30.86	54.69	14.45	0.00	256
Salvi	25.20	64.57	9.45	0.79	127
Total	26.84	58.15	14.14	0.87	1,386
Overall					
Rajput	24.64	58.02	15.78	1.56	767
Patel	24.17	57.77	16.02	2.04	1,030
Meghwal	28.67	56.31	14.16	0.85	586
Salvi	26.75	62.55	10.29	0.41	243
Total	25.55	57.96	15	1.49	2626

The prevalence of underweight was higher among Meghwal than Salvi. Rajputs recorded a lower prevalence of underweight compared to other caste groups. The prevalence of overweight height among Patel, Rajput, and Meghwal is about 15.78, 16.02, and 14.16 percent, respectively while Salvi recorded a lower overweight percentage. Similarly, the prevalence of obesity was also high among Patel and Rajput compared to Meghwal and Salvi.

5.3 Factors Analysis

Table 5.14 and 5.15 shows relationship between the selected variables and height. After the adjustment of caste, age and place of residence father' occupation and education are positively

associated with average height. Increased in a year in the father's education led to 2 cm increase in the average of their child (table 5.14).

Table 5.14 Liner Regression Results for Relationship Between Selected Variables and Height

Variables	Reference Category	R1	R2	R3	R4
Caste	Non Dalit's	-1.84***	-1.75***	-2.32***	-1.83***
Age	41-60 years	2.67***	2.13***	2.21***	2.27***
Residence	Rural	-0.04	0.3	0.12	-0.15
Occupation (Father)	Non-Traditional	-0.81*			
Education (Father)	Illiterate		1.96***		
Occupation (Respondents)	Non-Traditional			-1.53***	
Education (Respondents)	Illiterate				1.73***
Constant		165.24	163.97	165.58	163.55
R-squared		0.06	0.072	0.067	0.07
Adj R-squared		0.059	0.071	0.066	0.069
N		2626	2626	2626	2626

*p<.05, **p<.01, ***p <.001

Table 5.15 Liner Regression Results for Relationship Between Selected Caste and Height

Caste	Model 1		Model 2		Model 3		Model 4	
	20-40 Years	41-60 Years	20-40 Years	41-60 Years	20-40 Years	41-60 Years	20-40 Years	41-60 Years
Rajput	Ref.		1.04*	1.94***	2.45***	3.97***	2.16**	3.31***
Patel	-1.04*	-1.94***	Ref.		1.41**	2.02***	1.12	1.36**
Meghwal	-2.45***	-3.97***	-1.41**	-2.02***	Ref.		-0.29	-0.66
Salvi	-2.16**	-3.31***	-1.12	-1.36*	0.29	0.66	Ref.	
Constant	165.73	163.89	164.69	161.95	163.28	159.92	163.57	160.58
R^2	0.049	0.062	0.049	0.062	0.049	0.062	0.049	0.062
Adj R^2	0.04	0.06	0.04	0.06	0.04	0.06	0.04	0.06
N	1240	1386	1240	1386	1240	1386	1240	1386

*p<.05, **p<.01, ***p <.001

Table 5.15 reveals that average height of Rajput differs from the all studied communities. while Meghawal and Salvi not showing any significant difference among both generations. Interestingly, previous generation of Patel was significantly taller than Salvi while in current generation height difference among Salvi and Patel was decreased and not showing any significant difference, that indicates that improvement in the overall socio-economic led to reduction the height margin between the Salvi and Patel. Table 5.16 witnessed that how socio-economic factor contributed in the improvement in the average height.

Table 5.16 Liner Regression Result for Relationship Between Selected Variables and Height

Variable	Reference category	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18
Caste	Non-Datlits	-0.86	-1.84	0.05	-0.38	-0.55	-0.34	-0.13	1.18	2.25	1.84	-1.34	-0.62	1.04	0.56	-1.1	-0.71	-0.84	-0.68
Age	20-40 Years	-3.3	-2.94	-2.05	-2.99	-2.71	-3.66	-3.67	-3.74	-2.36	-3.44	-2.84	-3.74	-2.22	-3.11	-3.2	-4	-2.86	-2.02
Residence	Urban	-1.08	-0.86	-0.99	0.12	-0.09	0.94	-0.99	0.64	-0.05	0.23	-0.39	1.63	-0.05	-0.14	-0.16	1.52	-0.38	0.46
Birth Weight	Healthy	-5.33**																	
Source of Drinking water	inside house		2.62																
Distance between to drinking water	Less than 0.5 km			-4.05															
Sufficiency of water in house	yes				-1.16														
Type of House	Kuccha					1.63													
Toilet facility	No open defecation						1.21												
Agricultural land availability	No							-6.03											
Land amount/volume (in Bigha)	Less than 10 Bigha								3.96										
Source of irrigation	Alternative irrigation									-4.98*									
Food grain sufficiency	Yes										-2.74								
Diet (veg.-non-veg)	Vegetarian											3.12							
Frequency of pulse consumption	Less than 3 time in a												3.16						
Additional Nutrition supplements	Yes													-4.6**					
Regular availability of dairy product	Yes														-3.72				
Breastfeeding duration	Less than 24 Months															6.79**			
Occurrence of any disease	Yes																6.74***		
Reoccurrence of disease	Yes																	6.34	
Age started at work as earning member	<18 Years of age																		2.89
Constant		170.3	168.6	170.8	168.3	167.3	165.9	168.9	165.6	167.8	167.7	166.5	165.3	168.8	168.1	162.2	161.9	162.3	165.5
R-squared		0.14	0.05	0.1	0.04	0.04	0.03	0.07	0.06	0.1	0.04	0.07	0.08	0.12	0.04	0.12	0.22	0.08	0.07
Adj R-squared		0.08	-0.01	0.04	-0.03	-0.02	-0.03	0.01	0	0.04	-0.03	0.01	0.02	0.06	-0.02	0.06	0.17	0.02	0.01
N		65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65

Chapter -6 Determinants of Adult Height: Evidence from Life Histories

Human height are affected by the multiple factors such as food, education, occupation, income, disease episodes etc. and these factors jointly affect height growth at different phase of the life (conception to the late adulthood). Therefore, observing height with these factors would give nuance understanding about the determinants of height. Life history is one of the tools that help in assess the influence of these factors on the finalization of height. However, life history also have their own limitation of recall biasness but it is distributed uniformly across the respondents. The framing of the questions regarding the history of growing age would help in the reduction of recall bias and the possible answers could help us to shaping the life event of an individual such as history of hunger, availability of dairy product, water, sanitation, disease episodes, land availability, etc. To understanding the determinants of the height, 65 people's (father-son dyads) life history data were collected through semi-structured interview schedule from the studied villages and population groups.

6.1 Education and Height

The education of the respondents and their height show that those who are tall attained higher schooling years. However, the level of schooling years varies across the caste groups. Among all the four population groups Meghwal and Salvi attained more schooling years compare to the Patel and Rajput. As discussed in the social history that among the previous generation, Rajputs and Patel have sufficient agricultural land and the vast amount of agricultural land need more labour power in the absence of machinery such as tractor, irrigation tools, agricultural tools, and in that situation all family members were busy with farming. Another reason was physical punishment by the teacher, so, children (not parents) from these communities think why we go to school where the teacher beat us. If parents forcefully send them to school, they hide in the midway and on-time return to their homes. While Meghwal and Salvi do not have agricultural work and they were busy with their traditional occupation such as leather work and waving. The social status of Meghwal and Salvi was low among all caste groups, after the 1980s, when the Meghwal's caste panchayat took the decision not to work (leather work) they left their traditional occupation and moved to another occupation such as daily wages, therefore, parents thought that we have to educate our children so, they can get a good job. Similar things happened with the Salvi community because due to the textile industry their

traditional occupation (weaving) was completely wound up and they have to find other sources of livelihood to survive.

The education of parents helped them for employment, however, it would be varying across respondents. Based on 65 respondents, only 8 people qualified for graduation level while 15 were at primary level and 24 were illiterate. The similar average height of offspring was recorded whose parents were illiterate and had graduation degrees. The reason behind these fewer differences was unemployment or it could also be that employment came after the children were already grown up, or several other factors in a complex web. As respondents reported that "*what we will do with higher education, there is no government job available and have higher competition, therefore, after some standard of formal education we involved in our traditional occupation or move out for daily wages."* Literature from other countries showed that parental education has a significant impact on the child's height which indicate that children's height is positively associated with parents educated, as these studies considered education as a proxy of socioeconomic indicators (Galobardes et al., 2012; Lazzeri et al., 2011; Thomas, 1994; Thomas et al., 1991).

6.2 Occupation

Occupation plays a significant role in the determination of average height. As discussed that the Rajput and Patel are agrarian communities and continue while the Meghwal and Salvi changed their traditional occupation. The significant average intergenerational improvement in height was measured across the studied group. However, a higher improvement was observed among Meghwal and Salvi because of their occupation in the public and private sectors. While Patel and Rajput showed similar intergenerational improvement in adult height. The life histories showed that Permanent workers (168.78 cm, 95%CI, 163.69 to 173.86) and daily wagers (167 cm, 95%CI, 163.76 to 172.01) recorded higher average height compared to the farmer (166.92 cm 95%CI, 163.98 to 169.86). Weaver and leatherwork workers recorded lower average height. Despite higher intergenerational growth in the average height, Rajput and Patel still continue to be taller than the Meghwal and Salvi. Meghwal changed their traditional occupation due to the atrocity associated with the work and societal decisions, therefore, they started work in other sectors. The literacy level of Meghwal also increased after this period and people also started performing in the public and private sectors.

Salvi doesn't feel the atrocity associated with their traditional occupation (weaving). However, they wound up their work due to the higher price of raw materials and labour associated with weaving work, because cheap and machine made cloth are easily available in the market, so, people preferred cheap clothes, and no one going to buy handmade clothes. Therefore, they also started work in other sectors which lead to liquid cash in their hand which resulted in better living standards for the community members.

