Nutritional Status among the Dhimal Community of Naxalbari, West Bengal

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By

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DECLARATION

I, Suman Sarkar, hereby declare that the thesis entitled "NUTRITIONAL STATUS AMONG THE DHIMAL COMMUNITY OF NAXALBARI, WEST BENGAL" is an original work carried out by me under the guidance of Dr. Maibam Samson Singh. The contents of this thesis did not form the basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/Institute. This is submitted to the Sikkim University, for the award of the degree of Master of Philosophy in Anthropology.

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Nutritional Status among the Dhimal Community of Naxalbari, West Bengal

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CHAPTER-I

INTRODUCTION

The condition of health of a person that is influenced by the intake of foods and utilization of nutrients is called nutritional status (Brookover, 2015). When our body receives all the nutrients in appropriate amounts which our body needs then our body is in the state of good health and has a normal nutritional status. Malnutrition and its adverse consequences depend upon altered intake, functional changes, and finally anthropometric effects (Jeejeebhoy et al., 1990). Malnutrition has direct negative consequences in terms of poor health, disease and disability, brain development, educational attainment and income potential for individuals and communities. The World Health Organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions" (Onis et al., 1993). Malnutrition hurts people both mentally and physically. The sign and symptoms of malnutrition depend on which nutritional deficiencies a person has, although they may include the following: dizziness, poor growth, underweight, dry or scaly skin, decaying teeth, bloated stomach, muscle weakness, mental impaired, fatigue and low energy, poor immune function and many more (Weiss, 2016). The World Health Organization considers that poor nutrition is the single most important threat to the world's health (WHO, 2000). There are different forms of malnutrition like under nutrition and over nutrition. Under nutrition is a form of malnutrition resulting from a reduced supply of food or from inability to digest and assimilate. It includes being underweight for one's age, stunted, wasted and deficient in

vitamins and minerals. On the other hand, over nutrition is defined as a condition in which excess body fat is accumulated due to overconsumption of nutrients and food to the point at which health is adversely affected (Parks, 2012). Problems of underweight and overweight are caused by a chronic imbalance between energy intake and actual energy needs of the body (Bray, 1999). Under-nutrition is most common in low-income, developing countries like sub-Saharan Africa and Southern Asia where access to a well-balanced diet is very limited (Cunningham, 2015). More specifically, almost two-thirds of the people that suffer from under-nutrition are reported mainly from seven countries, which include India, Bangladesh, Ethiopia, Indonesia, China, Pakistan and the Democratic Republic of Congo (Cunningham, 2015). Earlier, over nutrition had been viewed as a problem that only affected developed nations. However, over nutrition is a growing problem worldwide. The prevalence of overweight and obesity are increasing in developing countries, and even in low-income groups in richer countries (WHO, 2000). Problems of over nutrition are increasing even in countries where hunger is prevalent. In 2003, WHO reported that the levels of overweight and obese women in the Eastern Mediterranean region and North Africa exceed those in the United States. Furthermore, obesity is now becoming a marker of poverty in a growing number of nations, including Brazil and Mexico (Chopra et al., 2002). A large percentage of the vulnerable population in South East Asian countries are affected by many deficiencies like protein energy malnutrition, chronic energy deficiency in adults. By 2020, an estimated two-thirds of the global burden of disease will be caused by chronic non-communicable diseases (Chopra et al., 2002). However, while hunger is a tremendous global health concern that cannot be

minimized, over nutrition should similarly be addressed as a top priority. The global prevalence of under nutrition is devastatingly high-one billion people are adversely affected by malnutrition, but another one billion people suffer from obesity.

Various socio-demographic factors such as lifestyles, smoking habits, dietary habits, socioeconomic conditions have also been recognized as modifying factors (Bray, 1999). In many developing and underdeveloped countries, chronic malnutrition is widespread simply because people do not have enough food to eat. In more wealthy industrialized nations, malnutrition is usually caused by: Poor diet, mental health problems, digestive disorders and stomach conditions, alcoholism and many more (Nordqvist, 2016). Poor diet may be caused by one of several different factors like dysphagia or swallowing difficulties. Again, mental health problems like depression may develop eating habits which leads to malnutrition. People with anorexia nervosa may develop malnutrition because they are ingesting too little food. Digestive malfunction when bodies cannot absorb the nutrients they need for normal nutritional status. Alcoholism is a chronic diseases which undermine the body's ability to digest food, absorb certain vitamins and produce hormones which regulate metabolism. Alcohol contains calories, reducing the patients feeling of hunger so that body cannot get proper nutrients (Nordqvist, 2016).

Economic inequality between and within nations is a primary cause of both over nutrition and under nutrition. Studies conducted in India show that income inequality had the same effect on the risk of being overweight as it did on the risk of being under weight. (Subramanian et al., 2007). However, increasing numbers of poor people are becoming

overweight in more nations, as these individuals consume affordable, yet highly caloric meals, such as fast food and processed foods (Subramanian et al., 2007). The increasing urbanization, mechanization of jobs and transportation, availability of processed fast foods and dependence on television for leisure, and overall sedentary lifestyles are the main cause of over-weight and obesity (WHO, 2003; Bell et al., 2002; Popkin, 2002, 2001, 1998; Drewnowski and Popkin, 1997). Because of urbanization and modernization, our lives are becoming more sedentary and less physically active than before. Such an increasing transition lead to increasing problems of overweight and obesity in due course of time (Popkin, 2001).

Overweight and obesity may lead to several health problems such as type- 2 diabetes, cardiac problem, arthritis, back pain, high cholesterol, high blood pressure and sleep apnea. An ideal nutritional status occurs when the supply of nutrients conforms to the nutritional requirements or needs (Popkin, 2001). Over nutrition can develop into obesity which increases the risk of serious health conditions, including cardiovascular diseases, hypertension, cancer and type- 2 Diabetes Obese people are more prone to diabetes, tuberculosis, cardiovascular irregularities, hypertension, arthritis and respiratory problems. Vitamin A and D toxicities is commonly observed in the obese. Obesity increases the risk of complications during surgery, pregnancy and childbirth. Obese women appear to be more prone to menstrual irregularities and infertility. There is impaired glucose tolerance and in many cases, hyper-glycaemia leads to diabetes (Parks, 2012).

There are many scientific processes to estimate the condition of health. Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose tissue (Ulajaszek, 1994). Anthropometry is a key component of nutrition status assessment including adults. The anthropometric data have been used to track growth and weight trends in the population for more than thirty years (Flegal et al., 2002; Hedley et al., 2004). There are several methods for assessing the nutritional status such as body mass index, skin fold measurement, abdominal circumference and bioelectrical impedance analysis or BIA etc. Weight is proportional to height, and this relationship, known as the BMI, is one of the most commonly used and simplest anthropometric measures. Skin fold thickness is an indirect measure of subcutaneous adipose tissue using skin fold calipers at various body sites. Body density and percentage body fat can then be estimated based on these measurements. Bioelectrical impedance analysis or BIA based on a two compartment model, which is used to measure resistance/impedance of a small electrical current as it passes through the body's water pool. Resistance to current flow is greater through adipose tissue and bone mineral than fat-free mass, as its water content is low.

For my present research I choose to use BMI to assess the prevalence of underweight and overweight. The body mass index (BMI) or Quetelet index is a value derived from weight and height of an individual. The BMI is defined as the body weight divided by the square of the body height, and is universally expressed in units of kg/m^2. The BMI is an attempt to quantify the amount of soft tissue mass (muscle plus fat) in an individual, and then categorize that person as underweight, normal, overweight and obese

based on that value. There are different categories to identify BMI because of huge variation in different population groups. It has become very troublesome to categories everyone under one category. These recommended distinctions along the linear scale may vary from time to time and country to country, making global longitudinal surveys problematic. Due to this problem, every country has made its own cut off marks to identify BMI. In recent years, there was a growing debate on whether there are possible needs for developing different BMI cut-off points for different ethnic groups. The associations between BMI, percentage of body fat, and body fat distribution differ across populations. Therefore, the health risks increases below the cut-off point of 25kg/m^2that define overweight in the WHO classification. Commonly accepted BMI ranges are BMI of greater than 30kg/m^2 is indicative of obesity, while a BMI of 25.0 to 29.9 is suggestive of overweight in an individual. BMI of 18.5 to 24.9 indicates normal and BMI<18.5, considered as underweight (WHO, 2000). According to Asian cut-off points, BMI $\geq$27.5kg/m^2 has been considered as obese, BMI between 23.5-27.4 kg/m^2, considered as overweight, BMI between 18.5- 23.4kg/m^2 indicates normal and BMI below 18.5kg/m^2 considered as underweight (WHO, 2000).

Significance of study

As per latest census, India has more than 8.4 million tribes which constitute 8.2 per cent of the total population (Mittal and Srivastava, 2006), which probably has the largest number of tribal communities in the world. In general the tribal populations are among the most underprivileged and undernourished people in India. Recent investigations have studied the anthropometric characteristics and levels of nutritional status among various

tribal populations of India like Kora Mudis (Bose et al., 2006), Mundas (Ghosh and Bharati, 2006), Oraons (Mittal and Srivastava, 2006) and Santals (Bose et al., 2006; Ghosh and Malik, 2007). Most of them found the worst condition of nutritional status among different tribal populations. There are several socio-economic conditions which defined nutritional status of Indian tribal communities. Studies carried out earlier by the National Institute of Nutrition among primitive tribal groups in different States of the country revealed that their socio-economic conditions and nutritional status are largely influenced by the eco-system (Rao et al., 1993). Illiteracy and absence of knowledge of proper diet are also cause for malnutrition among Indian tribe like Korku tribe (Das, 2010; Venkaish et al., 2002). Maternal health status, maternal educational level and age of marriage are some socio-economical factors that have also effect on nutritional status of the Indian tribes (Rao, 2001). Many works have been done on effect of socio-economic condition on nutritional status among different communities of the India but very few works have done on Dhimal community which is located in North-Bengal in the district of Darjeeling.

Therefore, the proposed research study is to undertake a cross sectional study to find out the nutritional status in relation to socio-economic conditions, food habits and lifestyles factors among adult Dhimal of semi-urban area of Naxalbari, West Bengal.

Objectives of the study

1. To find out Nutritional status among adult Dhimal (aged 20-60 years).
2. To analyze how Nutritional status associated with socio-economic conditions.
3. To understand the relationship of Nutritional status with dietary habits and life styles.

CHAPTER-II

REVIEW OF LITERATURE

Biological and socio-economic conditions are directly linked with nutritional status of children, adolescents and adults. It is universal to any culture. Family income, parental education, occupation, marital status, inactive physical activity and overall lifestyle are few examples of socio-economic conditions which have tremendous effect on nutritional status.

Prevalence of under nutrition and over nutrition is differed by age and sex. National Family Health Survey-3 (2006) reported that the prevalence of under nutrition in India is 33.0 percent among males and 28.1% among females. In urban areas, these figures were 19.8% and 17.5%, respectively. In rural areas, these were 38.8% and 33.1%, respectively. A study (Banik et al., 2007) among Dhimal tribe reported that the overall prevalence of under-nutrition was very high (36.4%). The prevalence was significantly higher in women (44.6%) than in men (27.0%). Goswami (2010) reported that the prevalence of under-nutrition is found to be very high among the Juangs women indicating their poor nutritional condition. Das and Bose (2012) found that the states of Karnataka, Gujarat, Madhya Pradesh and Odisha are highly affected by adult malnutrition with more than half of the adults having a BMI less than 18.5 kg/m^2. Patterns of adult malnutrition show extremely poor nutritional status in the states of Gujarat, Odisha, Arunachal Pradesh, Karnataka, Maharashtra, Madhya Pradesh and Andhra Pradesh (FAO, 2010). The overall prevalence of chronic energy deficiency (CED) was highest in Madhya Pradesh (76.0%) followed by Maharastra (71.9%), Jharkhand (58.5%), Tamil Nadu (55.0%), Andhra Pradesh (50.1%), Odisha (49.5%), West Bengal (45.9%), Kerala (37.8%), Andaman &

Nicobar Island (29.5%), Assam (21.5%) (NFHS, 2006). While Meghalaya shows the least (14.3%) prevalence of under nutrition among the all studied states of India.

Recent data from the Indian National Family Health Survey 2005-2006 reports a significant proportion of overweight women coexisting with high rates of under nutrition in India are coexist (Arnold et al., 2009). Among them 36 percent of women and 34 percent of men are undernourished with a BMI less than 18.5 indicating a high prevalence of nutritional deficiency and 13 percent of women and 9 percent of men are documented on the grip of overweight in all over the India. The simultaneous occurrence of over nutrition and under nutrition indicates that adults in India are suffering from a dual burden of malnutrition. Only 52 percent of women and 57 percent of men are at a normal weight for their height (Arnold et al., 2009). Again in state wise, nutritional problems are substantial in every state in India. More than 40 percent of women are too thin in Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, and Orissa. Delhi, Kerala, Punjab, and six small northeastern states have the lowest proportion of women who are too thin (less than 20 percent) (Arnold et al., 2009). Survey done by NFHS-3 found that, more than one-quarter of women in Punjab, Kerala, and Delhi are overweight or obese or under the grip of obesity (Arnold et al., 2009). Tamil Nadu and Goa also have a high prevalence of overweight and obesity (more than 20 percent). Less than 10 percent of women in 12 states are overweight or obese, including most states in the Central, East, and Northeast regions of the country. The percentage of women who are overweight or obese is lower than the percentage are too thin in every state except Delhi, Punjab, Sikkim, and Kerala (Arnold et al., 2009). NFHS-3 has documented the prevalence of

under nutrition and over nutrition in eight metropolitan cities of Chennai, Delhi, Hyderabad, Indore, Kolkata, Meerut, Mumbai, and Nagpur. Among the eight cities, the proportion of adults who are too thin ranges from 14 percent of women and 15 percent of men in Delhi to 31 percent of women and 35 percent of men in Nagpur. The proportion of men who are overweight or obese is lowest in Nagpur (13%) and highest in Hyderabad (25%). Overweight or obesity among women ranges from 19 percent in Nagpur to 39 percent in Chennai (Arnold et al., 2009).

In general, both women and men are more likely to be too thin in slums than in non-slum areas, but the differences are small in some cities. In every city, women and men are less likely to be overweight or obese if they live in slum areas than in non-slum areas. Even in slum areas, however, overweight and obesity are major problems. In slum areas in Chennai, Hyderabad, Kolkata, Meerut, and Mumbai, at least one-quarter of women are overweight or obese (Arnold et al., 2009).

Various socio-economic factors have tremendous influenced on nutritional status. Among non-Hispanic black and Mexican-American people, the prevalence of obesity was generally similar among all income levels, with a tendency to be slightly higher at higher income levels (Ogden et al., 2010). In America, almost 33 percent of men who live in households with income at or above 350 percent of the poverty level are obese, while 29.2 percent of men who live below 130 percent of the poverty level are obese. 44.5 percent of non-Hispanic black men with income at or above 350 percent of the poverty level are obese compared with 28.5 percent of those with income below 130 percent of the poverty level. Similarly, among Mexican-American men, 40.8 percent of these with

income at or above 350 percent of the poverty level are obese compared with 29.9 percent of those below 130 percent of the poverty level. In 1988-1994, the prevalence of obesity among men with income at or above 350 percent of the poverty level was 18.0 percent. In 2005-2008, the prevalence of obesity had increased in this group to 32.9 percent (Ogden et al., 2010). A study in low income areas of Southwest area of Nigeria by Afolabi et al. (2011) found that low socio-economic condition is related with malnutrition. Low socio-economic conditions are cause of poor dietary intake leads to malnutrition (Afolabi et al., 2011). The relationships between socioeconomic status and health are less consistent in adults (Macintyre and West, 1991). Goodman (1999) found that socioeconomic status was related to depression, obesity, and self-rated overall health (Goodman, 1999). Data from NHANES II indicate that teens from poor socioeconomic status are more likely to show stunting (Brooks-Gunn and Duncan, 1997). Kennedy et al. (1963) reported that the mean IQ of the highest socioeconomic status group was 25 points higher than the mean of the lowest socioeconomic status group. Much the same trend appears when household income is employed as the socio-economic indicator on their study. They found that the higher income males are fatter than lower income categories (Gran et al., 1977).

