Socio-Economic Disparities and Nutritional Status among the Nepalis of Sikkim

A Thesis Abstract Submitted

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By

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"Socio-Economic Disparities and Nutritional Status among the Nepalis of Sikkim"

Submitted by **Mr. Yogesh Sharma** under the supervision of **Dr. Maibam Samson Singh**, of the Department of Anthropology, School of Human Sciences, Sikkim University, Gangtok – 737102.

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DECLARATION

I, Yogesh Sharma, hereby declare that the thesis entitled "Socio-Economic Disparities and Nutritional Status among the Nepalis of Sikkim" 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 Doctor of Philosophy in Anthropology.

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I express my thanks to the faculty and staff member of Anthropology Department for their valuable help and advice towards shaping this thesis.

I would like to thank to the University Grants Commission for awarding me the Non-NET fellowship which funded my research work.

I am deeply indebted to adults Nepalis of rural areas of Sikkim, who hosted me, embraced me, incorporated in data collection and allowed me to be a part of their astonishing lives. I had a very good field work experience and I have had time of my life during research work.

Lastly, I express my greatest gratitude to my family, friends, and seniors for their support and encouragement, and help me in various ways.

Yogesh Sharma
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CHAPTER-I

INTRODUCTION

Nutrition is a basic human necessity for a healthy life. It is the intake of food in relation to the body's dietary needs. Proper nutrition is crucial since the very early stage of life for growth, development and to remain active (Mini, 2015). It might be understood in a wider sense. It is affected by a variety of psychological, sociological and economic functions (Williams, 1999). It is not impartially limited to physiological or biochemical processes involved in the consumption and utilization of food substances, but also with ingestion, digestion, absorption and metabolism of food (Norgan, 2002). While entire human wants a broad variety of nutrients to guide a healthy and active life, and these are consequent through the diet we consume regularly (Ajeet and Rajan, 2021). Psychological and physical health is often considerably affected by the existence of malnutrition.

In the field of Anthropology, the study of nutrition is one of the important areas to understand human health. Physical anthropologists are involved in the nutrition of modern populations, historic and pre-historic populations (Dufour and Piperata, 2018). Jelliffe (1966) talks about five direct methods for the assessment of nutritional status such as anthropometric measurement, biochemical assessment, clinical examination, vital statistics and dietary survey. Improper nutrition leads to the consumption of excess calorie or insufficient supply of one or more essential nutrients (Bhattacharya et al., 2019).There are various procedures to evaluate the nutritional status of a population. Body mass index (BMI) is one of them to excess the nutritional status of individual as well as population. Anthropometry is considered to be a main tool for assessing nutritional status of a person or of the community (Dipak et al.,

2006). In Biological Anthropology, anthropometry remains unique and it has been continuously used to assess the nutritional status of all populations. Measurements have benefits over other approaches like clinical signs of malnutrition, biochemical indicators and physical activity as indicators of nutritional status.

Nutritional status is the physiological state of an individual, which results from the relationship between nutrients intake and requirements (FAO and NSFS, 2007). It is a prime indicator of the overall health of a population or an individual (Beghin et al., 1988). Good nutrition with an adequate, well-balanced diet combined with regular physical activity is a cornerstone of good health (WHO, 2010). Poor nutritional status contributes to other health problems among adults population in the United States of America (Combs and Clung, 2016). Poor nutrition can lead to reduced immunity, increase susceptibility to disease, impaired physical and mental development with reduced productivity (WHO, 2010). Sedentary lifestyles and bad eating behavior causes poor health condition which may lead to obesity, diabetes, cardiovascular diseases, and some other diseases such as anxiety and depression (Hadi and Karim, 2021). There are various socio-demographic factors such as lifestyles, smoking habits, dietary habits and socioeconomic conditions affecting nutritional status (Bray, 1999). In wealthy industrialized nations, malnutrition is usually caused by poor diets, mental health problems, digestive disorders, stomach conditions and alcoholism (Nordqvist, 2016). The disparity between food intake and energy expenditure is determined to a large amount by socioeconomic perspectives (Clement and Ferre, 2003). The increasing urbanization, mechanization of jobs and transportation, accessibility of processed fast foods along with dependence on television for leisure, and overall sedentary lifestyles are the main reason for overweight and obesity (WHO, 2003).