Agricultural production is increased over a period of time because of the availability of alternative irrigation facilities, hybrid seeds, mechanization of agricultural tools, availability of chemical fertilizers and pesticides, etc. Indeed, the input expense such as ploughing, manuring, seeds, and fertilizer price also steadily increased, therefore, the profit from the agriproducts stabilized or improved little, which resulted in the lower household income that is reflected in their lower intergenerational height improvement.

6.3 Birth Weight and Height

Birth weight is associated with malnutrition and it is considered one of the major causes of mortality and morbidity in children under the age of five years (Rahman et al., 2016). It is well established that childhood malnutrition is associated with lower height gain in their adulthood. Other studies also confirmed that birth weight is a significant predictor of adult height (Binkin et al., 1988; De Franca et al., 2016; Jahanfar, 2018; Kitchen et al., 1992; Sørensen et al., 1999).

Table 6.1 Distribution of Mean Height According the Reported Birthweight of the Respondent

Birth Weight	N	Mean Height	Std. Err.	[95% Conf. Interval]	
Healthy	49	168.32	0.98	166.36	170.28
Weak	16	163.19	1.54	159.90	166.47
Difference		5.13*	1.92	1.29	8.97

* significant between Healthy and weak birth weight is p-0.009

The life histories recorded the reported birth weight of the respondents. The exact birth weight was not available at the time of the survey, so, the question was asked in terms of a healthy and weak-looking child at the time of their birth. Based on the responses, the result showed that those who were healthy at the time of birth, they are significantly taller about 5.13 cm [95%CI, 1.29 to 8.97, p-0.009] compared to weak born children (table 6.1).

6.4 Drinking Water & Sanitation and Height

Unsafe or contaminated water is one of the major causes of diarrheal disease in India (Maramraj et al., 2020), and it is well-established that morbidity related to diarrhea has a significant impact on stunting (Checkley et al., 2008) and subsequently on height.

Table 6.2 Source of Drinking Water and Distance Between the Source of Drinking Water and Home, Sufficiency and Use of Filtration Methods

Indicators	N	Mean Height	Std. Err.	[95% Conf. Interval]	
Source					
Piped supply	2	159.1	3.1	152.91	165.29
Open/uncovered well	46	166.95	1.02	164.91	168.98
River	5	165.62	4.55	156.54	174.7
Pond/Lake	1	166	-	-	-
Hand pump	9	171.19	1.75	167.68	174.69
Public water tank	2	163	1.6	159.8	166.2
Piped supply	2	159.1	3.1	152.91	165.29
Distance					
Less than 0.5 km	24	169.71	1.56	166.45	172.97
More than 0.5 and less than 1 Km	20	165.41	1.49	162.29	168.53
More than 1 km	19	166.26	1.24	163.65	168.87
Sufficiency					
Yes	24	168.15	1.75	164.52	171.77
No	41	166.41	0.92	164.56	168.27
Filtration Methods					
Strain through cloth	62	167.14	0.9	165.34	168.94
Without filter	3	165.33	2.91	152.83	177.84

In this study, we are trying to associate source of drinking water during the growing age with height on four grounds. First, is the source of drinking water is considered one the important factor for the availability and quality of water. Most of the respondents (70 percent) fetched water from the open/uncovered well and they recorded their average height as about 166.95 cm [95%CI, 164.91 to 168.98] (table 6.2), while around 13 percent fetched from the hand pump and their average height was 171.19 cm [95%CI, 167.68 to 174.69]. However, the difference between both is not significant. This description indicates that water from a hand pump helps more in height growth compared to the uncovered well because the hand pump would have decreasing distance between the home and the source of water and a lower distance lead to the sufficiency of water in the house.

Second, the distance between the house and the source of drinking water indicates that less than 0.5km distance is more favourable to height grain compared to more than 0.5 km. The third component of the above tables indicates that those who had sufficient water in the house during their growing age are taller compared to those who faced scarcity of water. There is best practice always seen in the study about water filtration through cloths because the major source of drinking water is open/uncovered wells in rural areas. Last section the above table shows that those who strain water through cloths is 1.80 cm [95%CI, -6.50 to 10.11] taller than those who did not strain the water.

Adequate sanitation along with hygiene and safe water are playing an essential role in reducing morbidity and mortality, in another word, it is fundamental to good health, and social and economic development (Cairncross & Vivian, 2006; Manickavasagam, 2020). During the growing age availability and accessibility of sanitation facilities are important factors to determine the nutritional status of children and debates on Dr. Panagariya's statement (Panagariya & Bhagwati, 2013) about stunting was also concentrated on sanitation as a determinant (Coffey et al., 2013; Spears, 2013). During the study, very few people reported the use of an in-house toilet during the growing age and based on that data there is not much difference in adult height recorded among the toilet user and open defecation.

Association with the house structure showed that those who had *kuccha* houses are around 2 cm shorter than those who have *pukka* houses. Around 50 percent of respondent belongs to the *kuccha* house and their average height is 165.91 ±5.89 [95%CI, 163.86 to 167.96] while 18 percent have pukka house. Thirty percent of people who had semi-kuccha/*pukka* houses were included for life histories and their average height was 168.59±6.53 cm [165.67 to 171.51].

6.5 Cultivation and Height

Availability of agricultural land can be taken as proxy indicator of availability of the food grain (cereals) in the household. As discussed, if the average monsoon happens, minimum three acres land is sufficient to produce cereals for the four person family round the years.

Table 6.3 shows that those who had agricultural land are 5.12 cm [95%CI, -2.03 to 12.27] are taller than those who did not. Furthermore, those who had less than 2 bigha land are taller than others while those more than that are shorter. Those who had less than 4 bigha land mostly depended on other occupations such as public/private sectors work, and daily wages among others. While those acquired more than 4 bighas in agriculture they were mostly involved in

farming. The association of height and amount of landholding showed that those who hold more than 10 bigha land are significantly taller than those who hold 4-10 bigha land about 5.39cm [95% CI 0.285 to 10.514, p- 0.03].

Table 6.3 Association Between Agricultural Land, Amount of Land Holding and Height

Indicators	N	Mean Height	Std. Err.	[95% Conf. Interval]	
Agricultural land					
Yes	61	167.37	0.89	165.59	169.15
No	4	162.25	3.13	152.30	172.20
Difference		5.12	3.58	-2.03	12.27
Amount of landholding					
Less than 2 Bigha	6	169.58	2.94	163.71	175.45
2-4 Bigha	21	167.58	1.11	165.36	169.8
4-10 Bigha	14	162.96	1.56	159.84	166.08
More than 10 bigha	24	168.35	1.69	164.97	171.73

Tenant cultivation was not much prevalent in the study area as social history reported, two respondents out of 65 reported tenant cultivation. However, one belongs to Patel and one Meghwal community, both have agricultural land but the landholding amount are less and they did not have other occupation except daily wages, therefore, they doing tenant cultivation on nearby filed belonging to Patel and Rajput. The tenant cultivators are shorter than the non-tenant cultivators about 5.77 cm [95%CI, -4.46 to 15.99], and the difference between those is not significant.

Irrigation is the lifeline of agriculture as the human body has blood. The production of crops depends on the source of irrigation. While collecting life history data, sources of irrigation were segregated into three parts. First are those who exclusively depend on rain-fed, another is those who have open/uncovered well for irrigation along with rain-fed, and third are those who avails canal irrigation facilities along with rain-fed. The result based on this showed that those who depend exclusively on rain-fed are 4.9 cm [95%CI, 0.46 to 9.32, p-0.03] significantly shorter than those who avail canal irrigation facilities.

6.6 Food Production, Availability, Culture and Height

Food production in own field is an important factor for household consumption. The following

table 6.4 represents two indicators related to food grain sufficiency and duration of insufficiency. First part indicates that those who produced sufficient food grain in their own farm are 1.19 cm [95%CI, -2.36 to 4.75] taller than those who have to depend on another sources for food grain.

Table 6.4 Distribution of Mean Height According to the Sufficiency of Food Grain Production and Duration of Insufficiency

Indicators	N	Mean Height	Std. Err.	[95% Conf. Interval]	
Sufficiency					
Yes	32	167.69	1.38	164.88	170.5
No	31	166.5	1.11	164.22	168.78
Difference		1.19	1.78	-2.36	4.75
Duration of food insufficiency					
180-270 days	14	167.08	1.72	163.37	170.79
More than 270 days	19	165.96	1.4	163.02	168.9
Difference		1.12	2.2	-3.36	5.6

If we see across social groups then Patels and Rajputs have sufficient food grain production while those who reported "no" they belonged to the Meghwal and Salvi community because mostly they were landless or had small landholdings which would not enough for sufficient production. Other part of the tables 6.4 showed that as days of food insufficiency increased the average height declined. Those who have agricultural land and not produce sufficient food grain they mostly depend on the other source of food grain such as open market (primary) and PDS (auxiliary) for six to nine months in a calendar year. There were no history of hunger reported in their growing age among the studied communities.

The consumption of pulses was common among the studied community. Among Pulses mung, chickpea and Urad were frequently consumed, because the production of these pulses was common in the study area. Around 90 percent of respondents reported pulses consumption was thrice in a week. When we analysis as per the consumption of frequency in a week, those consume pulse twice in a week were shorter and their average height was 165.5 cm while as consumption frequency of pulses increased the average height also increased. Those who consumed pulse more than three time in a week they were taller and their average height was about 168.78 cm. Caste specific difference were not observed in pulse consumption category. Study based on the tribal community in same result showed that there is positive and significant

relationship between the frequency of pulse consumption and average height (Choudhary, 2017).

Table 6.5 Distribution of Mean Height According to Consumption, Sufficiency, Regularity, Duration of Dairy Products Availability During the Growing Age of the Respondents

	N	Mean Height	Std. Err.	[95% Conf. Interval]	
Consumption					
Yes	50	167.33	1.02	165.29	169.38
No	15	166.12	1.64	162.61	169.63
Difference		1.21	2.07	-2.92	5.35
Sufficiency					
Yes	38	167.76	1.2	165.33	170.19
No	12	165.98	1.93	161.74	170.23
Difference		1.78	2.4	-3.04	6.6
Regularity					
Yes	33	168.32	1.27	165.72	170.91
No	17	165.43	1.65	161.94	168.92
Difference		2.89	2.13	-1.4	7.18
Duration of availability					
Less than 3 months	4	164.15	3.78	152.12	176.18
3 to 6 months	13	165.82	1.89	161.71	169.94
Difference		-1.67	3.99	-10.17	6.82

The consumption of non-vegetarian diet is positively associated with height. Those who were vegetarian are 3.03 cm [95%CI, -0.59 to 6.64, p-0.09] shorter than those who consumed non-vegetarian diet along with vegetarian diet. The frequency of consumption of a non-veg diet in the household during the growing age also positively associated with height. However, the difference between veg and non-veg diet consumption and the frequency of non-veg consumption was not significant for this study.