Many works have revealed that education level has played an important role on nutritional status. Gran et al. (1977) worked on level of education and level of income and level of fatness among adult participants in the University of Michigan. They found that the level of education and the level of fatness are systematically related in both sexes, but in dramatically opposite directions for adult males. For 2310 adult males, the level of

fatness increases with educational level such that those with more than 12 years of education are fatter than those with more or less than 8 years of education. According to them, males with college and professional education are approximately 10 percent fatter than those with less than high school education. Among men, 27.4 percent of those with a college degree are obese compared with 32.1 percent of those with less than a high school education (Ogden et al., 2010). The prevalence of obesity increased from 15.6 percent to 27.4 percent between 1988-1944 and 2005-2008 among men with college degree. Among those with less than a high school diploma, the prevalence increased from 22.6 percent to 32.1 percent. Similar increases were seen among men with some college degree or a high school diploma (Ogden et al., 2010). Another study in the EPIC-PANACEA region, done by Hermann et al. (2011) found that the BMI and waist circumferences are lower among low educational level than the higher educational level. Males with university degree had a 1.3kg/m^2 lower BMI compare with males with lower education level which is less pronounced than females. Among lower educational level, the average waist circumference of male was 2.9 cm which is much lesser then women (5.2 cm) (Hermann et al., 2011). In the same region, Rohrmann et al. (2012) studied on the association of education with long-term weight change. They found that higher educational level was associated with on average a lower body mass index at age 20 years. Many works have been done on the effect of educational level on nutritional status. Stanly et al. (1977) worked on level of education and level of income and level of fatness among adult participants in the Tecumseh (Michigan) project of the school of public health, University of Michigan. They found that the level of education and the level of

fatness are systematically related in both sexes, but in dramatically opposite directions for adult males. For 2310 adult males, the level of fatness increases with educational level such that those with more than 12 years of education are fatter than those with more or less than 8 years of education. According to them, Tecumseh males with college and professional education are approximately 10 percent fatter than those with less than high school education. Marital status is another determinant factor for nutritional status. Tzotzas et al. (2010) did a research on marital status and educational level associated with obesity in Greek Adults. They found that the overall prevalence of obesity (25.8%), overweight (41.0%) and abdominal obesity (26.4%) was higher among married people. Unmarried Korean are more likely to have low household income, less education and more likely to unemployed (Yim et al., 2012). There have been conflicting reports about relationship between marital status and obesity (Grove et al., 1983). A study on the SNNPR region of Ethiopia showed that malnutrition is higher among unmarried rural and divorced or separated urban women compared to married ones (Teller and Yimar, 2000).

Nutritional status always depends on dietary habits and supplement intakes. In Albuquerque area, it was found that, 15.8 percent of the men had a weight greater than 120 percent of their desirable body weight and were considered obese. In contrast 2.4 percent of the men were less than 80 percent of the desirable weight and thus were considered thin. Using a BMI cut-off point of greater than 27.0 as a measure of obesity, 18.6 percent of the men would be classified as obese on that region and 10.6 percent would be considered thin. The mean energy intake was below the recommended dietary allowances for men (Garry et al., 1982). Study by Yadav et al. (2012) on dietary habit

and nutritional status of elderly living in urban areas of Allahabad district found that 48.5 percent of elderly males are normal, 36.9 percent are obese and 14.6 percent are underweight. Due to decrease in nutrient intake results in corresponding decline in nutritional status. Intakes of calories were found to be more in obese and well-nourished urban and rural males. Study among the adolescents in Emilia-Romagna, Italy, it was found that the overweight and obese adolescent consumed less carbohydrates and less fiber than their normal weight and underweight counterparts (Toselli et al., 2011). A study on food intake and nutritional status among adults of Malaysia found that 52.7 percent females and 41 percent of males are conscious about their dietary food intake (Ahmed and Siwar, 2013). Further, a higher proportion of males (42.8%) under estimate their dietary fat intake. As we know that the dietary fat intake has serious impacts on nutritional status. It was found that the adjusted mean BMI of accurate estimators, over-estimators and under-estimators were 24.1kg/m^2, 25.8 kg/m^2 and 24.1 kg/m^2 respectively (Ahmed and Siwar, 2013). They also found that the group of over-estimators had the highest proportion of overweight and obese (60%) compared to under estimators (40.8%) and accurate estimators (31.6%) (Ahmed and Siwar, 2013). Another study by Sop et al. (2010) conducted on the relationship between nutritional status and food habit among the young adults in Cameroon University. They tried to find out the link between Nutritional status, food habit and energy profile. They found positive association between dietary habits and nutritional status. Food pattern is another lifestyle activity which determined our nutritional status. Nutritional status of an individual depends on the food that we consume. A study on Oraon population in the Ranchi district of the state of the Jharkhand

by Banik (2008), found that most a significant section of the adult population is suffering from under-nutrition due to taking inadequate food and nutrient supplement (Banik, 2008). This situation is also supported by other studies. Another study on adult Kharwar community of Uttar Pradesh and Bihar by Jaiswal (2015) revealed that that prevalence of under nutrition among Kharwar was 26.5 percent. The sex specific rates were 33.3 percent and 19.4 percent among females and males respectively. There was a highly significant sex difference in Chronic Energy Deficiency prevalence based on BMI. Kharwar adults were experiencing serious situation, especially the women and oldest were experiencing the most serious situation with respect to their health and nutritional status (Jaiswal, 2015). Another study by Laxmaiah et al. (2007) in the population of ITDA, Bhadrachalam in Khammam district of Andhra Pradesh revealed that the prevalence of Chronic Energy Deficiency among adults was about 51 percent due to nutrient deficiencies (Laxmaiah et al., 2007). It was also found that due to low intake of pulses, milk and milk products, green leafy vegetables, fruits, fats and oils, and sugar and jiggery most of the adult Korku population are under the grief of malnutrition (Das, 2010).

Sedentary lifestyles like watching television and inactive physical activity also influenced on nutritional status. Among Australian adults, BMI and physical activity patterns were both associated with hours of television watching (Salmon et al., 2000). Compared to those participants who reported watching less than one hour of television per day, those watching 1 to 2.5 hours were 93 percent more likely to be overweight. Those watching 2.5 to 4 hours were 83 percent more likely to be overweight, and those

watching more than 4 hours per day were four times more likely to be overweight (Salmon et al., 2000). Increase time spent on watching television, playing games, and/or using computers has increased sedentary behavior of both adults and children which have serious consequences on nutritional status (Hill and Peters, 1998, Jeffrey and French, 1998, Brownell, 2002). In sub-urban area of Uttar Pradesh, there was significant relationship between spending time on television and Nutritional status (Devina et al., 2014). Low levels of physical activity are associated with an increased risk of obesity (Erlichman et al., 2002). Obesogenic environments not only discourage physical activity but also encourage inactivity both occupationally and during leisure time (Hill and Peters, 1998; Brownell, 2002). There has been a great decline in occupationally related activity since the turn of the twentieth century (Popkin et al., 2005). In industrialized nations and urban areas of developing countries, jobs requiring heavy manual labor have been largely replaced by jobs in service and high-technology sectors, which require minimal physical exertion (French et al., 2001). Obesity is uncommon among occupational groups that undertake high levels of physical activity during working hours. In one population with high levels of obesity, Keighley et al. (2006) found that adults in American Samoa engaged in farm work had lower BMIs than those not engaged in such work.

Physical activity is another important factor for malnutrition. Decline in work related physical activity cause of overweight or obesity (Philopson, 2001). Modern technology including computer, television, time saving instruments, higher technologies, the organization of the work as well as the structure of the industries and occupation, labor relations are some of the example of socio-economical conditions with related physical

activities which determines the duration of physical activities (Ashford and Caldart, 1996; Adler et al., 1997; Auto et al., 2001; Freeman, 2007). Consequently, duration of physical activities reduced dramatically over time because of mechanization, automation or computerization (Auto et al., 2001; Helmchen, 2001). Strenuous jobs have decreased and sedentary jobs have increased significantly among male workers but not to the same extent in female workers (Lakdawalla and Philipson, 2007). Work related dynamic physical activities have been further decreased due to lean production systems restricting workers, in terms of work space as well as time and motion (Womack et al., 1991; Adler et al., 1997; Leslie and Butz, 1998; Nelson-Peterson and Leppa, 2007). Many studies (Jeffery et al., 1991; King et al., 2001; Hu et al., 2003) have investigated the role of low physical activity at work (sedentary work or low physical job demand) in the increasing prevalence of obesity of many industrial countries workers. In addition, the association between low physical activity at work and obesity has been inconclusive in the few existing studies, as is the case in other developing countries (Haglund, 1987; Pols et al., 1997; Bell et al., 2001; Gutierrez-Fisac et al., 2002; Ishizaki et al., 2004; Mummery et al., 2005; Ostry et al., 2006; Bockerman et al., 2008). Many works have been proved that the role of low physical activity at work sedentary work or low physical job demand in the increasing prevalence of obesity in many developed country workers (Jeffery et al., 1991; King et al., 2001; Hu et al., 2003). By contrast, Jeffery et al. (1991) found no association for men and a significant positive association for women between physical job activity and total obesity in the Healthy Worker Project.

A study by Yoon et al. (2016) found that overweight or obesity is associated with consumption of alcohol in regular basis (Yoon et al., 2016). Junk food is taken during consumption of alcohol and alcohol itself is high caloric beverage which causes malnutrition. Another study by Mathew et al. (2016) found that the prevalence of over nutrition and obesity is significantly high among those who consume alcohol rather than those who don't take alcohol (Mathew et al., 2016). It is common belief that drinking alcohol increases appetite, and so can lead to overeating and weight gain. A study in 2005 by National institute on Alcohol Abuse Alcoholism found that people who drank the smallest amount (one drink per day) with the greatest frequency (three to seven days per week) had a lower body mass index (BMI) than those who drank more infrequently, but in larger amounts. While we can't claim a cause and effect from the results, they may show a relationship between over-drinking and overeating (NIAAA, 2005). A study by Roda et al. (2016) found that the tendency of cardiovascular diseases and overweight or obesity increases with certain kind of behavioral activities like smoking behavior in adult in European urban region. But many published studies have produced conflicting results due to complex relationship between smoking and malnutrition. Though some studies have shown negative relationship between smoking behavior and Body mass index (Zbikowski et al., 2011), while others have suggested that smoking may be leads to lower Body Mass Index (Klesges et al., 1989) and cessation of smoking behavior may increase Body Mass Index (Munafo et al., 2009). Many studies also argue that the association reflects reverse causation due to overweight individual, those who are trying to lose weight, being more likely to start smoking (Chiolero et al., 2008). A study by Shadrach et

al. (2015) among middle aged adults in the UK general population found that obesity is not prevalent among former smokers and least prevalent among current smokers. The prevalence of obesity does not vary significantly according to duration of smoking. Among former smokers, the prevalence of obesity increased with both the amount previously smoked and the previous duration of smoker and the prevalence was highest among those who had quit within the last ten years and lowest among those who had quit more than thirty years previously (Shadrach et al., 2015). It is found that both malnutrition and smoking are more common among socio-economically deprived individuals (Laaksonen et al., 2005; McLaren, 2007; Sneye and Jorde, 2008).

CHAPTER-III

MATERIALS AND METHODS

Land and People

West Bengal is only state in India where Himalayas are in the north and sea is at the south, with both plains and plateaus covering the remaining region. It lies between 85^{o} 50M and 89^{o} 50M east longitude, and 21^{o} 38 M and 27^{o} 10M north latitude. The state has a total area of 88,752 square kilometers. With Bangladesh, which lies on its eastern border, the state forms the ethno-linguistic region of Bengal. To its northeast lie the states of Assam and Sikkim and the country Bhutan, and to its southwest, the state of Orissa. To the west it borders the state of Jharkhand and Bihar, and to the northeast, Nepal. The capital of the state is Kolkata. There are 20 districts and 3 divisions. There are different geographical locations which include hilly region, Terai and Dooars region, North-Bengal Gangetic plain, Rarh region, Coastal plain, Sundarbans, Western plateau and Ganges delta. The Vindhya alluvial region in the centre makes West-Bengal an incredible state. Different tribal groups reside in West Bengal. According to Census of India 2011, the state of West Bengal has got a total population of 91,347.736. This contributes to 7.5 percent of the country's total population. Total male population of West Bengal according to 2011 census is 46,809,027 and female population is 44,467,088. Sex ratio is 950 and literacy rate is 76.3 percent.

The Dhimal, a little known community of West Bengal had been categorized as non-Aryan Tibeto-Burman speaking Mongoloid tribe before the independence (Hodgson 1849). According to many eminent scholars like Hodgson (1849), Dalton (1872), Hunter (1876), Risley (1891), O'Malley (1907) and others identified Dhimals as tribe, aboriginal

tribe and so on (Biswas, 2008). Many pre-Independence Indian Scholars like Bista (1980), Gautam and Thapa-Magar (1994), as well as Regmi (1991) of Nepal suggested that they are the forgotten ethnic group of India mainly resides near the river Mechi in the border areas of India and Nepal (Banik et al., 2007). There are many theories which tell about the origin of the name of the "Dhimal". Dhimal community thinks that the name "Dhimal" was given by the indigenous neighboring community of Mech. Other scholars think that as because in earlier days "Dhimals" were lived at "Terai" region and from the name "Himalaya", the word "Dhimal came from. In the book "The Dhimals Miraculous Migrants of Dhimal" written by Regmi showed that the word "Dhimal" is the synonymous form of the "Himal" or great Himalaya (Regami, 1991).

Many characters including facial features, language and religious practices are very similar with the Khambu, Rai and Limbu people and Koch of Terai. They have also similarities in habits like quick temper and aggressiveness like Khambu Rai, Koch, Rajbanshi and Limbu peoples (Hodgson, 1849). In Nepal, they are also called Limbus and are found in Jhapa (Purbi Dhimals). They consider themselves as Kirati descent (Hodgson, 1849). They have their own language, culture and own customs. According to Hodgson (1849), Dhimal language is also categorized as indigenous language. Linguistic analyses by gluto-chronological methods estimate that the bifurcation of the Dhimal lineage from the main Mongoloid stock took place around 500 BC (Maitra, 2001). It was also stated that the Dhimals were nomadic cultivators of wild, forages transcending memory or tradition, and they have passed beyond the savage or hunter state, and also beyond the herdsman's state, and have advanced to the third or agricultural grade of

social progress, but so as to indicate a not entirely broken connection with the precedent condition of things (Banik et al., 2007).

"Dhimal" members uses "Mallik" as there surname. According to Dhimal members they think that the surname "Mallik" was given by the king of Bhutan. They follow animistic religion which is very close to Kirat religion. They are nature worshiper and along with they have many household gods. Many eminent scholars like Hodgson (1849) found that they don't believe in idol worship or they don't have any temple. Altogether their religion reflects their habits and manners (Biswas, 2008). According to 2001 census, it shows that Dhimals are one of the smallest indigenous communities that live in India.

Marriage takes place at maturity among Dhimals, the male being usually from 20 to 25 years of age, and the female from 15 to 20 years (Hodgson, 1849). Monogamy is practices among Dhimal people. Marriage in same clan was prohibited for male for seven generation and in case for female it was three generation. But at present, generally fourteen steps are found among the Dhimals namely Donge, Ding, Talipa, Haria, Nunia, Rathum, Hardia Nunia, Anlaiti, Kasher, Lambang, Tharu, Yogi and Tegree (Barman and Adhikari, 2015). Exogamy believes taboo among them and those couples are immediately excluded from the community. But now a day, marriage also occasionally took place with their neighboring Rajbanshi community (Barman and Adhikari, 2015). Both sexes are free to choose their own partner. Women get the higher priority in their family and in culture. They occupy an important place in the socio-economic structure of her society. An indistinct shadow of matriarchal society is still found in the Dhimal society. Girls are regarded as source of wealth and they are cherished. Widow marriage is

also practiced by them. Their marriage pattern is unique and different from Hindu marriage and Rajbangshi marriage pattern. Dowry practice is totally absent in their community. Bride price is practiced among their culture. Any taboo customs like "sati" or widow sacrifice is totally absent in their society (Barman and Adhikari, 2015). Child marriage is never practiced among them. But day by day their unique cultural pattern is fading because of adopting cultures from dominant neighbor community like Nepali, Bengali and Rajbanshi. In earlier days, dhimal marriage ceremonies were performed in a simple manner. But due to result of close contact and interaction with the Rajbanshis and other Hindu caste, some rituals and rites have entered into the society such as "saptak" or carrying the bride seven times round the bridegroom, "sindurdan" or smearing vermillion on girl's head, presence of village barber, presence of caste guru usually a Rajbanshi and showering of dub grass, sandal powder, water on the heads of the married couple by the assembled guests (Barman and Adhikari, 2015). In case of pregnancy problems, still they prefer for folk treatment instead of modern treatment.