There are several methods for assessing the nutritional status such as body mass index, skinfold measurements, abdominal circumference, bioelectrical impedance analysis etc. BMI is the most established anthropometric indicator used for the assessment of adult nutritional status (Das et al., 2010). Generally, the accepted formula for BMI takes the person's body weight in kilogram divided by the height in meter square i.e. kg/m^2 (Garrow, 1985).

The World Health Organization classified underweight, overweight and obesity as BMI $\leq$18.5 kg/m^2, between 25 to 29.9 kg/m^2 and $\geq$30 kg/m^2 respectively (WHO, 1995). The existing World Health Organization standards are built on the association of BMI with mortality and morbidity (WHO, 1998). However, Asian populations appear to have greater cardiovascular risk, higher morbidity and mortality than western populations at any given BMI level (Annette, 2013). Study suggested that important chronic conditions such as diabetes, higher systolic blood pressure and cardiovascular risk factors are significantly and independently associated with being overweight/obese (WHO, 1998). With the exception of heart attack, these same factors remain importantly related to being overweight/obese as defined by the Asian-specific definition. Although, it remains unclear that which cut-off points are appropriate for which Asian ethnic groups, it is necessary to consider alternative BMI definitions of overweight and obesity as number of important chronic diseases risk factors appear to remain important at BMI cut-offs lower than the WHO standard definition (Annette, 2013).

The waist circumference (WC) is a simple and straight measure of central adiposity. It was found associated with an increased risk of hypertension and diabetes in African American women (Warren et al., 2012). It is closely connected to the waist to hip ratio (WHR), which is considered extra specific than skin folds and also provides an

index of both subcutaneous and intra-abdominal adipose tissue (Bjorntorp, 1987). Waist hip ratio can mask the status of abdominal obesity with an excessively large hip circumference (Bourne et al., 2017).

The Nutritional status of an individual and overall health state shows the socio-economic conditions prevalent in the society. BMI has usually been measured as a good indicator not only for the nutritional status but also for the socioeconomic conditions of a population, especially adult populations in developing countries (Jyoti et al., 2018). Malnutrition refers to deficiency, excess, or imbalance intake of energy and other nutrients. It includes both undernutrition and overnutrition. Undernutrition is the intake of energy and nutrients that are inadequate to meet an individual's dietary necessities and keep good health (Maleta, 2006). Underweight adults frequently show chronic energy deficiency which is associated with reduced physical work capacity, productivity and maternal health consequences. Being underweight is also connected with a greater risk of morbidity and mortality. While, overweight and obesity are considered to be the risk factors for cardiovascular disease, type 2 diabetes, several cancers and respiratory related mortality. Obesity is also associated with depression (Mukherji et al., 1989).

Adult malnutrition is one of the main global health problems in present situation. Diet is a major provider to the worldwide burden of non-communicable diseases with 255 million disability adjusted life years attributable to dietary factors (Ward et al., 2022). Malnutrition is increased unevenly in populations and poverty enhances the threat for malnutrition (Ward et al., 2022). In Asia and Pacific countries, numbers of overweight and obese groups are comparable to about one billion. In Asia and Pacific countries, two out of every five adult persons are either overweight or obese (WHO, 2000). Economic development has made food gradually more accessible at lower cost, which

assists to lower the occurrence of stunting and wasting, but it also help in raise the possibilities of over eat and extreme weight gain. The rapid growth of urbanization in Asia has been one of the main factors to the raise in overweight. Urbanization in general means a more inactive lifestyle at work and even at home (Helble and Francisco, 2014).

The malnutrition signs and symptoms might comprise the various illness or diseases like underweight, faintness, poor growth, dry or scaly skin, decaying teeth, bloated stomach, muscle weakness, mental impaired, fatigue and low energy, poor immune function etc. (Weiss, 2016). In developing nation, obesity is a multifaceted situation with serious social and psychological proportions disturbing in all ages and socio-economic class (WHO, 2004). South Asians have low occurrence rates of obesity when evaluate with western countries where susceptibility to obesity related illness with increasing co-morbidities is higher than in developed country (Simkhada et al., 2011). In year 2013, 40.9 percent of adult's population in Asia and Pacific regions was overweight and obese compared to 34.6 percent in year 1990 (ADBI, 2017). The International Obesity Task Force (IOTF) reported that up to 1.7 billion people might be exposed to weight associated health threats. It recorded that above 2.5 million deaths each year is accredited to higher body mass index, and it is likely to double by 2030 (IOTF, 2003). At least 1,500 peoples in developing countries die every twenty minutes from one or additional illness, and the majority of which are intimately connected to nutrition and scarcity (Wamanji, 2006). Globally, more than 800 million people suffer from hunger and diseases associated to malnutrition (FAO, 2000). Poverty and food insecurity is the double challenge of the 21st century (Keino, 2004).