Consumption of dairy products positively contributed to the height (Baten, 2009; de Beer, 2012; Xueqin et al., 2004), bone health, and reduction in fracture risk in later life (Rizzoli, 2014). The previous study based on the study area suggests that consumption of dairy product are positively and significantly associated with height gain (Choudhary, 2017). Among the respondents, those who consumed dairy products in their growing age are taller than those who did not consume them (table 6.5). Similarly, those who had sufficiency and regularity of dairy products were taller compared to those who were lacking. However, the difference between the indicators of dairy products was not significant and might need more samples to draw aver conclusion. Dairy products were frequently available in the house of the Rajput and Patel, and

half of the household economy depends on that while very few among Meghwal and Salvi have milch cattle.

Table 6.6 Distribution of Mean Height According to Consumption and Duration of Consumption of Additional Nutritional Supplements During the Growing Age of the Respondents

Nutrition sup.	N	Mean Height	Std. Err.	[95% Conf.	Interval]
Yes	37	168.99	1.16	166.64	171.35
No	28	164.49	1.15	162.12	166.86
Difference		4.50	1.67	1.16	7.84
Duration					
Less than a month	7	164.67	2.11	160.38	168.96
One month	27	169.15	1.27	166.58	171.72
More than one month	3	177.67	4.51	168.52	186.82

Table 6.6 suggests that consumption of additional nutrition supplement during growing age were significantly associated with higher height gain in later life and the difference between these are about 4.50 cm [95%CI, 1.16 to 7.84, p-0.009]. There is a significant difference between those who consume supplements for less than a month and those consumed for more than a month about 13 cm 95% CI [-22.90098 to -3.089499, p- 0.01], and those who consumed one month and those for more than a month about 8.52cm 95% CI [.1940693 to 16.84297, 0.04] While there is no difference between the one months and less than one-month consumption of nutrition supplement. The additional nutrition supplement (*laddu)* were made from gum (*gond),* ghee, jaggery, coconut powder, and dry fruits. Those who afford it consumed it every year during the winter. People believe that the consumption of *laddu* once a year would beneficial for physical and mental health and they help in the reduction of episodes of disease, improving cognitive development. It is often seen that *laddu* was mostly consumed by the male member of the society while women consumed these laddus after every childbirth. Among the Rajput and Patel, every male member of the household consumed laddu during the winter season while among the Salvi and Meghwal those belonging to the higher income group consumed *laddu.*

6.7 Breastfeeding and Height

Breastfeeding is an important factor that helps body growth. Data from the interview of the mother of the respondents suggest that those who were fed for less than 24 months are

significantly shorter about 6.52cm [95%CI, 11.91 to -1.14, p-0.01] than those who feed for more than 24 months. The frequency of breastfeeding has a significant impact on average height. Those who fed less than seven times are significantly shorter than those who were fed seven times or more about 5.22 cm [95%CI, -8.26 to -2.18, p-0.001]. Previous studies on children from the study area also suggest that the prevalence of undernutrition is less among those who were breastfed for 2 years compared to those who breastfeed for less than 2 years (Choudhary, 2015). The same study indicates that episodes of malnutrition occurred between the 6 to 10 months of age of the children when they started complementary feeding. The complementary feeding of children mostly depended on in-house available resources like milk, rice, pulses, buttermilk, and among others. Respondents from the Rajput and Patel households reported that their children consume milk, curd, chapatti, and buttermilk as complementary feeding while children from Meghwal and Salvi reported they feed Milk, pulse water, and rice as complementary feeding. However, based on the complementary feeding practices there were no significant differences in the average height were observed. The use of goat milk as complementary feeding was not observed among the studied community while among tribe use of goat milk was higher as the previous study suggest (Choudhary, 2017).

6.8 Disease and Height

The occurrence of any prolonged disease during the growing age is inversely associated with height at a later stage. The following table 6.7 shows that those who suffered from the prolonged disease in their growing age are significantly shorter about 6.43 cm [95%CI, -9.90 to -2.95, p-0.0005] than those who did not affect.

Table 6.7 Distribution of Mean Height According to the Suffering From Prolonged Disease and Repetition of Disease During the Growing Age

Suffered	N	Mean Height	Std. Err.	[95% Conf. Interval]	
Yes	19	162.51	1.33	159.70	165.31
No	46	168.93	0.97	166.97	170.89
Difference		-6.43	1.74	-9.91	-2.95
Repetition or reoccurrence of disease					
Yes	4	160.90	4.20	147.52	174.28
No	60	167.27	0.86	165.55	168.98
Difference		-6.37	3.49	-13.34	0.61

The repetition or reoccurrence of any disease also showed an inverse relationship with average height. Those who reported the reoccurrence during their growing age are about 6.37 cm [95%CI, -13.34 to 0.61, p-0.07] shorter than those who were not suffered from the reoccurrence of the disease. Diarrhea and Malaria were major diseases that people report in the reoccurrence category. Literature also suggests that diseases like diarrhea during the growing age significantly affect the height of an individual (Checkley et al., 2003; Daniels et al., 1991; Hoddinott, 1997; Lima et al., 1992; Richard et al., 2013; Victora et al., 1990).

The health-seeking behavior of the respondent was not good and it has an impact on the economic status of the family. Many of the respondents reported financial unavailability was the major impediment to health-seeking behaviour and it also decides the preference for health-seeking behaviour. Approx. half of the respondents reported that they preferred private health facilities. The following table shows how people faced difficulties in health-seeking behaviour.

Table 6.8 Reported Disease and Difficulties in the Health Seeking Behaviour

No. of cases	Reported disease and difficulties in health seeking behaviour
1	*Salumber CHC was one of the government health institution where I took treatment for my ear problem. In childhood, doctor found that there was a small hole in my left ear. We did not have enough money to take treatment at private hospital at Udaipur from ENT specialist. Therefore, I took treatment from Salumber continuously for 2 years. In winter season, pain in my ear increased and fluid started to coming out from my ear. Then I visited to Udaipur district hospital where ENT specialist conducted a surgery which helped me to get rid of from the issue.*
2	*When I was at 10 years old, I got severe Malaria. My House is located near Som-Kamla-Amba dam, which is mosquito brooding space. For the treatment, I visited private hospital in Udaipur. The total expenditure was about 10000 rupees. Again at the age of 15 years, I contracted Dengue and took treatment from Choudhary hospital Udaipur (Private hospital). I was admitted in the hospital for 7 days and 25 thousand was spent. However, at that time we did not have enough money for treatment, so, we borrowed money from one of the Patels from our village and 7500 as an interest (at the rate of 2 rupees per hundred).*
3	*At the age of 2 months I got Malaria. I got admitted at Udaipur private hospital for 10 days. The hospital treatment bill was about 20000. At the age of 7 years I had typhus and got admitted in hospital and the bill was more than 20000 Rupees.*
4	*When I was at 12 years, I got Malaria. Treatment took place for 5 days and hospital charged 7000 rupees.*

5	*At the time of Birth he was healthy, but he never intake breast milk for first 21 day of his birth. That time he was suffered from the fiver and his body become yellow. First we took him into hospital, then doctor said he was a mouth ulcers, so he will cure shortly, doctor give us medicine and we returned home. But after the taking of two days medicine, he was not intake breast milk and crying hard. So, we again visited to hospital, doctor took blood sample of 5 day old baby, the laboratory reported conformed with jaundice. He was admitted for 15 days in Udaipur private hospital. Doctor give complementary feeding to him during the admission, because his mother was unable to go there. There was traditional believes that before 15 days of delivery mother were not allowed to go outside the home. On 21st day he started taking breastmilk after the cured of jaundice.*
6	*At the age 12 years, I got Malaria. Treatment took place at Choudhary hospital, Udaipur for 3 days and hospital charged 10000 rupees.*
7	*At the age of 17 years, I suffered from Typhus. Treatment took place at Government hospital. We had to pay 4000 Rupees for medicine.*
8	*At the age of 16 years, I went to Ahmedabad for work. In and accident I got burnt and fractured my elbow and had to pay 30 thousand in hospital. As economic condition was not good so we had to sell two buffalos.*
9	*At the age of 16 years, I went through appendix surgery. I took all the treatment in Ahmedabad private hospital. For this surgery, I was admitted in the hospital for 5 days. 10000 rupees was I paid in the hospital for the surgery and medicines.*
10	*At the age of 12 years, I suffered from pain in my lower abdomen. I visited to Ahmedabad private hospital. As per the lab report one of the kidneys was not functioning properly, so my mother donated kidney for the transplant. I was admitted for 20 days and we paid 3 lacs for the transplantation. I go for regular check up of kidney function which costs 1500 Rupees.*
11	*At the age of 13, he got Malaria. Treatment took place in private hospital, Udaipur and hospital charged 10000 rupees.*
12	*At the age 8 year I got operated for kidney stone.7000 rupees were paid to private hospital for the treatment.*
13	*I was he got tuberculosis at the age of 17. Treatment took place in private hospital, and my family had to sell ornaments due to bad economic condition.*
14	*When I was 10-year-old, I got operated for tumour in private hospital Udaipur, that time I was admitted for 23 days in hospital. My family borrowed money from other person on interest, 2.5 lakh rupees was the expenditure for this treatment we paid. Again at the age 14, I took dengue treatment from Salumber government hospital.*

6.9 Work and Height

The work done by the respondents were divided into two parts- one is respondent's age and nature of work along with family member in their domestic/traditional occupation and another is age and nature of work as an earning member of the family.