Poor socio-economical condition, poor education, higher price of medicine and negligence by government are the cause of their poor condition of their livelihood. Still they think that they will get lost if they go Siliguri, which is 25 km far from their place. They have their own traditional clothes. Women cloth is called "Dacca Bona" and male cloth is called "Ascot". In order to fulfill the demands of clothes, Dhimals acquired the knowledge of weaving. They used to make their clothes at home like the other tribal group mech. Now, by the influence of modern culture, many modern dresses have entered into their society. Dhimal men now wear pants, shirt, jeans and women wear

saari, blouse, salwar, kurta etc. However, the aged ladies of the society still wear their traditional dress “Dacca-bona” (Barman and Adhikari, 2015).

Three important festivals of the Dhimals are Harijata held in December-January at the time of ripening of cotton crop and Gavipuja, held in July-August and the last one, Pachima-paka celebrated in October. The first two festivals are related with agriculture mainly held on the bank of river and last one observed inside the house. But with the course of time, all these festivals gradually disappeared from the Dhimal society. Now the most important festival is “Gram-puja”, a collective festival by the villager for the welfare of the village. Despite this, “Asari-Ghasari Puja” at the time of sowing and “Jeth puja” for crops is also celebrated by the Dhimals (Barman and Adhikari, 2015). “Garam” is another main festival for them which is celebrated in the month of April to June. All these festivals that are now observed by the Dhimal society have been influenced by the Rajbanshi society. They have their own traditional dance which are performed in different occasion can divide into four categories and these are a) traditional dance during marriage ceremony, b) traditional dance during the time of agriculture and hunting, c) for devoting to the god, d) others type like “Bonafeka Heyaka” (the girl through away their cloth after first period takes place), during playing and many more. They are very fond of music and dance. During any occasion whole community come together and sing many songs and perform dance whole night. They believe “Bura-Thakur” as their musical god. All the Dhimal festivals are nature based where they worship the nature as a god or deity. There folk songs, traditional dance talks about morals, believe, faith, respect.

Rice is staple food of the Dhimals. They like to eat meat and fish. They always try to avoid vegetable and they are very fond of non-vegetable foods. But due to settled livelihood now they are cultivating some vegetables. Dry fishes are also preferable to their menu. From the writing of Hougson and Hunter, we get some picture of the food habit of the Dhimals. According to them, Dhimals eat all animals except oxen, dogs, cats, monkeys, elephants, bears and tigers (Barman and Adhikari, 2015). "Eiu" (local made alcohol) is their local drinks which they take in any occasion. Though they have their own rich culture, due to syncretism by other dominating community and modernization day by day, it is fading away.

In present day, they are recognized as OBC or other backward class, though they are not satisfied with present status and demand the status of Scheduled Tribe instead of OBCs (Biswas, 2008). Because of the uneven competitions with dominant communities like Bengalis, Rajbanshi and Nepali and others in respect of nation, they are much behind whether in the field of education, occupation or socio-cultural context as a whole (Biswas, 2008). As per occupation they are mainly cultivator, though the frequencies of laborers including agricultural laborers or in some extent tea garden laborers are also documented (Biswas, 2008). However, farming is their main occupation, earlier they were involved in slash and burn (jhum) cultivation. Most of the Dhimals are landless marginal labors (Banik et al., 2007). Due to poor socio-economical conditions many Dhimals are tea garden worker, meson, many of them sells fire woods, few sells local alcohol. Many Dhimals parches beetle from Nepal and sell them in market, few went to the other state for seeking jobs.

Study Area

According to 2011 census, Dhimals are one of the smallest communities in the country, totaling a number of approximately 1030 populations. They reside in 16 villages mainly under the Hatighisa and Maniram Gram Panchayat of Naxalbari in Darjeeling District, West Bengal. Naxalbari is located approximately 20 km away from Siliguri and the average elevation from the sea level is 152 meter. It is located at 26^{o} 41'N 88^{o} 13'E / 26.68^{o} N 88. 22^{o} E. Naxalbari block consist of one census town: Uttar Bagdogra and rural areas with 6 gram panchayats, viz, Gossaipur, Lower Bagdogra, Nakshalbari, Hatighisha, Maniram and Upper Bagdogra. This block has two police stations; Bagdogra and Naxalbari. The headquarters of this block is in Naxalbari. The total population of this sub-division is 144,915 whereas 75831 are males and 69084 are females. Sex ratio is 911 female per 1000 male according to 2011 census.

The data of the present study was collected from both adult males and females of the rural areas of the Hatighisa and Maniram Gram Panchayats of Naxalbari sub-division, which is under Darjeeling district. Statistical sampling of households and individuals was not applied for collection of data from each sampling areas. Instead, in each selected areas, manage to include in sample all those individuals who are willing to co-operate in order to get enough sample size. A total 112 adult Dhimal males and 113 adult Dhimal females were collected from the study areas.

Anthropometry

The data for the present study was collected from both adult males and females to find the prevalence of underweight and overweight. Selected anthropometric measurements

such as height and weight were taken on the subjects. Standard techniques of taking anthropometric measurements were followed as proposed by Weiner and Lourie in 1981. Height and weight was measured to the nearest 0.5cm and 0.1kg with subjects wearing light clothes. Body mass index (BMI) was utilized to classify each subject as underweight and overweight. In order to assess nutritional status I used Asian cut-off points recommended by WHO.

Data on socio-economic conditions

Data on socio-economic and demographic parameters such as age, family size, household income and expenditure, occupation, education and marital status were collected using appropriate schedule. Data on household income were collected directly from the subjects or the head of the households. The incomes were cross-checked against certain aspects of socioeconomic conditions like housing condition, types of occupation, land holding and monthly expenditure. The per capita monthly income of the households was classified as follows: Above 75th percentile (> Rs.3334) = High income group (HIG)

50th to 75th percentile (Rs. 2400-3334) = Middle income group (MIG)

Below 50th percentile (< Rs.2400) = Low income group (LIG)

Data on educational attainment of individuals were classified into four categories, namely, illiterate, primary, secondary and higher secondary and above. The illiterate in the present study are those individuals who were not able read or write. The primary level of education includes those individuals who studied up to class V. In the secondary level of education, we included those individuals who attended standard VI to X. Higher secondary level of education included those who attended standard XI to XII. In the

graduate and above level of education, we included those individuals who have completed graduation and those pursuing higher studies. Data on occupation of each subject were classified into government employee, self-employed, agriculture, housewife and no work. Data on age and marital status were also collected for the present study.

Data on lifestyles and food habits

Information on lifestyles such as physical activity, television watching, alcohol consumption, smoking etc. were collected from each subject following a recalled method of one week periods. The data on physical activity were divided into three categories: mild, moderate and heavy. The television watching time was classified into three groups, viz less than or equal to one hour, two hours and above and no (those who did not watch television). Data on alcohol consumption was divided as consumers and non-consumers. Data on smoking was divided as current smokers, non-smokers and those who quit smoking. Data on food habits were collected following a recalled method of one week before the survey. The consumption of non-vegetables was divided as once in week and twice and above in a week.

Statistical Analysis

The data were analyzed using MS-Excel for the present research. The parameters taken were analyzed statistically to find out the mean, standard deviation for the anthropometric measurements. Nutritional status of both adult males and females were categorized using Asian cut-off points (WHO, 2000). According to Asian cut-off points, BMI $\geq$27.5kg/m^2 has been considered as obese, BMI between 23.5-27.4 kg/m^2, considered as overweight, BMI between 18.5- 23.4kg/m^2 indicates normal and BMI below 18.5kg/m^2 considered as

underweight. Prevalence of underweight and overweight/obesity was calculated in relation to different socio-economic conditions, lifestyle factors, and food habits. In order to test the level of significance, both t-test and chi square have been used in the present study. All analyses were carried out separately for males and females. Females who are pregnant at the time of the survey or females who had given birth during the two months preceding the survey were excluded from the analysis.

CHAPTER-IV

RESULTS

Findings of the present study are discussed below:

Table-1 shows basic data on mean weight, height and BMI with standard deviation among adult males and females of Dhimal community of Naxalbari area. The table shows that the mean weight of Dhimal adult males (54.66±9.182) was higher than Dhimal females (49.66±8.896). The differences in mean weight were statistically significant (t=4.093; P<0.05). Similarly, the mean height of adult Dhimal males (160.61±9.962) was higher than adult Dhimal women (151.66±5.808). The differences in mean height were statistically significant (t=8.314; P<0.05). But the same result was not found for mean BMI. Result shows that the mean BMI value of adult Dhimal males (21.57±3.642) and females (21.27±5.848) are found more or less the same. The differences in mean BMI were statistically insignificant (t=0.464; P>0.05).

Table-1: Basic data on mean weight, height and BMI among adult Dhimal male and female.

Sex	N	Mean Weight (kg) ±SD	Mean Height (cm) ±SD	Mean BMI±SD
Male	112	54.66±9.182	160.61±9.962	21.27±5.848
Female	113	49.66±8.896	151.66±5.808	21.57±3.642
		t=4.093;P<0.05	t=8.314;P<0.05	t=0.464;P>0.05

The table-2 and figure-1 shows the distribution of different BMI values among adult Dhimal males and females. The table shows that the frequency of underweight was high among adult Dhimal males (22.32%) than females (17.70%). Whereas, the frequency of overweight/obesity was higher among Dhimal females (30.09%) than males (15.18%).

The frequency of normal BMI values among males and females was documented at 62.50 percent and 52.21 percent respectively. The differences in the distributions of different BMI values in adult males and females were statistically significant (χ^2= 7.1559; df=2; p<0.05).

Table-2: Distribution of different BMI values among adult Dhimal male and female.

Sex	N	Underweight	Normal	Overweight/Obese
Male	112	25(22.32%)	70(62.50%)	17(15.18%)
Female	113	20(17.70%)	59(52.21%)	34(30.09%)

χ^2= 7.1559; df=2; p<0.05

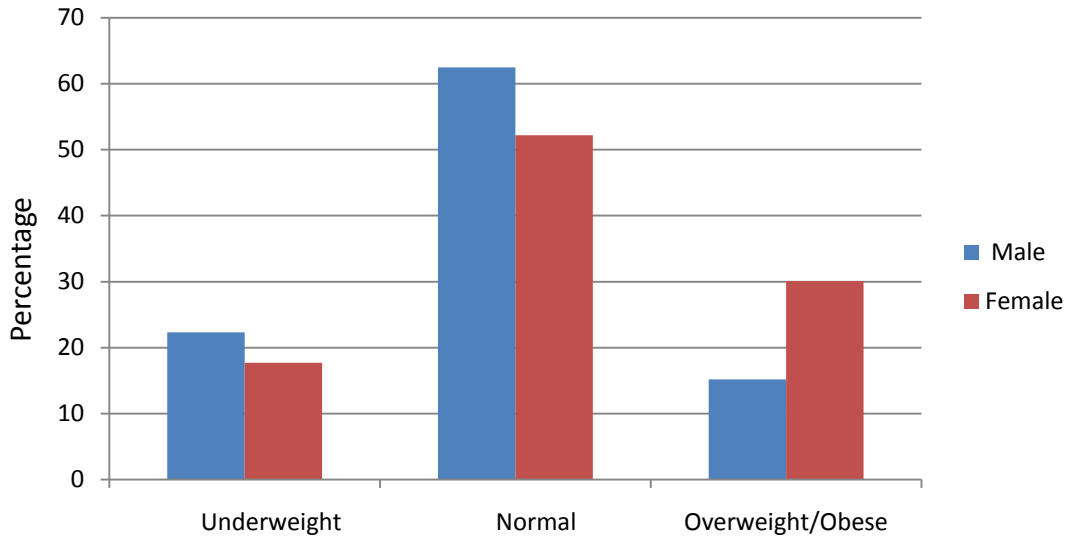


Figure-1: Distribution of different BMI values among adult Dhimal male and female.

The distribution of BMI values in relation to marital status among adult Dhimal males of Naxalbari area are given in table-3 and figure-2. The table shows that the frequency of underweight (57.14%) was found higher among Widow/Separate males. The frequency of underweight among married and unmarried males was 18.09 percent and 36.35 percent

respectively. However, the frequency of overweight/obese (18.20%) was higher among unmarried men. The prevalence of overweight/obese among married widow/Separate males was 14.89 percent and 14.29 percent respectively. Normal BMI values in relation to marital status were documented at 67.02 percent, 45.45 percent and 28.57 percent among married, unmarried and widow/ separate males respectively. The differences in the distribution of different BMI values in relation to marital status among adult Dhimal males were statistically insignificant (χ^2= 7.712; df= 4; p> 0.05).

Table-3: Distribution of BMI values in relation to marital status among adult Dhimal male.

Marital Status	N	Underweight	Normal	Overweight/Obese
Married	94	17(18.09%)	63(67.02%)	14(14.89%)
Un-married	11	4(36.35%)	5(45.45%)	2(18.20%)
Widow/Separate	7	4(57.14%)	2(28.57%)	1(14.29%)

χ^2= 7.712; df= 4; p> 0.05

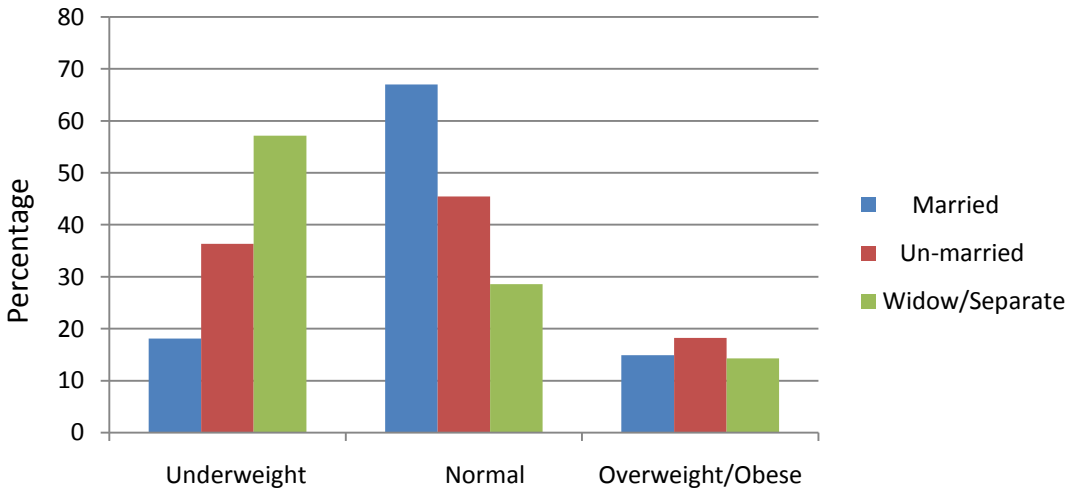


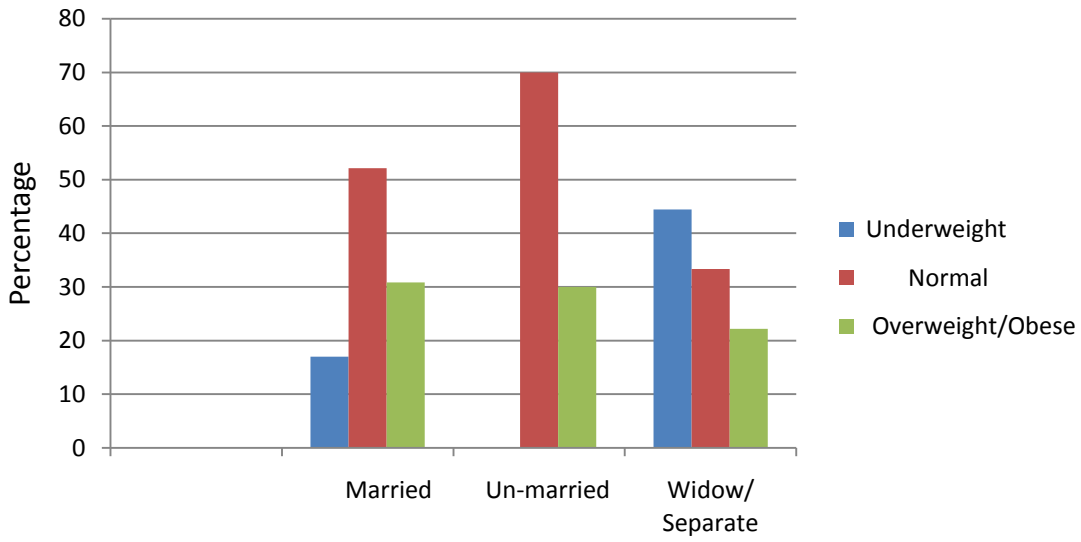
Figure-2: Distribution of BMI values in relation to marital status among adult Dhimal male.