India is facing the dual burden of undernutrition and overnutrition. In many developing countries, the majority of people are affected by dietary constraints and poverty, and meeting the nutrient requirement becomes a challenge (Bose and Das, 2015). Malnutrition influences a huge section of the population, both macro and micronutrient deficiencies are the main concern in developing countries (Ozah et al., 2017). Economic inequality between and within nations is a primary cause of both overnutrition and undernutrition. 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 underweight (Subramanian et al., 2007).

UNICEF (1990) developed a conceptual framework of undernutrition, which shows that the reasons for malnutrition are multifaceted and multi-layered. The main direct root for undernutrition is insufficient dietary intake and disease (Sinha and Sanghamitra, 2018). Undernutrition may cause obstetric complications leading to maternal and infant mortality, and increases the probability to give low birth weight babies and thus leading to the undernutrition cycle start again, spanning several generations. The major social risk factors are political situation, lack of education and economic inequality. Cultural influences on food habits along with several religious taboos and social customs may also cause nutritional deficiency (Bhattacharya et al., 2019). In spite of the high economic growth rates in India over the two decades, the stage of undernutrition among the population of India remains steadily high. Study between 2012-2014 tells that India had maximum number of malnourished people in the world, representing 15 percent of its whole population, and 50 percent additional than China (FAO, 2014). Undernutrition stays high in India than the majority of the countries in sub-Sahara Africa even though these countries have worse public health infrastructure (Deaton and Dreze, 2009).

Undernutrition 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 undernutrition are reported mainly from seven countries, which include India, Bangladesh, Ethiopia, Indonesia, China, Pakistan and Democratic Republic of Congo (Cunningham, 2015). From 1975 to 2014, the prevalence of underweight reduced from 13.8 percent to 8.8 percent in adult men and from 14.6 percent to 9.7 percent in adult women (peltzer and pengpid, 2017). It is generally reported that the basic causes of undernutrition and infectious diseases in developing countries are poverty, poor hygienic conditions and little access to preventive and health care facilities (Khongsdier, 2001). Undernutrition can be mild or severe, helpful or dangerous. In a condition of acute metabolic pressure where nutritional burdens are high, utilization of energy and nutrients are distressed and oral intake is likely to be compromised then nutritional depletion can occur rapidly and be severed (Schenker, 2003). Low efficiency not only restricts people to a low pay corner and a harmful circle of undernutrition, it leads to benefit inefficiencies (Chauhan and Bala, 2013). For adult women, undernutrition period of pregnancy increases the risk for a child, physical weakness, and impair cognitive capability and also increase the risk of maternal mortality (Smith and Haddad, 2015). Undernutrition is one of the most important public health problems affecting more than 900 million individuals around the World.

On the other hand, overweight and obesity have reached epidemic proportions affecting around 1.5 billion adults and 200 million children Worldwide. Obesity is now frequently associated with stunting in countries with a low per capita income and high food insecurity (Martin et al., 2011). Around 826 million people in the world are undernourished. Out of this, 792 million are from developing countries and 34 million

people from the developed world (Katona and Apte, 2008). The prevalence of overweight and obesity is increasing in developing countries and even in low income groups in richer countries (WHO, 2000). Obesity is a key factor for an increasing number of non-communicable diseases such as cardiovascular disease, hypertension, stroke, diabetes mellitus and cancer, leading to increase morbidity and premature mortality (peltzer and pengpid, 2017).