6.9.1 Work Along with Family Members

The studied Rajput and Patel communities mostly reported farming as their traditional occupation. The primary distribution of height showed that those who started working along with family member at less than 12 years of age are about 4.14 cm [95%CI, -11.43 to 3.15, p-0.49] shorter than those who started work after the 12 years of age. In the farming, respondents take care of crops from stray animal, birds and sometimes they provide help in pulling out unwanted weeds and irrigation. When plot the working hours with average height shows that those who work less than 2 hours are significantly taller than those who worked for 2-3 hours about 6.67 cm [95%CI, 0.46 to 12.89, p-0.03].

6.9.2 Working Age as an Earning Member of Family

Table 6.9 Distribution of Mean Height According to the Age of Started Work as an Earning Member

Age group	N	Mean Height	Std. Err.	[95% Conf. Interval]	
10 to 14 Years	7	163.06	0.92	161.21	164.9
15 to 17 Years	18	165.76	1.84	162.05	169.46
18 to 24 Years	18	167.87	1.29	165.27	170.47
More than 24 years	6	169.13	2.7	163.7	174.56

Table 6.9 shows that as the age of started as earning member increased, the average height also increased. Those who started work at their childhood are about 4.81 cm [95%CI, -9.30866 to -.3215, p-0.03] shorter than those who started work after 18 years. Similarly, those whose work started in childhood as compared to more than 24 has a significant difference of about 6.07 cm [95%CI, -11.96 to -0.18, p-0.04]. While no significant difference was observed among 15 to 17, 18 to 24 years age group and more than 24 years age group. The work started in childhood and more than 24 years has a significant difference [95%CI, -11.96 to -0.18, p-0.04]. Many of them worked as daily wage labourer and on monthly salary. While lower number started work in their traditional occupation. There was no significant difference observed among the occupational categories.

Chapter-7 Discussion and Conclusion: Trends in Adult Height as a Socio-Biological Phenomenon

The study of human height can be considered a sub-discipline of Auxology. Auxology is the science of human development and physical growth (Hermanussen & Bogin, 2014b). Curiosity about the physical characteristics of ancestors like height, and changes thereafter, are always a subject of public interest. Even among scholars, the physical growth of humans around the world has been a matter of intense debate. Height has been an important indicator for recruitment of army, police and guard personnel from their earliest organisation in human history. Human height, largely studied by the discipline of physical anthropology came into the course of discussion among the developmental economists and cliometricians at the end of the third quarter of 20thcentury. Economists had an interest in measuring malnutrition and its synergetic effect on economic performance. However, the economic logic has a fundamental limitation that it does not operate in case of housemakers and children due non-monetary contribution. During the 1990s, cliometricians introduced height as a measure of biological wellbeing (Fogel, 1994; Steckel, 1995).

The role of environmental factors pushes scholars to study height and its determinants with respect to living conditions and the environment in which they born and grow. Researcher work on, Scheduled Tribe (ST) population explained the relationship between the entitlements and improvement in living standard; further how it contributed in the average improvement in the adult height.

Literature on height and determinants suggests that itis the reflection of overall social-economic and biological wellbeing and primary shaped by the socio-economic conditions, nutrition intake and disease exposure during the growing age. The higher prevalence of stunting among Indian children was widely discussed (Coffey, Deaton, et al., 2013; Gillespie, 2013; Jayachandran & Pande, 2013; Panagariya & Bhagwati, 2013; Wable, 2013), while the dynamicity of height and genetic role were largely unexplored in the Indian context, except debate on Indo-Aryan based on the *Rakhigadi* project (Khan, 2019; M. A. Singh, 2021).

The study on children's height is limited to measuring the nutritional status among the under-five and beyond that not much attention paid to their physical health at policy level except Rashtriya Bal Swasthya Karyakram. Given the dynamicity of children and adolescent height, might not be able to provide holistic view on the determinants of height. The adults' height is

static and the determinants of height would, therefore, be easy to corroborate in adults, from their life and social histories. Given the above possibility we limited our study to adult height.

7.1 Intergenerational Variations:

Among all the studied groups aged between 20-60 years, Rajput (166.9 cm) was taller than others; the average height of Patel and Salvi is 164.7 cm and 164.6 cm, respectively. Meghwal (164.1) recorded lower average height. The average height of current generation improved significantly across caste categories. However, this improvement was not uniform across the population groups. Maximum intergenerational improvement was recorded among the Meghwal and Salvi communities which was more than 3 centimetres (cms). This was followed by Patel and Rajput, about 2.71 and 2.01 cms respectively. The base height or reference points were different among the all studied group. Despite a lower average improvement in height, Rajput were significantly taller than other studied communities. In the case of Patel's the starting point is almost similar to the Salvi while the average improvement in the height was lower.

Social history explained that overall quality of life of the Dalit communities (Meghwal and Salvi) had improved. Traditional occupation (leather work for Meghwal and weaving for Salvi) was the primary income source among the previous generations of these communities. Locally available daily wage was an add up to their livelihood. Through a societal decision, Meghwal completely gave up income source from their traditional occupation (leather work). They started refraining from leather work due to the stigma and discrimination associated with leather work. Salvi left their traditional occupation because of rapid expansion of textile industry and increasing cost of raw material. Handwoven cloth requires huge labour power and time to reach final stage and in exchange of that they received a very small amount. Therefore, Salvi community left this work. When traditional occupation was deserted, people started to explore new occupations, depending on their educational standard. As explained in chapter 5 (Living experience: an exploration of social history), the educational standard among the current generation of Meghwal and Salvi had improved much more as compared to other studied communities. Therefore, the number of permanent and contractual workers was higher among these two communities. Improvement in the educational level would be helped them to choose the better occupation which then led to improvement in living conditions of these communities. Thus, these communities recorded a higher improvement in the height between the last two consecutive generations compared to Rajput and Patel.

Cultivation and animal husbandry was prime source of income in the Patel and Rajput. History of migration was also recorded among the current generation of these communities, which is add-on to the household income. Indeed, the number of migrant workers in Patel community was higher than the Rajput. Lower improvement in the average height Patel and Rajput could be explained by linking their social history. The profile or surplus income from the agriculture were decreased over the period of time due increase in the input cost such as seeds, fertilizer, mechanical cost for ploughing, harvesting), wages etc. So, among those households who did not have extra source of income (migration, employment, etc.) were economically poor compared to those have extra source of income. Because, household economy has a core role in the shaping of living standard of household members, and improved living conditions or wage gain are positively associated with height gain (Barros et al., 2006; Schultz, 2002).

7.2 Father's Occupation and Child's Height

Farming, leather work, weaving, and daily wage were the four traditional occupations. Father's occupation could be a significant determinant of the child's height. This is because occupation decides the household consumption pattern, which then significantly affects the nutritional status (Arimond & Ruel, 2004; Casey et al., 2001) and further body height.

The transition was recorded in the occupation (from traditional occupation to searching of newer occupation) of Meghwal and Salvi and previous generation was part of this transition. The new occupation of these caste groups are daily wages permanent and temporary workers, and self-employment. All these occupational categories were associated with the liquid cash in hand, directly correlated to buying food and related stuffs. Therefore, the economic disabilities were minimized for these communities, and subsequently it added extra weightage in their food baskets compared to previous generation.

Among Rajput, offspring whose fathers had a permanent employment showed higher inter-generational improvement in the average height compared to farmers and other occupation group. The average height of the farmer's offspring was higher among both generations, due skewed sample (farmer v/s other occupation).

Among Patel, the offspring of a permanent employee were taller than the offspring of those in other occupations in both generations. The relationship between father occupation and height of the offspring akin to the household economic status that Extra add-ons from other sectors (such as daily wage, migration, and temporary and permanent employment) would make the

household (HH) more financially capable; thus, the purchasing power capacity of that HH would be higher than other HH.

Occupation showed an association with height. On one hand, among the same education background, taller people earn more or have higher possibility of white-collar jobs as compared to shorter people. And on the other hand, parents being in a permanent occupation is positively associated with children's height (Aurelius et al., 1996; Case et al., 2009; Deaton, 2007; Guntupalli & Baten, 2006). Permanent employees have been shown to be taller than other occupational categories with similar education may have better occupation or earn more compared to shorter (Deaton, 2007).

7.3 Father's Education and Height

The binary analysis (literate and illiterate) based on father's education shows that intergenerational improvements in the average height was higher in the literate category compared to illiterate. Intra-caste analysis also showed that father's education is positively associated with children's height across study groups.

Among the previous generation, a significant intergenerational improvement in average height was observed in the category of illiterates across caste groups due to higher proportion of respondents who reported father education as illiterate (around 92%). The higher proportion of illiterate father category reported among both Patel and Meghwal, thus, intergenerational improvement was not significant in the primary education category. However, remaining caste groups such as Rajput and Salvi showed significant improvement in the average height.

Average height and education of respondents also suggests that among both generations, those who had higher educational qualifications were taller than those who were illiterate. Individuals having schooling up to upper primary, secondary, senior secondary, and more showed significant intergenerational improvement in the average height. In other words, it could be concluded that taller people added more schooling years.

7.4 Canal Irrigation and Height

The pooled data showed that adult men from those villages benefited through canal irrigation were significantly shorter about 0.62 cms [95%CI, 0.07-1.16, p-0.027] than those villages used open/uncovered well for irrigation. Except Rajput, all other communities showed a negative relationship with canal irrigation facilities. The reason behind negative co-efficient of Rajput

are, they owned vast amount of plain land with canal irrigation facility and economically well-off compared to Rajput from non-canal irrigation area. Across means of irrigation, all communities are showing intergenerational improvement in average height. However, average improvement in height was higher among those villages which is exclusively depends on open/uncovered well for irrigation compared to village benefited with canal irrigation facility. The topography of the block substantially varies from north to south. The northern part is hilly and uneven, while the southern part has plain areas. Unlike north, the southern part has full access to canal for irrigation purpose. Cultivation in northern part completely depends on the rain and on alternative irrigation facilities like open well, bore-well etcetera. Southern part has advantage of canal irrigation in addition to rains and alternative irrigation facilities. Social history informed that the agricultural production was higher in the South and South-East region compared to other parts of the block because of ready access to canal as the irrigation source. Higher agricultural production is strongly associated with a higher mean income in the HH. And this has a positive impact on the average height. Social history of the community also suggested that higher agricultural production led to increase in HH income. Though residents from north had lesser income opportunity compared to those from south, they were comparatively taller. The reason behind this mystery was not clear until the life histories were recorded. Respondent from the southern part reported the south faces a higher incidence of waterborne and water related disease (vector borne diseases) such as diarrheal, malaria, dengue, typhoid in comparison to those from north. As discussed in the literature review, occurrence of disease during the growing age significantly lowers the height. Repeated occurrence of disease led to a lower growth in the mean height or a lower mean height among residents from the southern part in comparison to those from north. And studies show that vector borne diseases are one of the major adverse impacts of canal irrigation (S. Bhattacharya, 2012; Chambers, 1986; Joshi & Agnihotri, 1984; Vishwakarma et al., 2001).