Again the distributions of BMI values in relation with marital status among adult Dhimal Females are given in table-3.1 and figure-2.1. The table shows that higher prevalence of underweight was found among widow/separate females (44.45%). This was followed by prevalence of underweight among married females (17.02%). The distribution of normal BMI values in relation to marital status among adult Dhimal female was documented at 52.13 percent, 70.00 percent and 33.33 percent among married, unmarried and widow/separate females respectively. The prevalence of overweight/obesity was found more or less the same among married (30.85%) and unmarried females (30.00%). The prevalence of overweight/obesity in relation to marital status among widow/separate females was 22.22 percent. The differences in the distribution of different BMI values in relation to marital status among adult Dhimal females were statistically insignificant (χ^2=6.855; df= 4; p>0.05).

Table-3.1: Distribution of BMI values in relation to marital status among adult Dhimal female.

Marital Status	N	Underweight	Normal	Overweight/Obese
Married	94	16(17.02%)	49(52.13%)	29(30.85%)
Un-married	10	0(00.00%)	7(70.00%)	3(30.00%)
Widow/ Separate	9	4(44.45%)	3(33.33%)	2(22.22%)

χ^2=6.855; df= 4; p>0.05



Fugure-2.1: Distribution of BMI values in relation to marital status among adult Dhimal female.

Table-4 and figure-3 shows the distribution of BMI values in relation with house type among adult Dhimal males. It was found that the prevalence of underweight was higher among those males who lived in kaccha house (27.27%) than those who lived in pakka house (17.72%). However, the frequency of overweight/obesity was higher among those males who lived in Pakka house (17.72%) than those who lives in Kaccha house (9.09%). Distribution of BMI values in relation with house type among adult Dhimal males was insignificant (χ^2=1.665; df= 2; p> 0.05).

Table-4: Distribution of BMI values in relation with house type among adult Dhimal Male.

House type	N	Underweight	Normal	Overweight/Obese
Pakka	79	16(20.25%)	49(62.03%)	14(17.72%)
Kaccha	33	9(27.27%)	21(63.64%)	3(9.09%)

χ^2=1.665; df= 2; p> 0.05

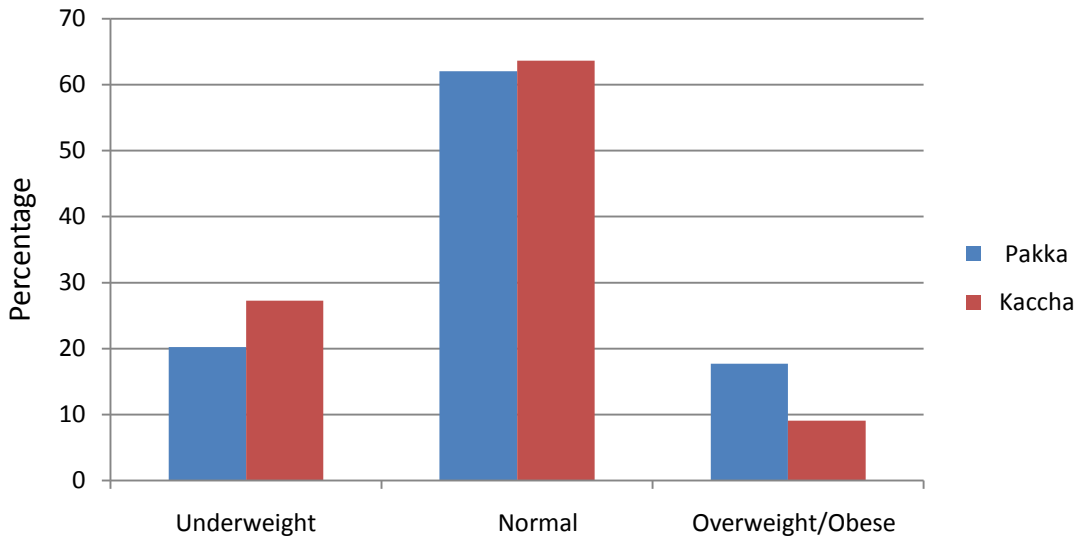


Figure-3: Distribution of BMI values in relation with house type among adult Dhimal Male.

Table-4.1 and figure-3.1 shows the distribution of BMI values in relation with house type among adult Dhimal females. It was found that the prevalence of underweight was high among those female who lived in kaccha house (19.05%). The frequency of underweight among females who lived in pakka house was 16.90 percent. The higher prevalence of overweight/obese was found among females who lived in pakka house (30.99%) than those who lived in kaccha house (28.57%). Distribution of BMI values in relation with house type among adult Dhimal females was insignificant (χ^2=0.120; df= 2; p> 0.05).

Table-4.1: Distribution of BMI values in relation with house type among adult Dhimal Female.

House type	N	Underweight	Normal	Overweight/Obese
Pakka	71	12(16.90%)	37(52.11%)	22(30.99%)
Kaccha	42	8(19.05%)	22(52.38%)	12(28.57%)

χ^2=0.120; df= 2; p> 0.05

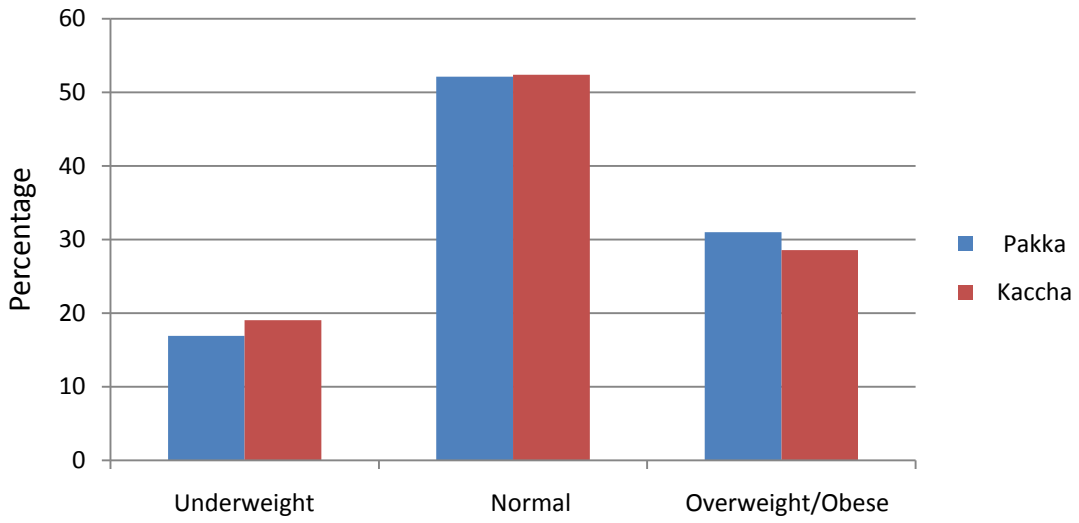


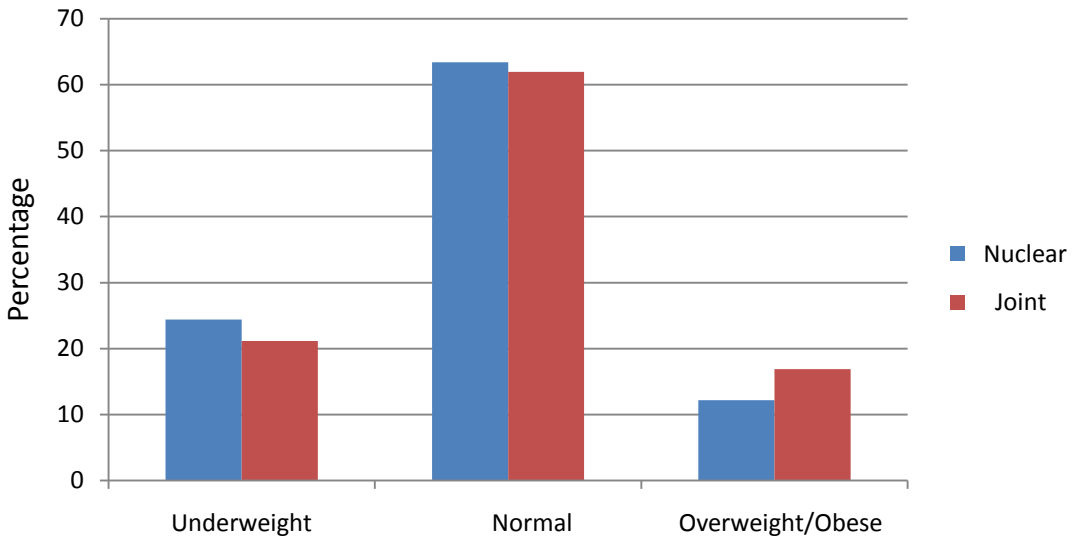
Figure-3.1: Distribution of BMI values in relation with house type among adult Dhimal Female.

Distribution of BMI values in relation with family type among adult Dhimal males is discussed in table-5 and figure-4. It was found that the prevalence of underweight was slightly higher among males who had nuclear family (24.39%). The frequency of underweight among males who had joint family was 21.13 percent. The frequency of 16.90 percent and 12.20 percent of overweight/obese was reported among males who had joint family and nuclear family respectively. Distribution of BMI values in relation with family type among adult Dhimal males was statistically not significant (χ^2=0.511; df= 2; p> 0.05).

Table-5: Distribution of BMI values in relation with family type among adult Dhimal Male.

Family type	N	Underweight	Normal	Overweight/Obese
Nuclear	41	10(24.39%)	26(63.41%)	5(12.20%)
Joint	71	15(21.13%)	44(61.97%)	12(16.90%)

χ^2=0.511; df= 2; p> 0.05



Fugure-4: Distribution of BMI values in relation with family type among adult Dhimal Male.

Table-5.1 and figure-4.1 discussed about the distribution of BMI values in relation with family type among adult Dhimal females. Table shows that joint family had high prevalence of underweight (23.07%) than nuclear family (10.42%). However, the frequency of overweight/obese was higher among nuclear family (33.33%) than joint family (27.69%). Distribution of BMI values in relation with family type among adult Dhimal females was not significant (χ^2=3.052; df=2; p> 0.05).

Table-5.1: Distribution of BMI values in relation with family type among adult Dhimal Female.

Family type	N	Underweight	Normal	Overweight/Obese
Nuclear	48	5(10.42%)	27(56.25%)	16(33.33%)
Joint	65	15(23.07%)	32(49.24%)	18(27.69%)

χ^2=3.052; df=2; p> 0.05

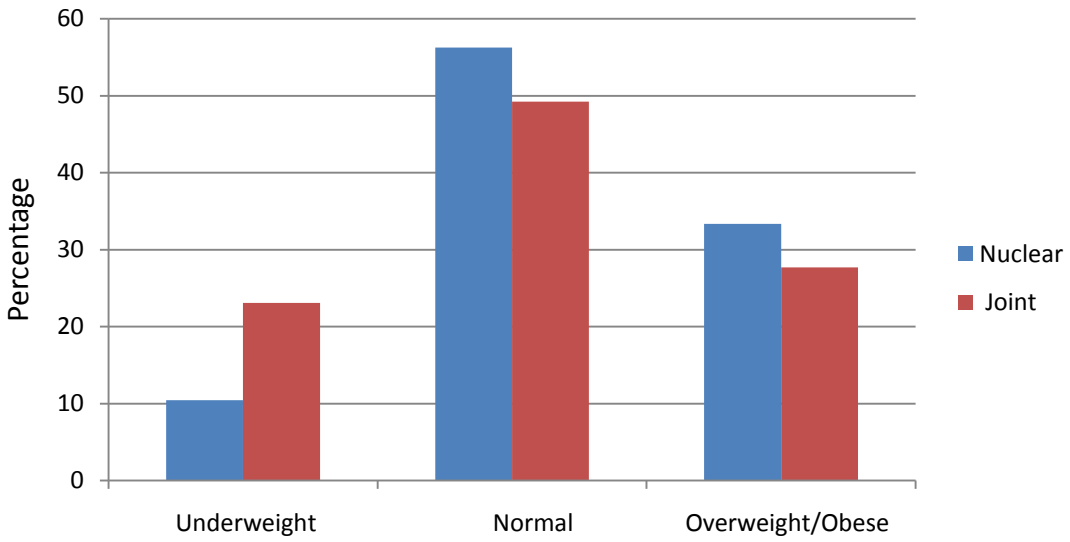


Figure-4.1: Distribution of BMI values in relation with family type among adult Dhimal Female.

Distribution of different BMI values in relation to income among adult Dhimal males is given in Table-6 and figure-5. The table shows that the prevalence of underweight was found higher in the higher income group (27.57%) followed by middle income group (24.14%) and lower income group (18.52%). However, the prevalence of overweight/obese was found slightly higher among middle income group (17.24%) followed by lower income group (16.67%) and higher income group (10.36%).

Table-6: Distribution of different BMI values in relation to income among adult Dhimal Male.

Income Status	N	Underweight	Normal	Overweight/Obese
Higher income	29	8(27.57%)	18(62.07%)	3(10.36%)
Middle income	29	7(24.14%)	17(58.62%)	5(17.24%)
Lower income	54	10(18.52%)	35(64.81%)	9(16.67%)

χ^2=1.476; df= 4; p> 0.05

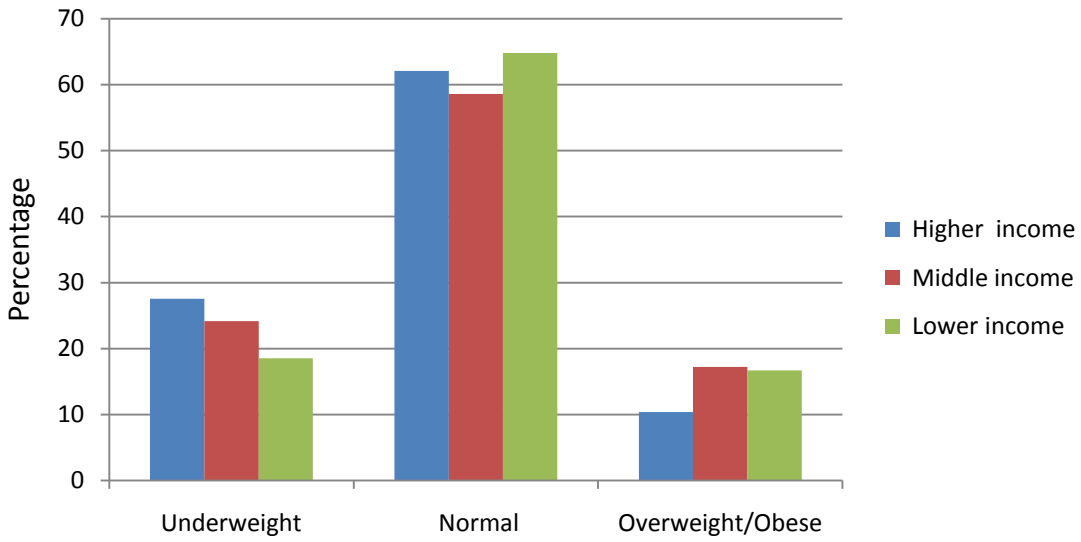


Figure-5: Distribution of different BMI values in relation to income among adult Dhimal Male.

The distribution of normal BMI values in relation to family income was documented at 64.81 percent among lower income group, 62.06 percent among higher income group and 58.62 percent among middle income group. The differences in the distribution of different BMI values in relation to income among adult Dhimal males was statistically not significant (χ^2=1.476; df= 4; p> 0.05).

Table-6.1: Distribution of different BMI values in relation to income among adult Dhimal Female.