Overnutrition is the excess intake of energy requirement resulting in overweight and obesity (WHO, 2012). The problems of being overweight and underweight are caused by a chronic imbalance between energy intake and actual energy needs of the body (Bray, 1999). The world is facing the growing public health problem of overweight and obesity. The occurrence of overweight and obesity is growing fast in country of all income groups. Since 1975, obesity almost tripled worldwide. In year 2016, 39 percent of adults were overweight and 13 percent were obese in Serbia where the growing occurrence of overweight and obesity is one of the main public health challenge (Rakic et al., 2018). Approximately 2.8 million deaths are reported as a result of major public health problem in both developing and developed countries. In India, more than 135 million individuals were affected by obesity (Ahiwar and Mondal, 2019). In the last three decades, the prevalence rates have increased worldwide from 10-14 percent among the adult population (Alsmadi et al., 2013). Rapid economic growth, urbanization and consequent changes in lifestyles are among the factors during the worldwide obesity epidemic (Alsmadi et al., 2013). According to the WHO (2006), approximately 1.6 billion adults (aged 15+ years) were overweight globally and at least 400 million adults were obese in 2005. At least 20 million children under the age of 5 years were also overweight globally in 2005. The WHO further projects that by 2015, approximately 2.3 billion adults will be

overweight and more than 700 million were obese. Once considered a problem only in high income countries, overweight and obesity are now dramatically on the rise in low and middle income countries (Shetty and Schmidhuber, 2011). The prevalence of obesity increased from 3.2 percent to 10.8 percent in adult men and from 6.4 percent to 14.9 percent in adult women (Peltzer and Pengpid, 2017). The prevalence of overweight and obesity is increasing in developing countries and even in low income groups in richer countries (WHO, 2000). Obesity affects all aspects of human life and is associated with many diseases. According to the literature, about 75-80 percent of diabetic patients are obese showing that obesity is a strong risk factor for developing type 2 diabetes mellitus ((Maria and Evagelia, 2009). The risk for developing type 2 diabetes mellitus increases with higher BMI. Apart from diabetes and cardiovascular disease, obesity is strongly associated with hypertension and atherosclerosis (Maria and Evagelia, 2009). The occurrence of obesity amongst men and women differs significantly within and between countries. The prevalence of obesity varies by sex, and also that the social determinants of obesity vary by gender (Ggorbani et al., 2015).

India has experienced a positive change of decreasing undernutrition. However, in the last two decades, there is increased in the prevalence of overnutrition and its associated non-communicable diseases such as diabetes, heart disease, arthritis, etc. (Singha, 2012). Hypertension is one of the global challenging health issues, which is associated with overweight and obesity. Worldwide, about 58 percent of diabetes mellitus and 21 percent of ischemic heart disease are attributable to BMI above 21kg/m^2 (Mungreiphy et al., 2011). Even in developing countries, high blood pressure is one of the hazard factors for cardiovascular diseases, and it was estimated that 7.1

million deaths especially among middle and old age adults are due to high blood pressure (Mungreiphy et al., 2011).

Statement of the problem

Malnutrition is an emerging health epidemic affecting worldwide. It is an increasing health problem in urban as well as rural areas in both underdeveloped and developing countries. India is facing a double burden of both undernutrition and overnutrition. As of now, there are only a few studies in Sikkim, particularly in Nepali communities. Bridging this gap in research is especially important in contemporary times because the recent urbanization has caused Sikkim's population to experience rapid socioeconomic and lifestyle changes. This may affect the nutritional status of the populations as there have been established connections between an individual's health and their socioeconomic status and lifestyle (Bose et al., 2006). At present, almost one in three persons worldwide experience at least one type of malnutrition such as underweight, overweight or obesity, diet-related non-communicable diseases, wasting, stunting etc. (WHO, 2016). Indian population is transient through a nutritional conversion and is likely to observe higher incidence of adult non-communicable disease like hypertension, diabetes and heart diseases (Rao, 2001).

Majority of the rural areas are deprived of proper healthcare systems where malnutrition still remains undetected and unaware. The alarming high prevalence is one of the reasons for the need of more malnutrition based studies especially in country like India, and particularly in Northeast India (Sidkar, 2012). Not only do we need to highlight the increasing incidence of malnutrition but also its multiple underlying causes and reasons behind it. Studies have shown that malnutrition is affected by multiple factors including an individual personal choice, sex, age, income, education, occupation, food habits, physical inactivity, BMI, and others (Rakhshanda

et al., 2021). This certainly requires the need to conduct in-depth studies invoking with more of a bio-cultural approach towards it.