7.5 Birth Weight and Height

Birth weight of child is positively associated with the adult height and height gain in later life (Karlberg & Albertsson-Wikland, 1995; Sørensen et al., 1999). Indeed, effect of low birth weight manifests on adult height mainly through a higher incidence of diseases and low nutritional intake during childhood (D. J. Barker et al., 1991). Birth weight of the respondents were not taken from any birth record documents. It was collected based on parents' recall in terms of how the baby looked at the time of birth – healthy or weak. The result showed that those who looked healthy at the time of birth were significantly taller than those who looked

weak by about 5.13 cms [95%CI, 1.29 to 8.97, p-0.009]. Mother describing birth weight and height relationship of her two male children upon asking question for height difference between her two children-

> *At the time of birth my elder child was weak and he faced difficulty in breastfeeding, so, he grew with thin and small body. My younger child was health at time of birth and he was looking good in health while he was growing, therefore, my younger child is taller than elder.*

Similar data for breastfeeding suggest that those respondents who were fed for less than 24 months were significantly shorter than those who were fed for more than 24 months. The frequency of breastfeeding also has significant impact on average height. Those who were fed less than seven times were significantly shorter than those who were fed seven times or more time in a day.

7.6 Physical Workload and height

Physical workload (Priya, 2000) and stress have substantial impact on the average height (Bozzoli et al., 2009). Respondents who started working along with family members at the age of 12 years were comparatively shorter than those who started working after 12 years. Similarly, working as an earning member of HH before adulthood also negatively correlated with achieved height. Increasing daily working hours have substantial and negative impact in the growth of height.

Respondents' who fetched water from an open/uncovered well were shorter than those who fetched water from a hand pump. The distance between the house and source of drinking water indicated that a distance less than 0.5km is more favourable to height gain than a longer distance. Indeed, the effect of source and distance of fetching water was primarily seen among the women, because it is they who are responsible for fetching water. The effect of source and distance of fetching water on men's height was affected through the scarcity of water in the household. Therefore, we asked the next questions on availability of water in the household. Those who had sufficient water in the house for drinking and other domestic purposes during the growing age were taller as compared to those who faced a scarcity.

7.7 Food Production, Consumption and average height

In the agrarian society, farm products are primary source of HH income. The net income from farm exclusively depends on the amount and quality (fertile) of landholding. As the amount of land holding increases, the HH income also increases. Increased HH income is positively associated with the height at population as well as at individual level (Bozzoli et al., 2009; Case et al., 2002; Komlos & Baur, 2004; Marwaha et al., 2011). Amount of land holding affects individual height in two ways: one is through the availability of food grain in HH, and another, by generating income by selling the farm products through which other expenditures (such as that on health, education, etc.) are met. Evidence from the researcher earlier study suggests that a properly irrigated land holding of 12 bigha or more can produce sufficient food grains for a 6-member family round the years (Choudhary, 2017).

Respondents who had ownership on agriculture land were taller compared to landless respondents. Indeed, the amount of agricultural land ownership matter a lot. Those who hold more than 10 bigha land are significantly taller than those who hold 4-10 bigha land. Holding of 2 to 3 bigha agricultural land was not much corroborated with average height because it did not produce to sufficient food grain even one month. Contrary to expectation to the expected in my study sample those who had less than 2 bigha land are taller than others. They were mostly dependent on the other occupations such as public, private and daily wages which fulfilled their nutritional other requirements.

Availability of agricultural land with increasing amount of holding ensures sufficiency of food grain in the household. As present study suggests that those who produced sufficient food grain in their own farm were taller than those who depended on other sources and as days of food insufficiency increased, the average height also showed a decline.

Consumption of pulses during the growing years had a positive association with adult height. In the study area, close to 90 percent of respondents reported the consumption of pulses thrice a week. Study results suggest that those who consumed pulses twice in week were shorter than those who consumed pulses more than thrice in a week. Researcher study also showed significant improvement in the average height with an increase in the frequency of pulses consumption in a week (Choudhary, 2017). Study based in Bangladesh shows that energy-adjusted protein from different sources (animal, pulses, and vegetables) and the total energy-adjusted protein were associated with height and weight gain, after controlling for sex, age, land ownership, diarrhoea, ARI and fever (Torres et al., 1994). Another study indicates that

inclusion of pulses or legume is beneficial for prevention and control of disease (Campos-Vega, Loarca-Piña, & Oomah, 2010; Tharanathan & Mahadevamma, 2003), which might aid in height gain.

The food consumption pattern from the life history data suggests that consumption of non-vegetarian diet is positively associated with adult height. Those who were vegetarian were shorter than those who consumed a mixed diet. The frequency of consumption of non-vegetarian diet in the household during the growing age was also positively associated with the height. Among the study population groups, except Patel, all communities consumed a mixed diet (some individuals might be vegetarian though). Effect of consuming non-vegetarian diet on height was confounded by the purchasing power of the HH. Those who were capable of purchasing non-vegetarian food frequently were taller than others because they owned much resource. That their wealth was comparatively higher than others was also corroborated by social history. Other studies also show a mixed result, because HH wealth or income is the biggest confounding factor in the relationship of consumption of non-vegetarian diet and average height gain. A study on groups having similar income levels but consuming different food (vegetarian versus non-vegetarian) might be able to provide evidence on the relative contribution of non-vegetarian food consumption on height gain.

Households with availability, sufficiency and consumption of dairy products show positive impact on the average height which is widely cited in the literature.

Additional nutritional supplements refer to food items that are not a part of regular diet, like dry meat, mixture of dry fruits, grain and ghee. Consumption of additional nutrition supplement during the growing age were significantly associated with a higher attained height. Furthermore, as the consumption of additional nutritional supplements increased, the average height also increased. Usually, extra nutritional supplement was consumed for one to three months in a year, generally in winter. The practice of consuming extra nutritional supplements was common across the population group, as revealed in the social history.

Earlier, the Dalit community, who were collecting meat from dead animals, stored it in the form of smoked meat and consumed it during winters. Even the fat portion of the meat was used for moisturizing dry skin. The economically well-off community used dry fruits such as almonds, cashew, and raisin along with gum, jaggery, and ghee. The frequency of supplementation exclusively depended on the economic status which increased with the

income quantile. The consumption of dried meat was decreasing over the period of time due to availability of fresh meat. Another consumption of dried meat was higher in those who were economically weaker, so, they used dried meat instead of *gond* and jaggery *laddoo*. As the economic conditions of almost all households improved compared to their previous generation. the consumption of *gond laddoo* during the winter become more frequent.

7.8 Episode of Disease and Height

The occurrence of any prolonged disease during the growing age is inversely associated with attained height (Choudhary, 2017, 2018; Kennedy, 2015; Perelman, 2014). Study results suggested that those who suffered from any prolonged disease during the growing age were significantly shorter than those who did not. Even the re-occurrence or repeated occurrence of any disease showed an inverse relationship with average height. Steady increase in the number of health facilities for primary health care somehow accounted for the lower suffering form disease across the study villages, as discussed in the social history; and also contributed in reduction in incidents of vector borne disease through creating awareness and remedial measures. Respondents from the previous generation mostly suffered from diarrhoea and primarily depended on home remedies to control illness. Even today, home remedies were the first preference in every household of the study area during illness; only when the disease became severe would they visit the nearest health facility (Choudhary, 2017, 2020). There were two reasons for this delay: unavailability of health facility, and poor transportation between the health facility and residence. Because of these delays, the disease would get severe and it would take more time to get back to normal functioning.

Recently, the role of ASHA in management of diarrheal disease became significant and its visible impact was observed in the field. Each household with children get packets of ORS and Zinc tablets during the monsoon. Also she is providing counselling to the family member about using of mosquito bed nets and facility visit for even minor illness among children. The accessibility and utilization of health services improved over a period of time and there are three major reasons reported behind it, increase in the number of health facilities, continuous improvement in road connectivity and transportation, and the interaction of frontline workers (ASHA, Anganwadi worker, and ANM) with the local community.

Conclusion

Studying intergenerational variation in adult height is one of the possible methodological approached to understand the determinants of adult height. The average height of the respondents of 20-40 years old respondents showed significant intergenerational improvement across all caste groups. However, the average improvement varied from one population group to another. This was because the determinants of height varied from one population group to another and even within the group. The social structure was seen to be the primary factors that affected nutrition, access and affordability to health care service, drinking water and sanitation. However, it is contrary to conventional understanding about social hierarchies and the benefits of development. Area-wise developmental activities (like irrigation projects and mining) also led to variation in average height. Studying adult height and its determinants is an important approach to developing a framework for tackle the prevalence of stunting in children and adults. Because of the dynamic nature of height before adulthood, understanding the determinants of children's height might not be adequate to draw conclusions about determinants of height. Adult height is static and it would allow a holistic window to study height's determinants. Determinants like improved living conditions, hassle free access to health care service, intake of adequate nutrition, etc. are enable individual to achieve their genetic potential.