Income status	N	Underweight	Normal	Overweight/Obese
Higher income	25	5(20.00%)	12(48.00%)	8(32.00%)
Middle income	30	3(10.00%)	18(60.00%)	9(30.00%)
Lower income	58	12(20.69%)	29(50.00%)	17(29.31%)

χ^2=1.902; df= 4; p> 0.05

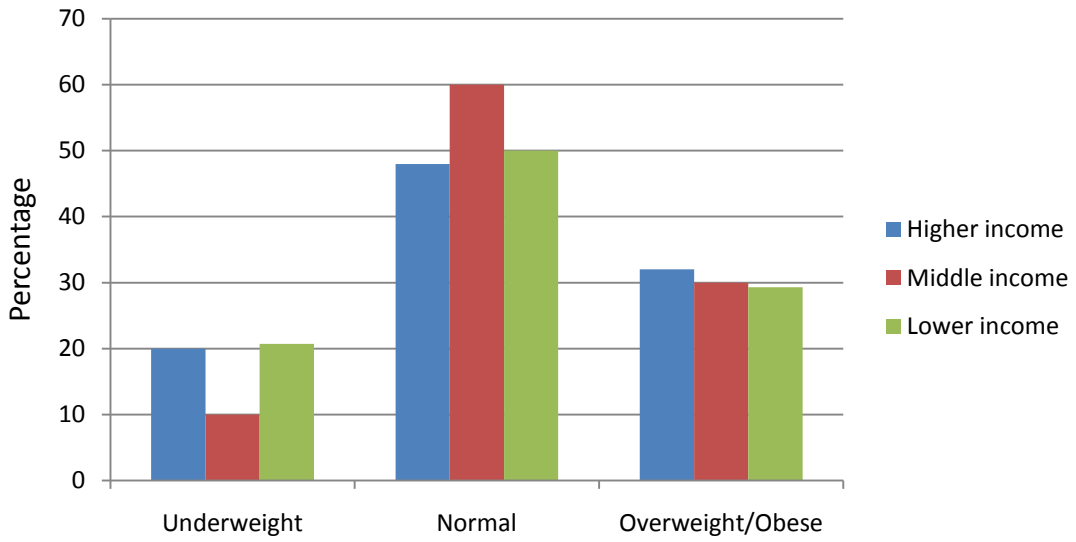


Figure-5.1: Distribution of different BMI values in relation to income among adult Dhimal Female.

Distribution of different BMI values in relation to income among adult Dhimal female is given in Table-6.1 and figure-5.1. The table shows that the frequency of underweight among higher income group (20.00%) and lower income group (20.69%) was found more or less the same. The lower prevalence of underweight was found in middle income group (10.00%). However, the prevalence of overweight/obesity was found slightly higher among higher income group (32.00%). This was followed by middle income group (30.00%) and lower income group (29.31%). The frequency of normal BMI values was documented higher among middle income group (60.00%), followed by lower income group (50.00%) and higher income group (48.00%). The differences in the distribution of different BMI values in relation to income among adult Dhimal females was insignificant (χ^2=1.902; df= 4; p> 0.05).

Table-7: Distribution of BMI values in relation to educational level among adult Dhimal Male.

Educational level	N	Underweight	Normal	Overweight/Obese
Illiterate	41	10(24.39%)	26(63.41%)	5(12.20%)
Primary	41	10(24.39%)	26(63.41%)	5(12.20%)
Secondary	24	3(12.50%)	15(62.50%)	6(25.00%)
Higher secondary +	6	2(33.33%)	3(50.00%)	1(16.67%)

χ^2= 3.696; df= 6; p> 0.05

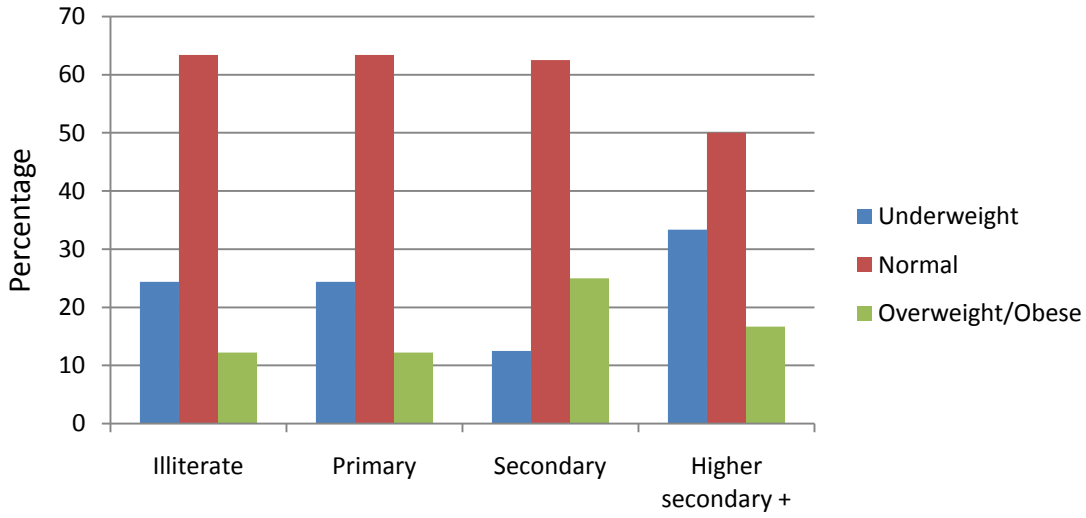


Figure-6: Distribution of BMI values in relation to educational level among adult Dhimal Male.

Distribution of different BMI values in relation to educational level among adult Dhimal males is given in table-7 and figure-6. The higher prevalence of underweight was found among males who attained higher secondary education (33.33%). The frequency of underweight was found the same among illiterate (24.39%) and primary education (24.39%). The prevalence of underweight among males who attained secondary education was 12.50 percent. In case of prevalence of overweight/obesity, the secondary

groups showed the higher frequency of overweight/obesity (25.00%) followed by higher secondary education (16.67%). The frequency of overweight/obesity was found the same among illiterate (12.20%) and primary (12.20%). The differences in the distribution of different BMI values in relation to educational level among adult Dhimal males was not significant (χ^2= 3.696; df= 6; p> 0.05).

Distribution of different BMI values in relation to educational level among adult Dhimal females is given in table-7.1 and figure-6.1. Here it was showed that females who are illiterate have the highest prevalence of underweight (21.88%). This was followed by the higher frequency of underweight among females who attained higher secondary education (16.67%), secondary (14.29%) and primary (10.34%). The frequency of overweight/obesity was slightly higher among females who attained higher secondary education (33.33%). This was followed by the higher frequency of overweight/obesity among illiterate (32.81%), primary (27.59%) and secondary (21.42%). The differences in the distribution of different BMI values in relation to educational level among adult Dhimal females was insignificant (χ^2= 3.720; df = 6; p> 0.05).

Table-7.1: Distribution of BMI values in relation to educational level among adult Dhimal Female.

Educational level	N	Underweight	Normal	Overweight/Obese
Illiterate	64	14(21.88%)	29(45.31%)	21(32.81%)
Primary	29	3(10.34%)	18(62.07%)	8(27.59%)
Secondary	14	2(14.29%)	9(64.29%)	3(21.42%)
Higher secondary +	6	1(16.67%)	3(50.00%)	2(33.33%)

χ^2= 3.720; df = 6; p> 0.05

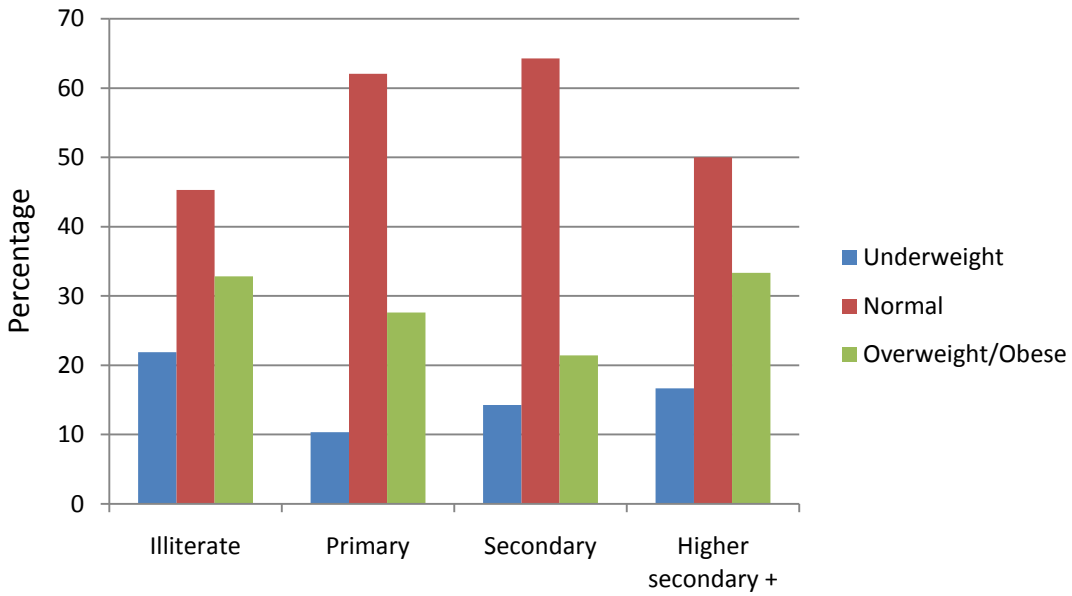


Figure-6.1: Distribution of BMI values in relation to educational level among adult Dhimal Female.

Table-8 and figure-7 shows the distribution of BMI values in relation to occupation among adult Dhimal males. It was found that higher underweight frequency was 55.56 percent among adult Dhimal males who had no work. The frequency of underweight among males who engaged in self employee agriculture was 21.13 percent and 16.66 percent respectively. In case of overweight/obese frequency, the government employee showed the higher frequency (100.00%). The frequency of overweight/obesity among males who were engaged in agriculture and self employed was 26.67 percent and 9.86 percent respectively. The distribution of different BMI values in relation to occupation among adult Dhimal male was significant (χ^2=22.518; df= 6; p< 0.05).

Table-8: Distribution of BMI values in relation to occupation among adult Dhimal Male.

Occupation	N	Underweight	Normal	Overweight/Obese
Government employee	2	0(0.00%)	0(0.00%)	2(100.00%)
Agriculture	30	5(16.66%)	17(56.67%)	8(26.67%)
Self employee	71	15(21.13%)	49(69.01%)	7(9.86%)
No work	9	5(55.56%)	4(44.44%)	0(0.00%)

χ^2=22.518; df= 6; p< 0.05

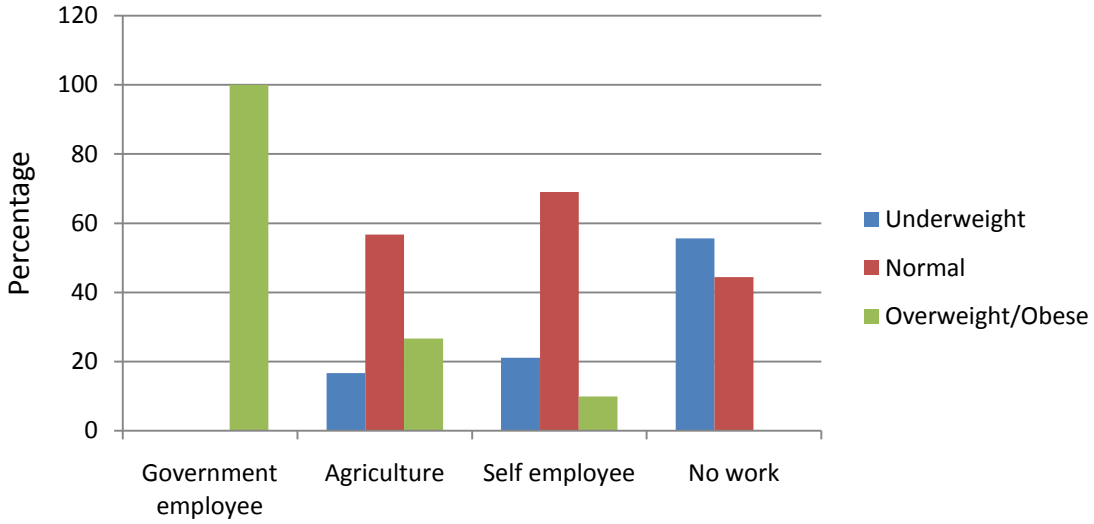


Figure-7: Distribution of BMI values in relation to occupation among adult Dhimal Male.

Table-8.1 and figure 7.1 shows the distribution of BMI values in relation to occupation among adult Dhimal females. The higher frequency of underweight was found among those females who are engaged with agriculture (23.08%). The frequency of underweight among housewife, self employed and no work was 16.67 percent, 21.05 percent and 16.00 percent respectively. The table further shows that the higher frequency of overweight/obesity (32.00%) was found among house wife. This was followed by higher frequency of overweight/obesity among the females who were engaged with agriculture (30.77%), self-employed female (26.32%) and no work (16.67%). The distribution of

different BMI values in relation to occupation among adult Dhimal females was insignificant (χ^2=1.334; df= 6; p> 0.05).

Table-8.1: Distribution of BMI values in relation to occupation among adult Dhimal Female.

Occupation	N	Underweight	Normal	Overweight/Obese
House wife	75	12(16.00%)	39(52.00%)	24(32.00%)
Agriculture	13	3(23.08%)	6(46.15%)	4(30.77%)
Self employee	19	4(21.05%)	10(52.63%)	5(26.32%)
No work	6	1(16.67%)	4(66.66%)	1(16.67%)

χ^2=1.334; df= 6; p> 0.05

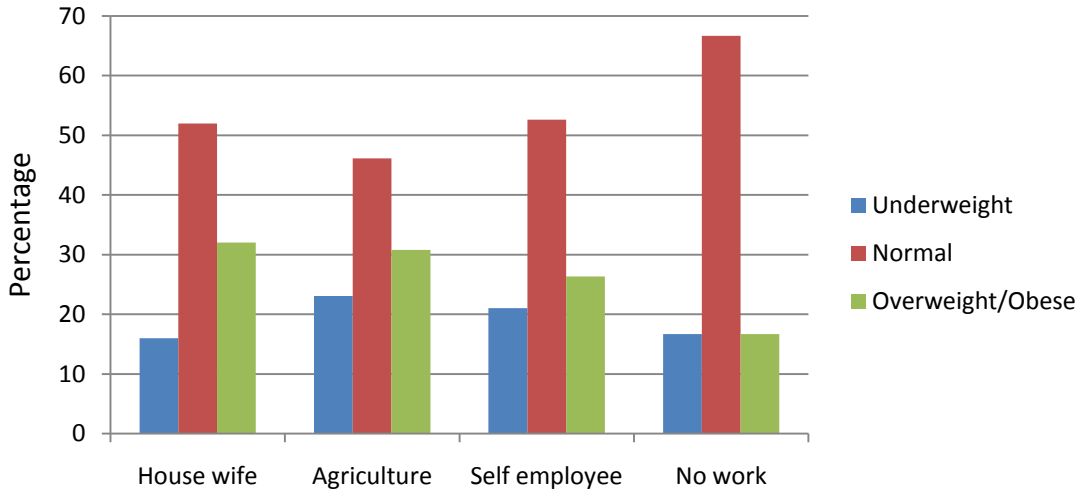


Figure-7.1: Distribution of BMI values in relation to occupation among adult Dhimal Female.

Table-9 and figure-8 shows the distribution of BMI values in relation to physical activity among adult Dhimal males. Table shows higher percentage of frequency of underweight (25.58%) among those males who were engaged with moderate physical activity. Those males who were engaged with heavy physical activity had documented the least frequency of underweight (19.05%). The frequency of underweight among males who engaged with mild physical activity was 22.22 percent. The table further shows that

higher frequency of overweight/obese (18.52%) was found among males were documented among males who had mild physical activity. This was followed by moderate physical activity (16.28%) and heavy physical activity (11.90%). The distribution of different BMI values in relation to physical activity among adult Dhimal males was insignificant (χ^2=1.400; df= 4; p> 0.05).

Table-9: Distribution of BMI values in relation to physical activity among adult Dhimal Male.