Better health is considered to be the best wealth for the wellbeing of the society. A better health condition is only possible with better nutritional status of the individuals and society. There are substantial numbers of literature and research on health issues related to nutrition, lifestyle, and socio-economic conditions. The existing literature discusses the role of lifestyle, food habits and socio-conditions disparities. Moreover, there is no dearth of the previous study in relation to reported morbidities and the nutritional status. However, there is negligible number of corresponding work in regards to the society of Sikkim. Existing literature with research or other academic works in relation to nutrition and health in Sikkim is unfortunately sparsely scattered and unorganized. Majority of such existing literatures over pertinent issue are found to overlook the crucial relationship of socio-economic conditions of individual and society in large. Hence, present study is conducted to fill such gap of literature bringing the possible findings and outcome to understand this pertinent issue of health and nutritional status of people in relation with socio-economic conditions, lifestyles and food habits of adult Nepali males and females of Sikkim. Further, it also tries to understand the prevalence of nutritional status among adult Nepali males and females with different self-reported morbidities.

Objectives of the study

1. To assess the nutritional status of adult Nepali males and females of rural areas of Sikkim.
2. To examine the relationship between nutritional status and socio-economic conditions.
3. To understand the association of nutritional status with relation to lifestyles and food habits.
4. To see the association between nutritional status and self-reported morbidities.

CHAPTER-II

REVIEW OF LITERATURE

Prevalence of nutritional status

Malnutrition is a serious global health problem, which is influenced by economic growth, urbanization and globalization. In the year 2014, approximately 462 million adults worldwide were underweight and 1.9 million were overweight/obese (WHO, 2016). Around 36 percent of women and 34 percent of men are undernourished in India. And 13 percent of women and 9 percent of men are overweight or obese (WHO, 2016). The simultaneous occurrence of overnutrition and undernutrition indicates that adults in India are suffering from a dual burden of malnutrition (Arnold et al., 2009). National Family Health Survey-3 (2006) reported that the prevalence of undernutrition in India is 33.0 percent among males and 28.1 percent among females. The NFHS-4 (2015) fact sheet of Sikkim state shows that the prevalence of obesity for men is 41.5 percent in the urban areas and 29.7 percent in the rural areas. Among the women, the data shows 34.1 percent and 23.1 percent in the urban and the rural areas respectively. The prevalence of underweight among women is 7.5 percent in urban and 6.4 percent in rural areas. Among men, it is 1.2 percent in urban areas and 3.3 percent in rural areas.

The prevalence of overweight and obesity is growing worldwide both in developed and developing nations. In 2008, 33.9 percent of American adults were obese and 34.4 percent were overweight (Fryar et al., 2012). The prevalence of overweight was 36.6 percent and 25.6 percent among men and women respectively in European countries (Fryar et al., 2012). People in United Kingdom had the maximum occurrence of obesity (12%), whereas Italians, French and Swedes had the lowest

levels of obesity (7%) (Martinez et al., 1999). The prevalence of overweight and obesity among Chinese adults were 21.51 percent and 2.92 percent respectively, though higher prevalence was found in the north than in the south (Wang et al., 2001). The occurrence of overweight and obesity was 31.5 percent and 7.8 percent among the Thai adult population (Wang et al., 2001). Again, the prevalence of overweight and obesity were 41.1 percent and 14.4 percent in Malaysia in the year 2003 (Nishida and Mucavele, 2005). A study shows that the percentage of obesity among men has increased from 3.2 percent to 10 percent and from 6.4 percent to 14.9 percent among women between 1975 to 2014 (Shafique, 2007). However, underweight is the main problem for developing countries with a decreasing percentage from 13.8 percent to 8.8 percent in men and from 14.6 percent to 9.7 percent among women (Shafique, 2007). The prevalence of underweight is reported 19.2 percent in Thailand and 9.6 percent in Malaysia in 2003 (Nishida and Mucavele, 2005). Whereas, in Vietnam, the prevalence of the underweight is 20.9 percent (Feskens et al., 2011).