Improved living conditions such as *pukka* house, access to safe water and sanitation facilities were positively associated with the average adult height. Availability of agricultural land along with irrigation facility was important to agricultural production. Food availability, frequency of pulses' consumption and non-vegetation diet were positively correlated with the average height. Consumption of dairy products (milk, buttermilk, curd, ghee), of additional nutritional supplements, and its frequency helped in better height growth. All these factors (food availability, pulses consumption, availability of dairy products, consumption of additional nutritional supplements) have improved over a period of time among all study groups. Infant feeding practices were one of the determinants of height. Occurrence and reoccurrence of diseases during the growing age made a huge impact on the average adult height. This was largely determined by the accessibility and affordability of health care services. Workload and nature of work during the growing age was one of the significant predictors of average adult height.

The socio-economic factors play a significant role in the shaping of body size. Growth in the average height across the globe has also been shown to align with socio-economic indicators. This study also found that height of the population group/caste group changed with their social and economic status, and removal different caste based restrictions and practices contributed in the height improvement. The inter-caste variations in intergenerational height could be explained with the changing social and economic status. Occupation plays a primary role in the shaping of socio-economic conditions. Farming was the primary occupation of both, the Rajput and the Patel. But the average improvement in height across generation was higher among Patel as compared to Rajput. This was because Patel were more proficient in agriculture as compared to Rajput. Moreover, because of migration, other sources of income were also higher among the Patels. Migration was also observed among the Rajput, but not as much as among the Patel.

The traditional occupation of Meghwal and Salvi had completely changed. Meghwal were earlier involved in tanning work. But they decided to completely stop doing it during the 1980s as it was associated with untouchability. Salvi were earlier involved in weaving work. But due to boom in the textile industry and increase in the raw material costs, they were pushed to leave this occupation. Therefore, both these communities had to search new avenues for survival. While the education level had increased across all population groups, this was especially true for the Salvi and Meghwal. They saw education as a tool that would help them sustain their lives. Consequently, the proportion of government servants and temporary workers were higher among these two communities as compared to Rajput and Patel. Affirmative action (reservation policy, laws) by the government provided a shield against the social exclusion and enabling them to be a part of the social mainstream. The changing occupation of Meghwal and Salvi helped in overall improvement in their standard of living which reflected in the average height of current generation. These two communities showed the highest, and similar, intergenerational change in average height. Similarly, changes in the socio-economic status of Patel and Rajput led to different rate of improvement in the average height of both communities.

The study results are not aligned with Dr. Panagariya and Bhagwati's statements about lower genetic potential and inappropriate measurement methodology being responsible for the higher prevalence of stunting recorded in India. Average height of all the studied population/caste groups improved with their socio-economic improvement. In addition to the traditional

occupation, shifting to newer occupations, improved accessibility and utilization of health care service, and improved nutritional status led to average improvement in adult heights.

Earlier Studies shows improving in the height from 1840 to 2005 (Fig.1.1) The National Family Health Survey, 2015-16 and 2019-21, indicate that average height of Indians is showing a reverse trend from 2005-06 (Choudhary et al., 2021), which might be due the policy negligence of contributing factors that affect height. Before the 1980s, most of the developing countries gave attention to Protein Energy Malnutrition (PEM) and instituted multi-sectoral nutritional approaches. The policies and programs since the 1990s have been primarily designed with a micronutrient centric lens. Micronutrient centric approach did not pay much attention to underlying socio-economic and political determinants of malnutrition. With the shifting of these, attention toward PEM was diverted to micronutrient based solution of malnutrition. Micronutrients deficiencies deserve serious attention in India but at the same time nearly one fourth population of suffer from the undernutrition. Both issues (micronutrient deficiencies and undernutrition) are unacceptable and need to kept in proper perspective, and by doing this we could possibility be able to achieve our genetic potential of height which is unknown.

This study's findings show even greater than food and nutritional supplementation programs there has been the impact of larger socioeconomic developments. Post-Independence, the *Zamindari* system were abolished. This created an opportunity to break the shackle of feudalism, bonded labour system and to some extent the caste based occupations as Salvis and Meghwal in this study achieved. In consequence the condition of life and work improved among the Salvis and Meghwals. Secular and liberal changes in the socio-economic and political aspects of the country facilitated their social mobility. It also improved the meso level changes in the local/social environment as well rural infrastructure like road connectivity, electricity, educational institutions, and health facilities, among others. All these changes together led to improvements in adult height in a short term over two generations of all caste groups in Salumber block of Udaipur district. These finding illustrate the larger changes in the Indian society that the Indian macro datasets reflects for the periods of 1960s to 2000.

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Annexure-1 No and (Percent) of Male Population as per Census (above-6 years)

S.N	Name	Total HH	Total Male pop.	Male SC Pop.	Male ST pop.	Male General and OBC
1	Salumber (urban)	3390	8420	941 (11.2)	426 (5.1)	7053 (83.8)
2	Kharka	728	1743	259 (14.9)	512 (29.4)	972 (55.8)
3	Bhabarana	1189	2778	259 (9.3)	676 (24.3)	1843 (66.3)
4	Utharda	769	1968	234 (11.9)	768 (39)	966 (49.1)
5	Gurel	575	1278	222 (17.4)	255 (20)	801 (62.7)
6	Loda	405	1010	199 (19.7)	276 (27.3)	535 (53)
7	Saradi	373	831	179 (21.5)	391 (47.1)	261 (31.4)
8	Banora	518	1252	158 (12.6)	166 (13.3)	928 (74.1)
9	Dudar	218	576	144 (25)	197 (34.2)	235 (40.8)
10	Dal	280	653	142 (21.7)	76 (11.6)	435 (66.6)
11	Kholri	475	1147	128 (11.2)	773 (67.4)	246 (21.4)
12	Gingla	941	2384	120 (5)	260 (10.9)	2004 (84.1)
13	Edana	343	792	116 (14.6)	196 (24.7)	480 (60.6)
14	Bassee Singawat	285	685	114 (16.6)	19 (2.8)	552 (80.6)
15	Gaonra-Pal	178	457	103 (22.5)	0 (0)	354 (77.5)
16	Bamaniya	193	459	101 (22)	6 (1.3)	352 (76.7)
17	Gur	304	703	95 (13.5)	159 (22.6)	449 (63.9)
18	Bassee Jhujhawat	597	1351	89 (6.6)	116 (8.6)	1146 (84.8)
19	Bassee Samchot	381	879	81 (9.2)	74 (8.4)	724 (82.4)
20	Isarwas Dangiyan	139	331	79 (23.9)	76 (23)	176 (53.2)
21	Seriya	698	1445	78 (5.4)	376 (26)	991 (68.6)
22	Itali-Khera	519	1167	78 (6.7)	109 (9.3)	980 (84)
23	Dagar	386	862	76 (8.8)	12 (1.4)	774 (89.8)
24	Deo-Gaon	296	705	74 (10.5)	122 (17.3)	509 (72.2)
25	Randela	182	424	74 (17.5)	113 (26.7)	237 (55.9)
26	Karawali	502	1227	68 (5.5)	62 (5.1)	1097 (89.4)
27	Jetana	544	1462	62 (4.2)	622 (42.5)	778 (53.2)
28	Isarwas Tapran	150	348	53 (15.2)	156 (44.8)	139 (39.9)
29	Payra	353	889	52 (5.8)	286 (32.2)	551 (62)
30	Khira-Wara	160	417	50 (12)	88 (21.1)	279 (66.9)

Annexure-2 Consent Form

(सूचित सहमति पत्र)

परियोजना का शीर्षक : वयस्क पुरुषों की ऊंचाई में अंतरपीढ़िय अंतर :सलुम्बर तहसील ,उदयपुर जिल्ले में 20 से 40 एवं 41 से 60 वर्ष तक की आयु वर्ग के विभिन्न जातियों का एक अध्यन .

शोधकर्ता का नाम : कृष्ण कुमार चौधरी

जवाहरलाल नेहरु विश्वविद्यालय ,नई दिल्ली .

शोध-अध्ययन का संक्षिप्त विवरण:

प्रस्तावित अध्ययन वयस्क आदमियों की ऊँचाई में अंतरपीढ़िय परिवर्तन का अध्ययन करेगा ओर यह जानने का प्रयास किया जायेगा कि दो पीढ़ियों में कोई परिवर्तन हुआ हैं या नहीं .साथ ही परिवर्तन चाहे वह सकारात्मक या नकारात्मक हुआ है तो उसके पीछे के क्या कारण रहे हैं .ऊँचाई में परिवतन के कारणों का पता लोगो जीवन काल) मुख्यतः जन्म से बीस वर्ष तक की आयु (का अध्ययन करके पता लगाया जायेगा .साथ ही समुदाय तथा गाँव का भी सामजिक इतिहास से आधार पर भी ऊँचाई में परिवर्तन को समझा जायेगा .

प्रतिभागी सहमति पत्र

मुझे शोधकर्ता द्वारा ,जिस उद्देश्य के लिए ,मुझे शोध में भाग लेना हैं ,उसके फायदे और नुकसान बता दिए गए हैं . मैं बिना किसी दवाब के ,अपनी इच्छानुसार इस शोधकार्य में भाग लेने के लिए सहमत हूँ ; इस शोधकार्य के लिए सभी प्रकार के परीक्षण ,जो मानव जाति के कल्याण के लिए ,ज्ञान प्रदान करते हैं , के लिए सहमत हूँ .

मेरी सहमति प्रत्यक्ष रूप से ,किसी भी व्यक्तिगत जानकारी के खुलासे के लिए नहीं हैं .मेरी व्यक्तिगत जानकारी के खुलासे के लिए मेरी अगली अनुमति अनिवार्य हैं .

मुझे यह जानकारी दे दी गई है कि JNU और इसके शोधकर्ता (PI) ,कृष्ण कुमार चौधरी एवं इनके सहयोगी ,किसी भी फायदे के कार्य से पहले ,जो मेरे द्वारा दी गई जानकारी पर आधारित है ,मेरी अनुमति लेंगे .

गवाह के हस्ताक्षर प्रधान अन्वेषक के हस्ताक्षर

गवाह का नाम प्रधान अन्वेषक

संपर्क विवरण

शोधकर्ता का विवरण : शोधकर्ता) कृष्ण कुमार चौधरी (वर्त्तमान समय में जवाहरलाल नेहरु विश्वविद्यालय से पी० एच० डी० कर रहे हैं .