Physical activity	N	Underweight	Normal	Overweight/Obese
Mild	27	6(22.22%)	16(59.26%)	5(18.52%)
Moderate	43	11(25.58%)	25(58.14%)	7(16.28%)
Heavy	42	8(19.05%)	29(69.05%)	5(11.90%)

χ^2=1.400; df= 4; p> 0.05

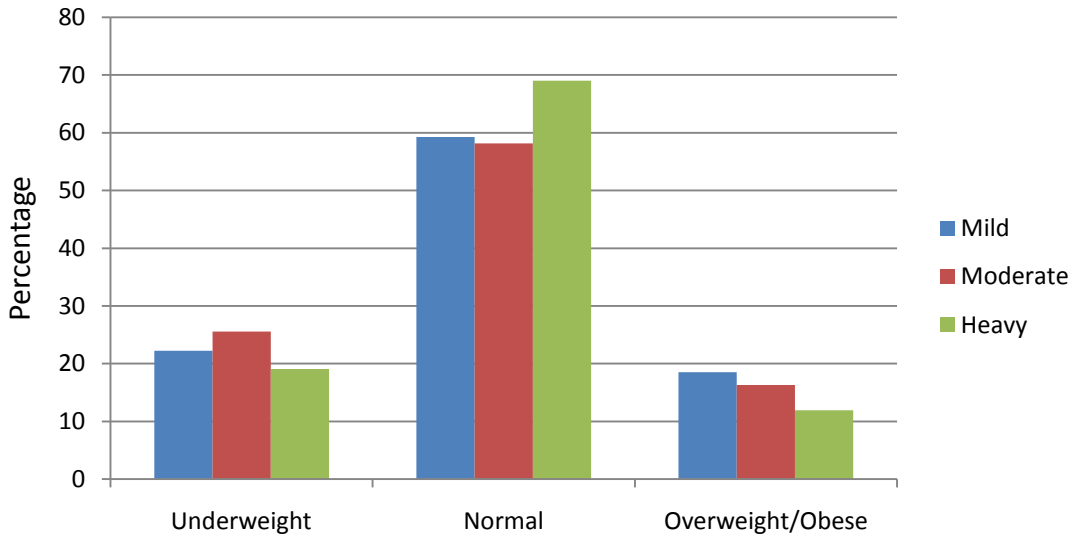


Figure-8: Distribution of BMI values in relation to physical activity among adult Dhimal Male.

Table-9.1 and figure-8.1 shows the distribution of BMI values in relation to physical activity among adult Dhimal female. Higher frequency of underweight (25.00%) was

documented among females who engaged in mild physical activity. 18 percent of underweight was found among females who were engaged with moderate physical activity. The higher frequency of overweight/obesity was found among females who are engaged with heavy physical activity (40.00%). This was followed by moderate physical activity (31.00%) and mild physical activity (12.50%). The distribution of different BMI values in relation to physical activity among adult Dhimal female was insignificant (χ^2=2.392; df= 4; p> 0.05).

Table-9.1: Distribution of BMI values in relation to physical activity among adult Dhimal Female.

Physical activity	N	Underweight	Normal	Overweight/Obese
Mild	8	2(25.00%)	5(62.50%)	1(12.50%)
Moderate	100	18(18.00%)	51(51.00%)	31(31.00%)
Heavy	5	0(0.00%)	3(60.00%)	2(40.00%)

χ^2=2.392; df= 4; p> 0.05

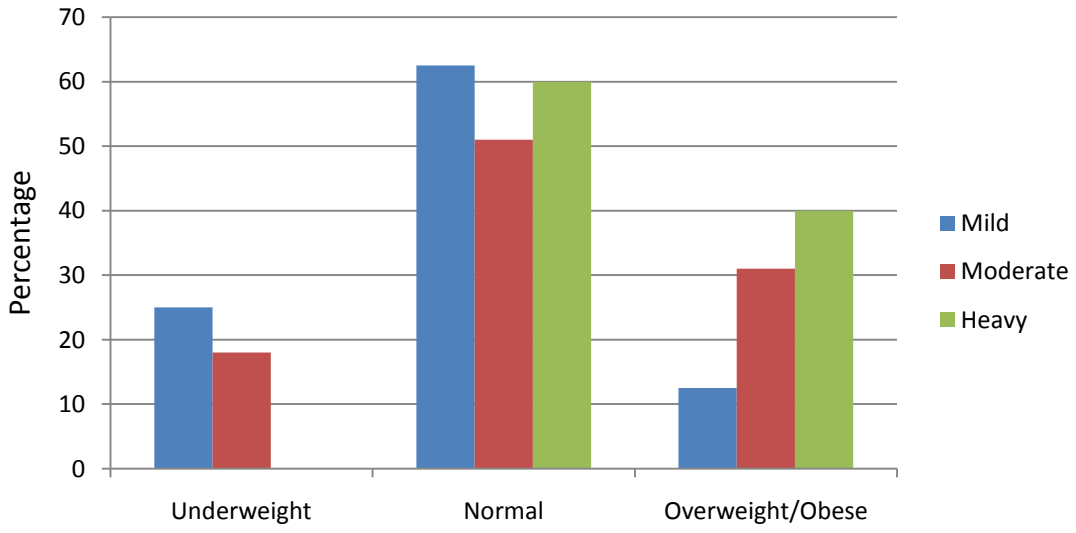


Figure-8.1: Distribution of BMI values in relation to physical activity among adult Dhimal Female.

Table-10: Distribution of BMI values in relation with television watching among adult Dhimal Male.

Television time	N	Underweight	Normal	Overweight/Obese
No	43	13(30.24%)	22(51.16%)	8(18.60%)
1 hour	43	11(25.58%)	28(65.12%)	4(9.30%)
2 hour+	26	1(3.85%)	20(76.92%)	5(19.23%)

χ^2=8.775; df= 4; p> 0.05

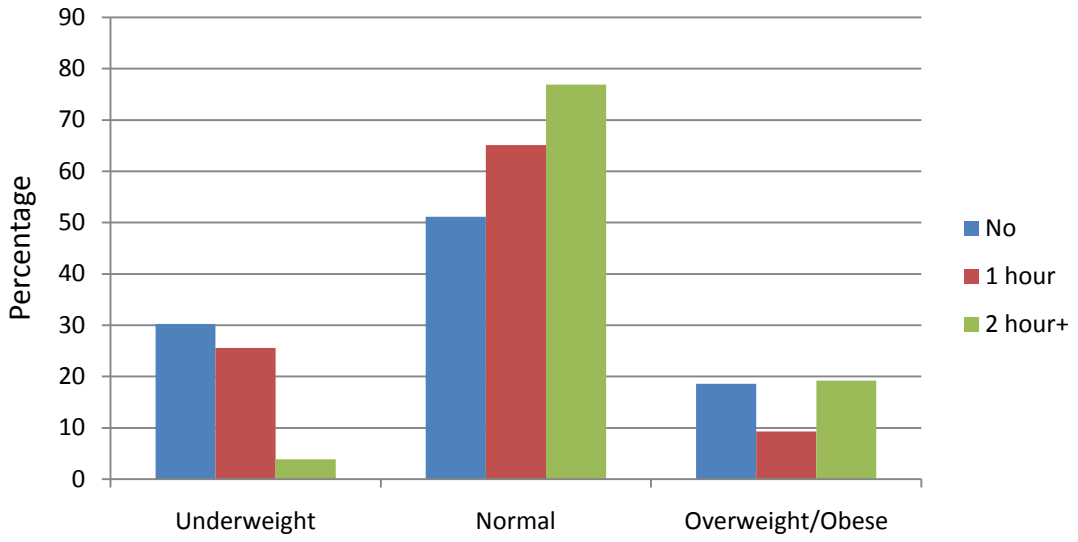


Figure-9: Distribution of BMI values in relation with television watching among adult Dhimal Male.

Table-10 and figure-9 shows the distribution of BMI values in relation with television watching among adult Dhimal males. Table shows that the frequency of underweight was higher among those male who did not watched television (30.24%). Least frequency of underweight (3.85%) was found among males who spent more than 2 hours on watching television. The frequency of underweight (25.58%) was also found among

males who watched television for one hour. In case of overweight/obesity, the frequency (19.23%) was found slightly higher among males who spend more than 2 hours on watching television. Those who spent 1 hour for watching television had documented the least frequency of Overweight/Obese (9.30%). The frequency of overweight/obesity among males who did not watched television was 18.60 percent. The distribution of different BMI values in relation to television watching among adult Dhimal males was insignificant (χ^2=8.775; df= 4; p> 0.05).

Table-10.1: Distribution of BMI values in relation with television watching among adult Dhimal Female.

television time	N	Underweight	Normal	Overweight/Obese
No	47	9(19.15%)	26(55.32%)	12(25.53%)
1 hour	39	7(17.95%)	20(51.28%)	12(30.77%)
2 hour+	27	4(14.81%)	13(48.15%)	10(37.04%)

χ^2=1.126; df= 4; p> 0.05

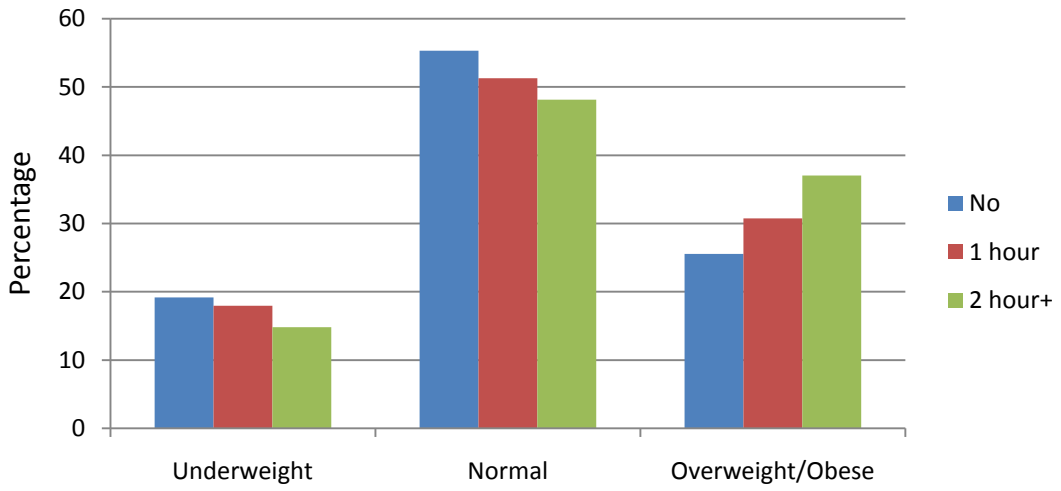


Figure-9.1: Distribution of BMI values in relation with television watching among adult Dhimal Female.

Table-10.1 and figure-9.1 shows the distribution of BMI values in relation with television watching among adult Dhimal females. It was found that the prevalence of underweight (19.15%) was slightly higher among those females who did not watched television. This was followed by those females who watched television for one hour (17.95%) and two hours and above (14.81%). Table also shows that those females who spent more than 2 hours on watching television had higher overweight/obese (30.77%). The frequency of overweight/obesity among females who did not watched television and watching television over two hours was 25.53 percent and 30.77 percent respectively. The distribution of different BMI values in relation to television watching among adult Dhimal females was insignificant (χ^2=1.126; df= 4; p> 0.05).

Table-11 and figure 10 shows the distribution of BMI values in relation to non-vegetables intake among adult Dhimal males. It was found that higher prevalence of underweight (36.36%) was found among males who consumed non-vegetables more than twice in a week. The frequency of underweight 16.46 percent was found among females who took non-vegetables food once in a week. Again higher prevalence of overweight/obese was found among males who took non-vegetables once in a week. 12.12 percent of overweight/obesity was found among males who took non-vegetable foods more than twice in a week. The distribution of different BMI values in relation to non-vegetable intake among adult Dhimal males was significant (χ^2=14.746; df=2; p< 0.05).

Table-11: Distribution of BMI values in relation to non-vegetable intake among adult Dhimal male.

Non-vegetables intake	N	Underweight	Normal	Overweight/Obese
Once in week	79	13(16.46%)	53(67.08%)	13(16.46%)
Twice+ in week	33	12(36.36%)	17(51.52%)	4(12.12%)

χ^2=14.746; df=2; p< 0.05

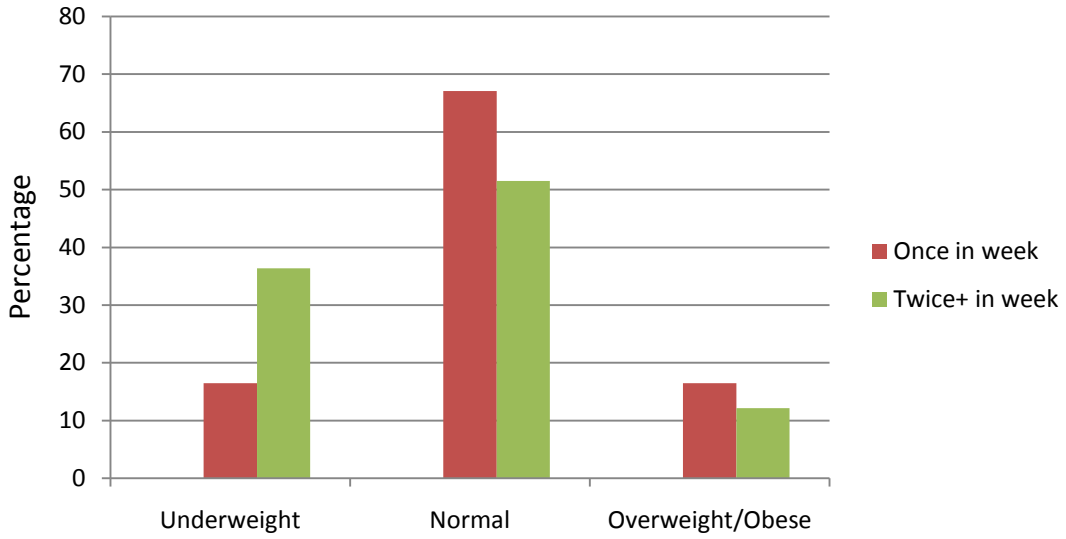


Figure-10: Distribution of BMI values in relation to non-vegetable intake among adult Dhimal male.

Distribution of BMI values in relation to non-vegetables intake among adult Dhimal females is shown in the table-11.1 and figure-10.1. Table shows that the prevalence of underweight (21.84%) was higher among females who took non-vegetable foods once in a week. It was 3.85 percent among females who took non-vegetable foods twice in a week. Again, the prevalence of overweight/obesity (34.61%) was higher among females who took non-vegetables twice in a week in comparison to those who took once in a

week (28.74%). The distribution of different BMI values in relation to non-vegetables intake among adult Dhimal females was not significant (χ^2=4.454; df=2; p> 0.05).

Table-11.1: Distribution of BMI values in relation to non-vegetable intake among adult Dhimal Female.

Non-vegetables intake	N	Underweight	Normal	Overweight/Obese
Once in week	87	19(21.84%)	43(49.42%)	25(28.74%)
Twice+ in week	26	1(3.85%)	16(61.54%)	9(34.61%)

χ^2=4.454; df=2; p> 0.05

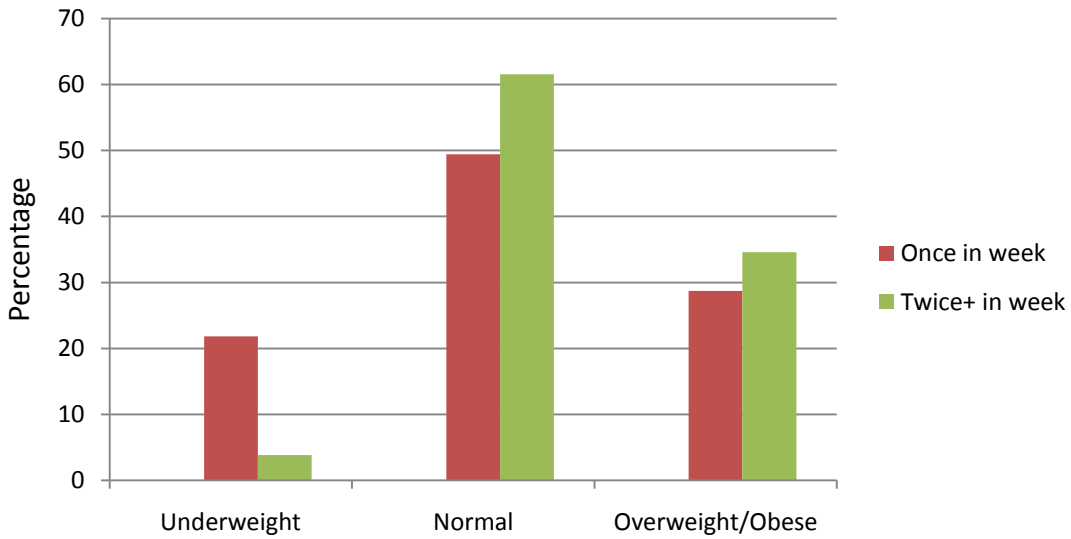


Figure-10.1: Distribution of BMI values in relation to non-vegetable intake among adult Dhimal Female.