पता – 336 : ए बी , मुनिरका गाँव ,नई दिल्ली .110067 ,

घर का पता :मुकाम पोस्ट -आजोदर ,तहसील रानीवाड़ा ,जिल्ला जालोर) राजस्थान 343040 -(

फोन नं : 9462289228

Annexure-3 Height Data Recording Scheduled

Inter-generational Variation in the Height of Adult Men: A Study across Caste Categories in Salumber Block, Udaipur District between the age groups of 20 to 40 and 41 to 60 years.

Part 1. First round survey tools for collection of adult heights of tribal *(Note – if need will be used separate sheet)*

No of Respondests	Name	Age	Caste	Village	Occupation of Father	Fathers Educations	Respondent occupation	Respondents educations	Height (cm)	Weight (kg)
			1		2	3	2	3		
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										

Code.

1. [1] Rajput [2] Patel [3] Meghwal [4] Salvi

2. [1] Permanent employee [2] contractual worker [3] daily wages [4] student [5] Farmer [6] farming and daily wages [7] other (specify).

3. [1] Illiterate [2] literate [3] primary [4] upper primary [5] secondary [6] Sen. Secondary [7] Graduation [8] Post Graduation [9] Doctorate

Annexure-4 Life History Scheduled

वयस्क पुरुषों की ऊंचाई में अंतरपीढ़िय अंतर :सलुम्बर तहसील ,उदयपुर जिल्ले में 20 से 40 एवं 41 से 60 वर्ष तक की आयु वर्ग के विभिन्न जातियों का एक अध्यन

जीवन इतिहास साक्षात्कार पत्र

गाँव _____

उत्तरदाता की लम्बाई (सेमी.)_____

उत्तरदाता के माता_____ पिता_____ के लम्बाई

क्या यह साक्षात्कार माता पिता / संरक्षक की मौजूदगी में किया गया हैं [1] हाँ [2] नहीं [ ]

प्र. सं.	**मद**	**कूट**
प्र. 1	**सामान्य जानकारी**	
1.1	उत्तरदाता का नाम	
1.2	आयु	
1.3	शिक्षा – [1] निरक्षर [2] साक्षर [3] प्राथमिक [4] उच्च प्राथमिक [5] माध्यमिक [6] उच्च माध्यमिक [7] स्नातक [8] स्नात्कोतर [9] स्नात्कोतर एवं उससे ज्यादा	
1.4	वर्तमान व्यवसाय [1] स्थाई नौकरी [2] संविदा पर [3[दैनिक मजदूरी [4] विद्यार्थी [5] किसान [6] अन्य	
1.5	मासिक आय _____	
1.6	अभिभावक की शिक्षा – [1] निरक्षर [2] साक्षर [3] प्राथमिक [4] उच्च प्राथमिक [5] माध्यमिक [6] उच्च माध्यमिक [7] स्नातक [8] स्नात्कोतर [9] स्नात्कोतर एवं उससे ज्यादा	
1.7	घर में मुख्य कमाऊ व्यक्ति का व्यवसाय [1] स्थाई नौकरी [2] संविदा पर [3[दैनिक मजदूरी [4] विद्यार्थी [5] किसान [6] अन्य	
2	**अभिभावक के प्रवासन का इतिहास**	
2.1	प्रवासन का प्रकार [1] स्थाई प्रवासन [2] अस्थाई प्रवासन	
2.2.	प्रवासन की अवधि _____	
2.3	प्रवासित कार्य की प्रकर्ति _____	

3	जाति [1] राजपूत [2] पटेल [3] मेघवाल [4] सालवी	
4	जन्म के समय का वजन [1] स्वस्थ [2] कमजोर	
5	**मुलभुत सुविधायें (एतिहासिक सन्दर्भ में)**	
5.1	पीने के पानी का स्त्रोत क्या था [1] नल के द्वारा [2] बोरिंग [3] कुआँ [4] झरना [5] नदी [6] तालाब/झील [7] अन्य	
5.2	परिवार के लोगों को कितनी दुरी से पीने का व अन्य कार्यो हेतु पानी लाना पड़ता था (दुरी किमी _____)	
5.3	पानी की गुणवता _____	
5.4	क्या पानी परिवार की आवश्यकता के अनुरूप संपूर्ण था [1] हाँ [2] नहीं	
5.5	यदि नहीं, तो परिवार के लोग कैसे परिस्थिति से निपटते थे.	
5.6	पानी को साफ करने के लिए क्या इस्तेमाल करते थे [1] उबलना [2] कपडे से छानना [3] पानी के फ़िल्टर का उपयोग [4] बिना छाने इस्तेमाल करते थे [5] अन्य	
5.7	शोचालय के लिए कहाँ जाते थे [1] स्वयं का शौचालय [2] सामुदायिक शौचालय [3] खुले में शौच	
5.8	आपके बचपन में घर कैसा बना हुआ था [1] कच्चा [2] पक्का [3] अधकच्चा/पक्का	
6	**खाद्यान उत्पादन, उपलब्धता, उपभोग, भोजन के अनुप्ब्लाधता , भुखमरी**	
6.1	क्या आपके पास में खेती की जमीन हैं [1] हाँ [2] नहीं	
6.2	यदि हाँ तो कितना बीघा _____	
6.3	क्या आपके परिवार ने सिजारे पर किसी और की जमीन खेती हेतु ली है [1] हाँ [2] नहीं	

6.4	सिजारे की शर्ते क्या थी	
6.5	सिचाई का स्त्रोत क्या था [1] बोरिंग [2] कुआँ [3] नहर [4] वर्षा [5] अन्य	
6.6	क्या आपका परिवार साल भर के लिय आवश्यक अनाज का उत्पादन कर पता था [1] हाँ [2] नहीं	
6.7	यदि नहीं , परिवार के लोग फिर भोजन कहाँ से लाते थे [1] बाजार [2] वस्तु विनिमय [3] उचित मूल्य की दुकान पर निर्भरता [4] भोजन का कम इस्तेमाल करना [5] अन्य	
6.8	यदि नहीं , तो परिवार में कितने समय तक भोजन की अपर्याप्तता रहती थी _____(दिनों की संख्या)	
6.9	क्या आप सिर्फ शाकाहारी भोजन ही करते थे बचपन में [1] हाँ [2] नहीं	
6.10	यदि नहीं, मांसाहार सेवन का प्रवर्ती [1] सप्ताह में एक बार [2] पखवाड़े में एक बार [3] महीने में एक बार [4] साल में कुछ समय [5] कभी कभी	
6.11	सप्ताह में कितने दिन आप अपने बचपन में दाल खाते थे	
6.12	आपके गाँव में उचित मूल्य की दुकान है [1] हाँ [2] नहीं	
6.13	आप उचित मूल्य की दुकान से क्या खरीदते थे [1] गेहू [2] चावल [3] शक्कर [4] घासलेट [5] अन्य	
6.14	आपने बचपन में क्यों भोजन के अलावा कोई अन्य पोषण आंगनवाडी से लिया था. [1] हाँ [2] नहीं	
6.15	आपने बचपन में क्यों भोजन के अलावा कोई अन्य पोषण अपने घर से लिया था. [1] हाँ [2] नहीं	

6.16	यदि हाँ, [1] गोद के लड्डू [2] अन्य	
6.17	साल में कितने महीने ये पोषण लेते थे. _____	
6.18	घर में दुधारू पशु थे [1] हाँ [2] नहीं	
6.19	अपने बचपन में दुग्ध या उसके उत्पाद का इस्तमाल खाने में करते थे [1] हाँ [2] नहीं	
6.20	कौनसे दुग्ध उत्पाद आप खाते थे [1] घी [2] दूध [3] दही [4] छाछ [5] उपरोक्त सभी	
6.21	परिवार के सभी लोगो के लिए दुग्ध उत्पाद पर्याप्त थे [1] हाँ [2] नहीं	
6.22	परिवार के सभी लोगो के लिए दुग्ध उत्पाद सालभर पर्याप्त थे [1] हाँ [2] नहीं	
6.23	यदि नहीं तो कितने समय तक दुग्ध उपलब्ध रहता था _____	
6.24	परिवार के लोग दुसरे घर से क्या दुग्ध उत्पाद लाते थे [1] हाँ [2] नहीं	
6.25	परिवार को कौनसे दुग्ध उत्पाद मुफ्त में मिलते थे [1] घी [2] दूध [3] दही [4] छाछ	
6.26	आपके बचपन में भोजन की कमी थी क्या ? [1] हाँ [2] नहीं	
6.27	परिवार के द्वारा भोजन को कम खाने की या एक समय खाने की स्थति बनी थी क्या [1] हाँ [2] नहीं	
6.28	भुखमरी के दिन गुजरे थे आपके बचपन में [1] हाँ [2] नहीं	
6.29	यदि हाँ , दिनों की संख्या _____	
6.30	स्तनपान का समय _____(माह)	
6.31	पूरक पोषाहार में क्या भोजन लेते थे _____	
6.32	२४ घंटों में कितनी बार स्तनपान करते थे _____	
7	**बीमारी**	

7.1	आप अपने बचपन में किसी गंभीर बीमारी से पीड़ित थे [1] हाँ [2] नहीं	
7.2	यही हाँ, बीमारी का नाम _____	
7.3	बीमारी का समय _____	
7.4	बीमारी के दौरान दवाई हेतु निरंतर पहुच थी क्या [1] हाँ [2] नहीं	
7.5	बीमारी के इलाज के लिए कहा जाते थे [1] आधुनिक दवाई [2] परम्परागत इलाज [3] आयुष [4] कोई इलाज नहीं	
7.6	इलाज नहीं करवाने के पीछे कारण [1] स्वास्थ्य सेवाओं की दुरी, [2] वित्तीय समस्या [3] अन्य	
7.7	उपचार के दौरान आपको क्या परेशानी हुई _____	
7.8	सामान्य बीमारी में आप पहले कहा जाते हैं [1] सरकारी अस्पताल [2] निजी अस्पताल [3] भोपजी [4] घरेलु उपचार [5] अन्य	
7.9	आपको कोई बार बार बीमारी होती रहती हैं क्या [1] हाँ [2] नहीं	
7.10	यदि हाँ, कौनसी बीमारी _____	
7.11	पुनरावर्ती होने की बारंबारता _____	
8	**कार्य**	
8.1	आपने अपने परिवार के सदस्यों के साथ पारिवारिक काम करना कब से शुरू किया (उम्र)_____	
8.2	क्या काम करते थे _____	

8.3	कितने समय तक काम किया _____
8.4	किस उम्र में आप कमाने लगे थे _____
8.5	काम की प्रकर्ति _____

Annexure-5 Checklist for Social History

वयस्क पुरुषों की ऊंचाई में अंतरपीढ़िय अंतर :सलुम्बर तहसील ,उदयपुर जिल्ले में 20 से 40 एवं 41 से 60 वर्ष तक की आयु वर्ग के विभिन्न जातियों का एक अध्यन

जाति का सामाजिक इतिहास निम्नलिखित बिन्दुओं पर एकत्रित किया जायेगा.