Table-12 and figure-11 shows the distribution of BMI values in relation to alcohol consumption among adult Dhimal males. The table shows that the prevalence of underweight (25.00%) was higher among those who never consumed alcohol. The frequency of underweight among males who consumed alcohol was 20.31 percent. The frequency of overweight/obesity among males who consumed alcohol and who did not

consumed alcohol was 12.50 percent 18.75 percent respectively. The distribution of BMI values in relation to alcohol consumption among adult Dhimal males was not significant (χ^2=1.500; df=2; p> 0.05).

Table-12: Distribution of BMI values in relation to alcohol consumption among adult Dhimal Male.

Alcohol consumption	N	Underweight	Normal	Overweight/Obese
Yes	64	13(20.31%)	43(67.19%)	8(12.50%)
No	48	12(25.00%)	27(56.25%)	9(18.75%)

χ^2=1.500; df=2; p> 0.05

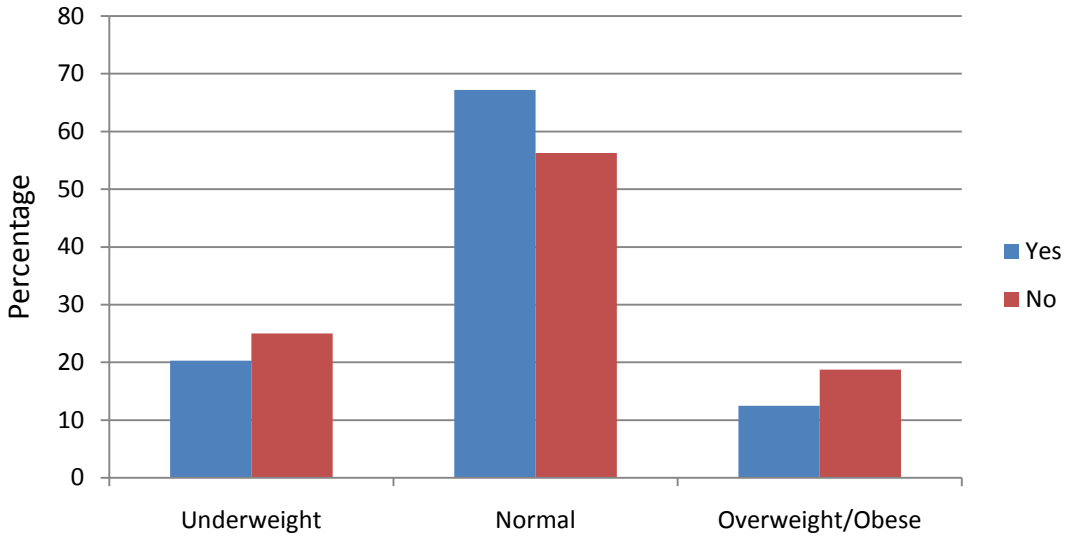


Figure-11: Distribution of BMI values in relation to alcohol consumption among adult Dhimal Male.

Distribution of BMI values in relation to alcohol consumption among adult Dhimal females is discussed in table-12.1 and figure-11.1. It was found that prevalence of overweight among females who did not consume alcohol was 42.86 percent. The frequency of overweight/obesity was higher females who consume alcohol (42.86%) than

those who did not consume alcohol (29.24%). Distribution of BMI values in relation to alcohol consumption among adult Dhimal females was insignificant (χ^2=1.759; df=2; p> 0.05).

Table-12.1: Distribution of BMI values in relation to Alcohol consumption among adult Dhimal Female.

Alcohol consumption	N	Underweight	Normal	Overweight/Obese
Yes	7	0(00.00%)	4(57.14%)	3(42.86%)
No	106	20(18.87%)	55(51.89%)	31(29.24%)

χ^2=1.759; df=2; p> 0.05

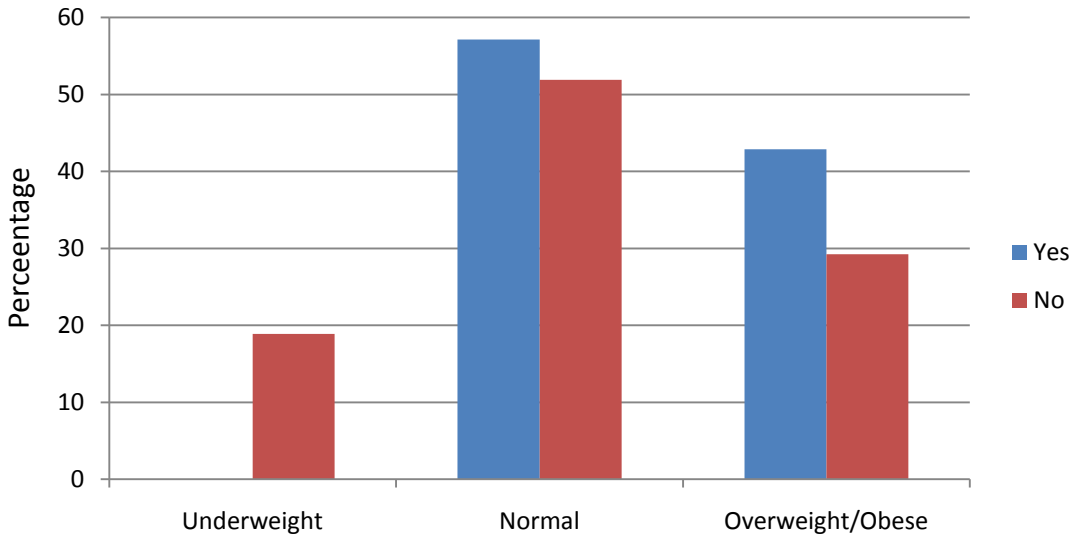


Figure-11.1: Distribution of BMI values in relation to Alcohol consumption among adult Dhimal Female.

Table-13 and figure-12 shows the distribution of BMI values in relation to smoking among adult Dhimal males. It shows that the frequency of underweight was higher

among those male who never smoke (28.57%). It was followed by those males who still smoke (18.87%) and who quit smoking (17.64%). The frequency of overweight/obesity was slightly higher among males who quit smoking (17.65%). This was followed by frequency of overweight/obesity among males who still smoke (16.98%) and who never smoke (11.90%). Distribution of BMI values in relation to smoking among adult Dhimal males was not significant (χ^2=1.758; df=4; p> 0.05).

Table-13: Distribution of BMI values in relation to smoking among adult Dhimal Male.

Smoking	N	Underweight	Normal	Overweight/Obese
Yes	53	10(18.87%)	34(64.15%)	9(16.98%)
No	42	12(28.57%)	25(59.53%)	5(11.90%)
Quit	17	3(17.64%)	11(64.71%)	3(17.65%)

χ^2=1.758; df=4; p> 0.05

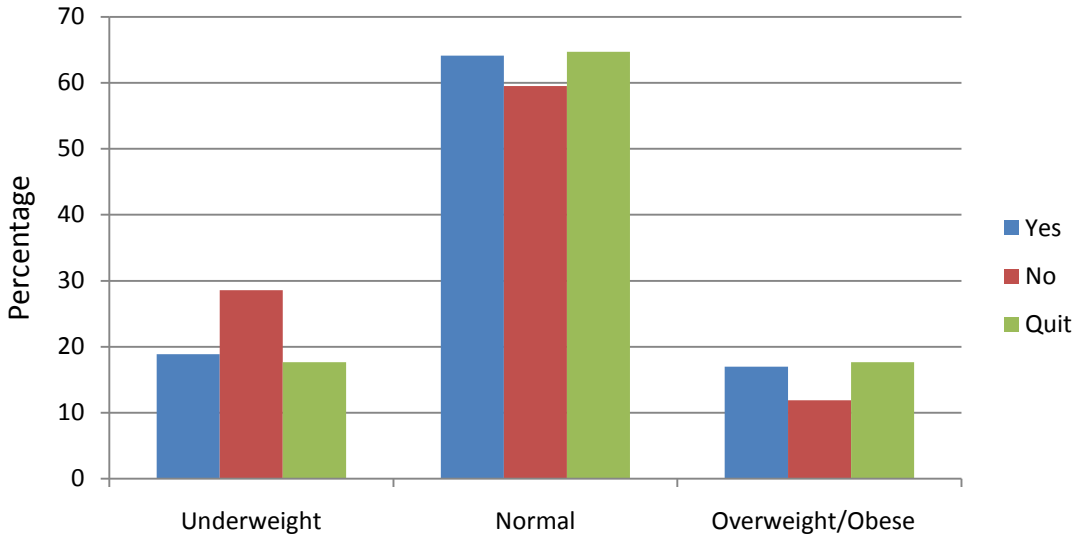


Figure-12: Distribution of BMI values in relation to smoking among adult Dhimal Male.

Table-13.1 and figure 12.1 shows the distribution of BMI values in relation to Smoking among adult Dhimal females. Table shows that the prevalence of underweight was much higher among those females who smoke (62.50%). The prevalence of underweight was 15.00 percent among females who never smoke. The frequency of overweight/obese was higher among females who never smoke (32.00%). The frequency of overweight/obese among females who smoke and who quit smoking was 12.50 percent and 20.00 percent respectively. Distribution of BMI values in relation to Smoking among adult Dhimal females was significant (χ^2=13.367; df=4; p< 0.05).

Table-13.1: Distribution of BMI values in relation to Smoking among adult Dhimal Female.

Smoking	N	Underweight	Normal	Overweight/Obese
Yes	8	5(62.50%)	2(25.00%)	1(12.50%)
No	100	15(15.00%)	53(53.00%)	32(32.00%)
Quit	5	0(00.00%)	4(80.00%)	1(20.00%)

χ^2=13.367; df=4; p< 0.05

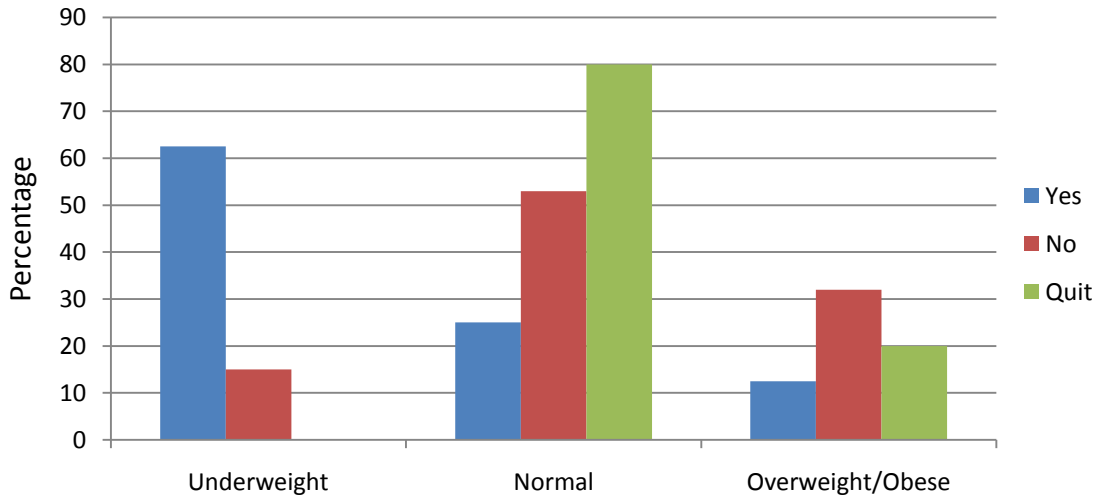


Figure-12.1: Distribution of BMI values in relation to Smoking among adult Dhimal Female.

Table-14 and figure 13 shows the distribution of BMI values in relation with using motor vehicle among adult Dhimal males. Table shows that the prevalence of underweight was slightly higher almost males who do not use motor vehicle (22.58%) than those use motor vehicle (21.05%). But the prevalence of Overweight/Obese was much higher (21.05%) among those males who use motor vehicle than those males who do not use motor vehicle (13.98%). Distribution of BMI values in relation with using motor vehicle among adult Dhimal males was not significant (χ^2=0.614; df=2; p> 0.05).

Table-14: Distribution of BMI values in relation with using motor vehicle among adult Dhimal Male.

Motor Vehicle	N	Underweight	Normal	Overweight/Obese
Yes	19	4(21.05%)	11(57.90%)	4(21.05%)
No	93	21(22.58%)	59(63.44%)	13(13.98%)

χ^2=0.614; df=2; p> 0.05

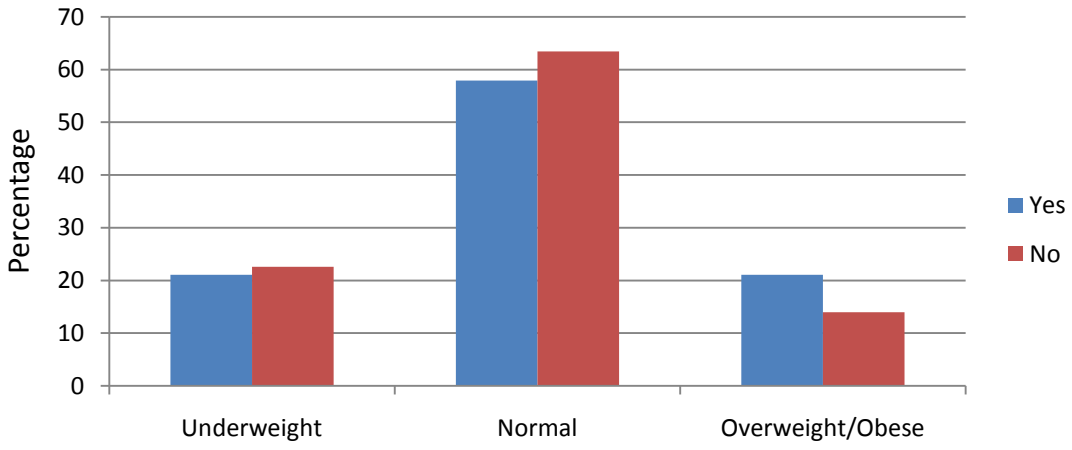


Figure-13: Distribution of BMI values in relation with using motor vehicle among adult Dhimal Male.

Table 14.1 and figure-13.1 shows the distribution of BMI values in relation with using motor vehicle among adult Dhimal females. Table shows that the frequency of underweight (17.85%) and overweight/obesity (30.36%) was found among females who do not use motor vehicle. Distribution of BMI values in relation with using motor vehicle among adult Dhimal females was not significant (χ^2=0.923; df=2; p> 0.05).

Table-14.1: Distribution of BMI values in relation with using motor vehicle among adult Dhimal Female.

Motor Vehicle	N	Underweight	Normal	Overweight/Obese
Yes	1	0(00.00%)	1(100.00%)	0(00.00%)
No	112	20(17.85%)	58(51.79%)	34(30.36%)

χ^2=0.923; df=2; p> 0.05

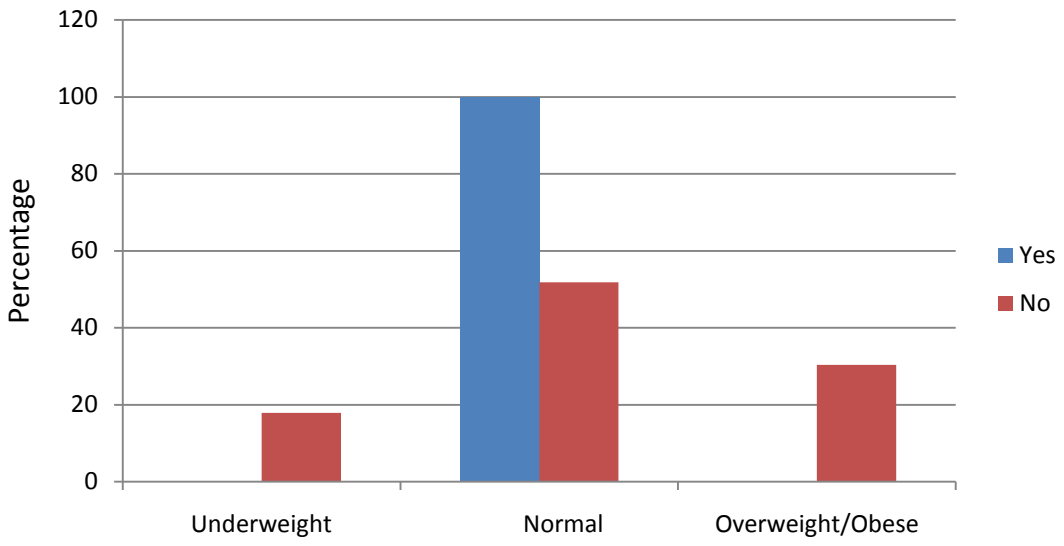


Figure-13.1: Distribution of BMI values in relation with using motor vehicle among adult Dhimal Female.

CHAPTER-V

DISCUSSION

The double Burden of Malnutrition is the coexistence of both under nutrition and over nutrition in the same population across the life course. It affects all countries, rich and poor, and is a particular concern in countries with high stunting rates, cardiovascular disease and many chronic diseases. The consequences of the double burden of malnutrition are enormous (Shrimpton and Rokx, 2012). It is commonly asserted that low to middle income countries are characterized by the co- existence of underweight and overweight (Popkin, 1994; Kapoor and Anand, 2002; WHO, 2003; Lukito and Wahlqvist, 2006). Furthermore, studies in low and middle income group have suggested that burdens of overweight and obesity has or will shift to lower socioeconomic status groups as countries developed economically, exposing these groups simultaneously to under nutrition and over nutrition (Monteiro et al., 2002; Monteiro et al., 2004). Recent studies in countries like Vietnam demonstrate that over nutrition/obesity and a number of nutritionally related chronic diseases (hypertension, diabetes, cardiovascular diseases) are on the rise at the alarming state. This could be result of dietary and life style changes. The double burden of malnutrition is a typical phenomenon during nutrition transition in developing countries, has been clearly reported in many countries (Khan and Khoi, 2008).

The present study shows the nutritional status in relation to socioeconomic conditions, lifestyles and dietary habits of adult Dhimal males and females of Naxalbari area in Darjeeling district, west Bengal. The mean weight and height are higher among adult males than females. However, the mean BMI values show almost the same among

adult males and females. The study further indicates that the adult females show the higher frequency of overweight/obese than males. Whereas, the frequency of underweight was higher among males than females. An increasing trend of overweight/obesity in combination with a high prevalence of underweight is found to be common in many developing countries (Doak, 2000). The present study further indicates the higher occurrence of both underweight and overweight/obesity. One possible reason for the high occurrence of underweight could be traced to poverty, low dietary intake and chronic infections (Ramzan et al., 2008). The nutritional problems due to nutrition transition could be other reasons for both forms of malnutrition occurring in present study similar to those experienced in many developing countries (Hossian et al., 2007). The co-existing state of under and over nutrition among the population is evidenced from the results which is described as double burden of malnutrition by Shukla et al. (2002).

Unmarried males show the higher prevalence of overweight/obesity. The frequency of underweight was higher among widow/separated males in the present study. Similarly, the frequency of underweight was higher among the widow/separated females. Whereas, the prevalence of overweight/obesity was found more or less the same between the married and unmarried females. There have been conflicting reports about relationship between marital status and obesity (Grove et al., 1983). It is still not clear how and under what conditions marital status is associated with obesity although interesting hypotheses linking these two outcomes have been raised recently (Averett et al., 2008). The positive relationship between marital status and overweight can be explained by the fact that people, after marriage have less physical activity, change their

dietary pattern, may be less focused on being attractive, have more social support, or may be exposed to other environmental factors (Janghorbani et al., 2008). Marital status has also been shown to be associated with BMI and most cross-sectional studies tend to find that married people are more often overweight and obese than those living alone; however, important variations exist according to gender and ethnicity (Sobal et al., 2003; Sobal et al., 2009). Poor health affects both high and low income group people. Low income group people are at risk for under nutrition while high and middle group people are at greater risk for overweight (Mukherjee and Majumdar, 2013). The prevalence of overweight/obesity and underweight shows fluctuation among adult males and females in different income levels. The frequency of underweight is higher among males belonging to higher income families. The frequency of overweight/obesity was more or less the same between middle income and lower income groups in the present study. The study further indicates that the frequency of underweight was more or less the same among females between the higher income and lower income groups. The frequency of overweight/obesity is slightly higher among females belong to higher income families. Overweight was more prevalent in urban and high-socioeconomic status groups (Wang et al. 2009). People of low socioeconomic status are most vulnerable to insecurity since purchasing power serves as a main determinant of the ability to afford nutritional food sources. Households cannot attain nutritious foods due to income poverty are most associated with the inadequate diet and diseases leads to malnutrition (Black et al., 2008). The prevalence of underweight is higher among males who live in kaccha houses. However, the frequency of overweight/obesity is males who live in pakka house.

Similarly, the prevalence of underweight and overweight/obesity is higher among females who live in kaccha house and pakka house respectively. Study further shows that prevalence of underweight is higher among males have nuclear family. Prevalence of overweight/obesity is higher among males with joint family. However, in case of females, the prevalence of underweight and overweight/obesity is found in those who live in joint family and nuclear family respectively. Possible reason could be allocation and quantity of food becomes less for each individual in joint family due to high number of family member. But the quantity becomes much for individuals who lives in nuclear family. Again, Dhimals are mainly agriculturalist and it needs proper diets because of heavy physical activity.

The frequency of underweight and overweight is found fluctuation in different educational levels among adult Dhimal males and females. The frequency of overweight/obesity is recorded higher among males who attained secondary education followed by higher secondary education. Study further indicated that the prevalence of underweight is higher among males who attained higher secondary and above level of education. Again, in case of females, the prevalence of underweight is higher among illiterate. Whereas, the prevalence of overweight/obesity is recorded more or less same in between the illiterate and higher secondary educated peoples. The higher educated people spent more of their time reading, writing, and in front of computer, that is more of sedentary lifestyles which cause less physical activity resulting accumulation of extra fatty acid in their body leads to overweight or obesity (Devaux et al., 2011). Dhimals are mainly agriculturalist and most of them are engaged with agriculture. High physical

activity is involved during agriculture and proper diet is needed for energy. Under nutrition among highly educated adult Dhimal males may be due to improper diet. The frequency of overweight/obesity among adult males is found only among the government employees followed by those who are engaged in agriculture and self-employed. The prevalence of underweight is higher among males who have no works. Among females, the higher frequency of overweight/obesity is found among housewife followed by agriculture. The prevalence of underweight is higher among females who engaged in agriculture followed by self employed. Dhimal males and females are mainly associated with agriculture and there economic status is very weak due to limited resources. Most of them are daily wage laborers which hardly fulfill their everyday needs and for that they overlook on their proper healthy diet which leads may lead them to underweight. A study by Ulijaszek and Lofink (2008) shows that people who work in the farm had low BMI values as compared to those who work anywhere.

Physical activity is important factor for determining the body weight of an individual. The higher frequency of underweight is observed among males who are engaged in moderate physical activity. This was followed by higher prevalence of underweight among males with mild physical activity. However, the higher prevalence of overweight/obesity is found among males with mild physical activity. The study further indicated that the prevalence of overweight/obesity decreases with increasing the level of physical activity for males. In case of females, the prevalence of overweight/obesity increases with increasing the level of physical activity. The prevalence of underweight is higher among females with mild physical activity. Sedentary life style is the cause of less

physical activity and for that there is a less chance for body movement which may results in the deposition of extra energy as a fatty acid in adipose tissues. The decline in work related activity seems a prime suspect in the growth of Overweight or obesity (Philopson, 2001). Many studies have investigated the role of low physical activity is the cause of increasing prevalence of obesity (Jeffery et al., 1991; King et al., 2001; Hu et al., 2003). Present study also reveals that those males who use motor vehicles for their daily transport are highly under the prevalence of overweight/obesity. Again, it is found that the prevalence of underweight is slightly higher among males who did not used motorized transportation. Using motor vehicles for daily transportation decreases the physical activity levels. Many works have done and proved that using motorized vehicle have influence on overweight or obesity (Nunez-Cordoba et al., 2013).

The frequency of overweight/obesity is slightly higher among adult males who spent more time on watching television. However, the prevalence of underweight increases with decreasing the levels of television watching time. Similarly, the prevalence of underweight increases with decreasing the level of television watching time among females. The table further shows that the prevalence of overweight/obesity increases with increasing television watching time. Many researchers have reported a positive association between hours spent watching television and overweight or obesity status (Sidney et al., 1996; Jeffery and French, 1998; Kronenberg et al., 2000; Salmon et al., 2000; Hu et al., 2001; Giles-Corti et al., 2003; Hu et al., 2003; Jakes et al., 2003; Koh-Banerjee et al., 2003; Liebman et al., 2003). Television viewing is a popular leisure time activity and promotes a sedentary lifestyle by infringing on the time available for

physical activity (McCarthy et al., 2002). Gore et al. (2003) found that snacking while watching television was associated with increased intakes of total calories and calories from fat. Therefore, television viewing may not only facilitate low energy expenditure but also increase energy intake and hence may play an important role in the current obesity epidemic (Bowman, 2006).

Food habit is another important factor affecting the body weight of a person. Food is the source of energy and this energy is utilized in the form of calorie for daily activities. Excess calorie is accumulated in the form of fatty acid in body and if it is not utilized properly, it may leads to overweight or obese. The consumption of non-vegetable food shows fluctuation in adult Dhimal males and females. Study shows that the prevalence of underweight is high among males who frequently consume non-vegetable foods. Whereas, the prevalence of overweight/obesity is higher among males having less consumption of non-vegetables foods. In case of females, the prevalence of overweight/obesity is higher among those who consumed non-vegetables more frequently. Table further shows that underweight is higher among females with less consumption of non-vegetable foods. Non-vegetable foods include animal proteins like fish, meat, and eggs. Along with vegetables, non-vegetable foods have also high food value which fulfills our body requirements in terms of proteins and other important minerals and vitamins. Excessive taking of protein and less physical activity leads to storage of extra calories in terms of fatty acid in our body which may result overweight or obesity. In recent study, it is found that females who take non-vegetable foods more than two days are tends to overweight or obese as because of accumulation of fatty acid in

their adipose tissues (Rautiainen et al., 2015). Present study indicates that those who consume more non-vegetable foods are associated with overweight/obese and those who consume less non-vegetable foods are more prone to underweight. Many works have showed that consuming a diet with less non-vegetable foods, reduced fat dietary, low in red and processed meat fast food was associated with smaller gains in BMI (Newby et al., 2003).

Alcohol consumption can affect nutritional status by displacing healthier foods from the diet. Alcohol has a caloric value of seven calories/gram (more than either protein or carbohydrate at four calories/gram), but contains no vitamin, minerals, protein, fat or carbohydrate (Toffolo et al., 2012). Excessive alcohol consumption can satisfy caloric requirements, but easily leads to malnutrition and anemia. Although alcohol in small doses is an appetite stimulant, larger amounts suppress hunger, which doubly deprives the body of nutrients (Smith, 2012). The prevalence of both underweight and overweight among are higher among males who never consume alcohol in the present study. But, among females, those who consume alcohol are highly affected by overweight/obesity. Because of high caloric value of alcohol, it needs to utilize by proper physical activates. Extra calories are stored in body which leads to overweigh/obesity (Smith, 2012). Another reason could be taking of excessive junk food during alcohol consumption. Wang et al. (2010) found that women with drinking habits are highly prone to overweight/obesity as compared to those females who never drinks. Present study shows that the prevalence of underweight is higher among males who never smoked. Prevalence of overweight/obesity is higher among males who quit smoking and those

who are still smoking. Females who never smoke are under the high prevalence of overweight/ obesity. But those females who smoke are under the high prevalence of underweight. A number of studies indicate that smokers tend to have lower body weight than non-smokers, either because of appetite reduction or increased energy expenditure (Machowsky, 2011). One study also noted that the weight-controlling effect of smoking was more pronounced in women than men (Machowsky, 2011). Study by Chiolero et al. (2008) determined that heavy smokers (more than one pack a day) tended to have greater body weight than light smokers or non-smokers. The researchers theorized that heavy smoking was linked to other risky behaviors, such as low physical activity and poor diet. On the other hand, study by Kiesges et al. (1990) determined that continuous smokers had a lower body mass index than non-smokers and those who had quit smoking long term. The physiological influences of nicotine are also frequently identified as the reasons why many people experience weight gain when they quit smoking. Regardless of weight, smoking is tied to a number of negative metabolic conditions, including insulin resistance and an increased tendency of central obesity (Machowsky, 2011).

CHAPTER-VI

CONCLUSION

The present research provides the nutritional status of adult Dhimal males and female of Naxalbari area in Darjeeling district of the West Bengal. The distribution of underweight and overweight in relation to different socio-economic conditions, lifestyles and food habits are discussed in the present study.

The mean height and weight are higher among adult males than females. However, the mean BMI value shows almost the same in both the sexes. The study further indicates that the adult males show the higher frequency of underweight whereas, adult Dhimal females shows the higher frequency of overweight/obesity. The frequency of underweight was found higher among Widow/Separate males and the frequency of overweight/obese was higher among unmarried males. Marital status is not statistically significant in relation to the differences in the distribution of different BMI values for males. It means that marital status has no effect on BMI for adult Dhimal males. The higher prevalence of underweight was found among widow/separate females. Whereas, the prevalence of overweight/obesity was found more or less the same among married and unmarried females. Males who live in kaccha houses show the higher frequency of underweight than those who live in pakka house. However, the frequency of overweight/obesity was higher among those males who lived in Pakka house. Similarly, among females, the prevalence of underweight was high among those who lived in kaccha houses. The higher prevalence of overweight/obese was found among females who lived in pakka houses. Family type is another socio-economic condition which is considered in the present research. It is found that the prevalence of underweight is

slightly higher among males who had nuclear family. Overweight/obesity is higher among males who lived in joint family. Whereas, among females, it is found that joint family had higher prevalence of underweight. The frequency of overweight/obese was higher among nuclear family. In different income groups, it is found that the prevalence of underweight among males was found higher in the higher income group. Overweight/obese was found slightly higher among males belong middle income group. However, among females, the frequency of underweight is higher in lower income group and overweight/obesity is found higher among higher income group. Family income shows positive relationship with prevalence of overweight/obesity among females whereas; it shows negative relationship among males. Males who attained higher secondary education show the higher frequency of underweight. The prevalence of overweight/obesity is higher among males who attained secondary level of education. In case of females, it is found that illiterate females show higher prevalence of underweight. The frequency of overweight/obesity was slightly higher among females who attained higher secondary education. Dhimal males who have government service showed the higher frequency of overweight/obese. The higher underweight frequency is found among adult Dhimal males who had no work. The higher frequency of underweight is found among females who are engaged with agricultural works. The frequency of overweight/obesity was found among house wife.

Physical activity is considered as important factor for maintaining body weight. The present study shows that the frequency of underweight and overweight/obesity is higher among males who are engaged in moderate physical activity and mild physical

activity respectively. Whereas, the higher frequency of underweight is found among females who engaged in mild physical activity. Overweight/obesity is found higher among females who are engaged with heavy physical activity. Spending time on watching television is another factor for determining the BMI status. Present research shows that that the frequency of underweight is higher among those males who do not watch television. However, the frequency of overweight/obesity is higher among males who spend more time watching television. Similarly, the prevalence of underweight is higher among those females do not watch television. Overweight/obesity is higher among females spending more time watching television. Sedentary lifestyles associated with television watching could be the explaining reasons for higher prevalence of overweight/obesity in both the sexes. The consumption of non-vegetable foods shows negative relationship with prevalence of underweight and overweight/obese among males. However, the frequent consumption of non-vegetable foods shows the higher prevalence of overweight/obesity among females. Prevalence of underweight is higher among females who take less non-vegetable foods. The prevalence of both underweight and overweight/obesity is higher among males those who never consumed alcohol. Females who consumed alcohols regularly show higher prevalence of overweight/obesity. Study further shows that the frequency of underweight is higher among those males who never smoke whereas; the frequency of overweight/obesity is higher among males who quit smoking. The prevalence of underweight and overweight/obesity is higher among those females who smoke and who never smoke

respectively. Using motor vehicle for daily transportation shows higher prevalence of overweight/obese among males.

In conclusion, the present study among the Dhimal community shows the co-existence of both underweight and overweight in both the sexes. Different socio-economic conditions, lifestyles and food habits are considered as important determining factors for nutritional status in the present research. Marriage patterns, house type and family income show positive relationship in both the sexes. Study further indicates that different lifestyles such as levels of physical activities, watching television, alcohol consumption and motorized transportation do influence the nutritional status of adult Dhimal males and females to certain extend. The consumption of non-vegetable foods shows positive relationship with nutritional status among males and negative relationship among females. The present study among the adult Dhimal males and females shows the double burden of malnutrition similar to different studies from developing and underdeveloped countries. Such a double burden of malnutrition can exposed Dhimal populations to different kinds of health consequences. Therefore, it necessary to educate them and create awareness programs to check the double burden of malnutrition.

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