(क) भौगोलिक बसावट

गाँव में बस्ती का स्थान) लोकेशन ,(पीने के पानी का स्रोत ,मुख्य अवश्यक्ताओ से जुडाव जैसे – पानी ,शोचालय ,जलाऊ लकड़ी ,गंदे पानी की निकासी ,आंगनवाडी केंद्र ,उप स्वास्थ्य केंद्र ,उचित मूल्य की दुकान ,विद्यालय से दुरी.

(ख) जातियों कि बसावट संरचना एवं पैटर्न

घरों की संरचना के सम्बन्ध में – सरकारी योजनाओं जैसे इंदिरा आवास योजना, मुख्यमंत्री आवास यौजना, प्रधानमंत्री आवास योजना आदि के लाभार्थिओं की संख्या, घरो का प्रकार – कच्चा, पक्का, अध्कच्चा . समय के साथ उपरोक्त मदों में परिवर्तन.

(ग) जमीन, सिचाई, कृषि उत्पादन

जमीन पर मालिकाना हक़ की प्रवर्ती, जमीन के प्रकार – खेती योग्य, बंजर, असिंचित व सिंचित भूमि, जाति आधारित एवं गाँव की सामूहिक संपदा.

हिस्सेदारी खेती की प्रवर्ती, हिस्सेदारी खेती करने वालो का अनुपात, समय के साथ हिस्सेदारी खेती में अनुपात एवं समझोते में परिवर्तन.

सिचाई का स्त्रोत – सिचाई के स्त्रोत में एतिहासिक परिवर्तन (कुआं, विधुत मोटर, नहर), सिचाई के लिए पानी की उपलब्धतता, वर्ष भर पानी की उपलब्धतता.

कृषि उत्पादन की प्रवर्ती एवं उत्पादन, नई फसल के बुवाई की शुरुआत का दशक और वर्ष उदा. गेहू, चावल आदि . खाद्दान एवं नकदी फसल की प्रवर्ती एवं उत्पादन. समुदाय में साल भर के लिए

अवश्यक अनाज न उत्पन करने वाले परिवारों का अनुपात. रासायनिक खाद व कीटनाशक के उपयोग की प्रवर्ती.

खेतिहर मजदुर, खेतिहर मजदुर में श्रम विभाजन, खेतिहर मजदूरों की जाति. मजदूरी की संरचना, मजदूरी की शर्ते.

(घ) पशुपालन

पशु रखने का मुख्य उद्धेश्य, दुग्ध एवं दुग्ध उत्पादन, मुर्गी पालन, मांस का घर में उपयोग. दुग्ध संकलन केद्रों की स्थापना. पशुओं के प्रकार – दुग्ध के लिए, खेती के लिए, इर्धन के लिए, आदि.

(ड) भोजन एवं पोषण

खाद्यान का मुख्य स्त्रोत – (स्वयं के खेत, भागीदारी में खेती, वस्तु विनिमय). खाद्यान उपभोग की प्रवर्ती, खाद्यान में सम्मिलित वस्तुए, मुख्य भोजन, अनाज व दाले , फल व सब्जियां, शक्कर व गुड, दुग्ध व दुग्ध उत्पाद, वसा व तेल, विशेष भोजन (सुप्लिमेंट).

पर्याप्त भोजन की उपलब्धता- भुखमरी का इतिहास, कुपोषण से मृत्यु, भोजन को छोड़ना या एक समय भोजन ग्रहण. भोजन के लिए मजदूरी पर निर्भरता, सामंती व्ययस्था में भोजन का परम्परिक व्यवस्था. भोजन को संरक्षित करने की तकनीक- पारम्परिक भोजन संरक्षण उपयोग एवं परिवर्तन.

भोजन संस्कृति में परिवर्तन के सन्दर्भ में मुख्य पड़ाव- डेरी, हरित क्रांति, बांध, नहर, विधुतीकरण, उचित मूल्य की दुकान, विद्यालय मध्यान भोजन, आंगनवाडी.

(च) खेती के अलावा अन्य आर्थिक गतिविधिया

आय का परम्परागत स्त्रोत, गैर कृषि आधारित आय का स्त्रोत – कोयला उत्पादन, डेरी, ठेकेदारी, दुकानदार, निर्माण आदि. आय व व्यय के मुख्य आयोजन- विवाह, जन्म, मृत्यु, जाति आधारित दंड का भुगतान.

(छ) व्यवसाय एवं रोजगार सम्बंधित क्रियाएं

परम्परागत व्यवसाय में सम्मिलित लोगो का अनुपात, पराम्परागत व्यवसाय में आर्थिक परिवर्तन, रोजगार व कार्य में परिवर्तन व प्रवर्ती (स्वयं के खेत में काम करने वाले, दूसरों के खेत में काम करने वाले), समुदाय में खेतिहर मजदूरों का अनुपात, उनके पास उपलब्ध जमीन की मात्रा, काम के घंटे, सेवा शर्ते, काम की प्रकर्ति. बंधुआ मजदुर, जबरदस्ती मजदूरी की प्रकीर्ति में परिवर्तन, समुदाय के लोगो का निजी एवं सरकारी क्षेत्र में रोजगार की स्थिति- माईन्स, दैनिक मजदूरी, स्वयं का रोजगार. काम के प्रक्रति – हल्का, सामान्य, भारी, काम शुरू करने की उम्र.

(ज) प्रवासन व काम की प्रक्रति

प्रवासन की प्रवर्ती, आव्रजक स्थान, काम की सेवा शर्ते, भुगतान की संरचना, कार्य क्षेत्र, प्रवासन का प्रकार, विभिन्न काम में सलग्न होने के कारण, प्रवासन के समय उम्र.

(झ) अकाल, सुखा, बाढ़, एवं अकाल रहत कार्य

अकाल व सुखा से प्रभावित होने का वर्ष, सकल के दौरान भोजन की उपलब्धता, अकाल, सुखा एवं बढ़ के दौरान समुदाय के लोगों का जूझने का तरीका.

(ण) स्वास्थ्य संस्कृति

शरीर को परम्परागत रूप से स्वस्थ रखने के अभ्यास – शरीर बनाना, बच्चों एवं बड़ो के लिए परम्परागत खेल (कुश्ती, कबड्डी, शिकार,), शरीर को स्वस्थ रखने के लिए भोजन का चुनाव.

बीमारी के दौरान स्वस्थ्य संस्कृति- परम्परागत वैद (दाई, हाडवेद, भोपाजी, हाकिम,) उन तक पहुच और उनकी जिम्मेदारियां. परम्परागत वैद की अनुपस्थिति में मुख्यत बीमारी में किससे इलाज करवाया जाता था. इलाज की प्रकर्ति एवं अभ्यास- इतिहास, आधुनिक दवाओं तक पहुच, बारंबारता और मृत्य की औसत आयु.

(त) संस्थायें एवं उन तक पहुच

स्वस्थ्य सुविधायें (निजी/सरकारी), आंगनवाडी , उचित मूल्य की दुकान, स्वस्थ्य सेवा प्रदाताओं का समुदाय के लोगों के प्रति व्यवहार. विद्यालय (शिक्षा प्राप्त करने के परेशानी), शिक्षकों का समुदाय

के लोगों के प्रति व्यवहार. राजनितिक क्रियाकलाप, राजनितिक भागीदारी, ग्रामीण पंचायत, राजनितिक भागीदारी के अलावा गाँव में शक्ति सम्बन्ध.

(थ) संस्कृतिक कार्यकलाप

विवाह, विवाह विच्छेद में समाज की भूमिका, अपराध एवं आपसी झगड़ों का निपटारा, उतराधिकारी के अधिकार, समाजीकरण के चरण- सामुदायिक मूल्य, आदते, लड़के में पितृसत्ता का भाव.

Annexure-6 Office Order Regarding Study from Block Medical Officer, Salumber

कार्यालय ब्लॉक मुख्य चिकित्सा अधिकारी सलूम्बर जिला उदयपुर (राज.)

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कार्यालय आदेश

सामाजिक चिकित्सा शास्त्र एव सामुदायिक सवास्थ्य केंद्र, जवाहरलाल नेहरू विश्व विद्यालय, नई दिल्ली के द्वारा संचालित सर्वेक्षण "वयस्क पुरुषों की ऊंचाई में आन्तरपीढीय वैविध्य:सलुम्बर तहसील, उदयपुर जिले में विभिन्न सामाजिक वर्गों में से 20 से 40 एवं 41 से 60 वर्ष तक की आयु वर्गों का अध्ययन" मे संबधित आंगनवाड़ी (सलग्न गाँव सूची) मे कार्यरत आशा एव कार्यकर्ता सम्पूर्ण सर्वेक्षण के दौरान आवश्यक सहयोग प्रदान करे।

खण्ड मुख्य चिकित्सा अधिकारी
सलूम्बर जिला उदयपुर।

प्रतिलिपी –

1. कृष्ण कुमार चौधरी, जे. एन. यू. , नई दिल्ली
2. कार्यालय प्रति।

खण्ड मुख्य चिकित्सा अधिकारी
सलूम्बर जिला उदयपुर।