The data from the Indian National Family Health Survey-3 (2005-2006) reports a significant proportion of overweight women coexisting with high rates of undernutrition. The pattern of adult nutritional status shows very poor in the states of Gujarat, Odisha, Arunachal Pradesh, Karnataka, Maharashtra, Madhya Pradesh and Andhra Pradesh (FAO, 2010). 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/m². According to National Family Health Survey-4, the prevalence of overweight/obesity among males were 10.6 percent in Arunachal Pradesh, 6.7 percent in Assam, 13.4 percent in Manipur, 8.2 percent in Meghalaya, 16.9 percent in Mizoram, 8.4 percent in Nagaland, 17.3 percent in Sikkim and 5.2 percent in Tripura. And in females, the

prevalence of overweight/obesity were reported to be 12.5 percent in Arunachal Pradesh, 7.8 percent in Assam, 17.1 percent in Manipur, 20.3 percent in Mizoram, 10.2 percent in Nagaland, 21 percent in Sikkim and 5.3 percent in Tripura (Bisai et al., 2013).

The data from the National Family Health Survey-3(2005-2006) reports also show that underweight among females was 16.4 percent in Arunachal Pradesh, 36.5 percent in Assam, 14.8 percent in Manipur, 14.6 percent, 14.4 percent in Mizoram, 17.4 percent in Nagaland, 11.2 percent in Sikkim and 36.9 percent in Tripura. Among males, the prevalence of underweight was 15.2 percent in Arunachal Pradesh, 35.6 percent in Assam, 16.3 percent in Manipur, 9.2 percent in Mizoram, 14.2 percent in Nagaland, 12.2 percent in Sikkim and 41.7 percent in Tripura.

Nutritional status and socioeconomic conditions

The pattern of socioeconomic inequalities in obesity is far more mixed in middle income countries, particularly among men (Dinsa et al., 2012). Torres et al., (2014) talks about poor nutritional status commonly observed among elderly living in both rural and urban areas. A low level of education and income is significantly associated with poor nutritional status. Ogden et al., (2010) found that among the Mexican American people and non-Hispanic blacks, the prevalence of obesity is generally equal in all income levels but slightly higher among the higher income level. Tzotzas et al., (2010) found that marital status and educational level are associated with obesity in Greek adults. Islam et al., (2010) said that the low level of education of both the women and their spouses along with poverty were factors associated with poor nutritional status in rural areas in Bangladesh. Baltrus et al., (2010) have studied the association of socio-economic status with measures of central adiposity and body mass index. Lao et al., (2015) explained that socio-economic status such as education,

occupation and housing areas were found to be related to obesity. Bjerregaard et al., (2013) studies found an increasing positive association of obesity with social position among the Inuit men and women of Greenland. Epidemiologic facts demonstrate that the world's populations living below low socio-economic situations and high rates of parasitic illnesses are similar to individuals that have most of the world's malnutrition (Jaiswal, 2018). Several studies found that higher socio-economic position is positively linked with overweight and obesity in developing nations mostly among women but negatively connected among the peoples of developed nations (Bhurosy and Jeewon, 2014). Studies were conducted in middle and low income countries found that there is a strong and straight association between socioeconomic status and overweight/obesity both in men and women (Rodriguez et al., 2009).

Aekplakorn et al., (2014) stated that socioeconomic status affects obesity in people and those who have the higher income have better access to the food supply. Barma and Sil (2013) study in North Bengal shows that housewives were higher in weight and body mass index than working women. It also shows that body fat percentage of working women was in the normal category and it was over the normal level in housewives. Obesity is common among people who work in a government office (Hazizi et al., 2012). Rengma et al., (2015) explained that age, education, occupation and income have higher association with overweight and obesity among adults Rengma Naga. Changing lifestyles among the Tangkhul Naga through better socio-economic status is the contributing factor for the growing prevalence of overweight and obesity and associated morbidity (Rengma et al., 2015). Persons with higher educational levels are noted with higher occurrence of obesity than individuals with lower education (Pereko et al., 2013). The educational achievement of females has a significant effect on the nutritional status. Well-educated females have better

nutritional status in Bangladesh as well as in India (Benerjee et al., 2020). Khan et al, (2008) talks about high socio-economic status women being considerably overweight and low socio-economic status women are considerably underweight. There are many factors for increasing number of overweight and obesity among children, teenager and adults such as socioeconomic conditions, sedentary lifestyles and behaviors, physical activities and genetic factors (Hadi and Karim, 2021).

The study conducted in Bangladesh reported that older age, lower educational level of individuals and poverty are definitely connected with underweight, whereas younger age, urban residence and higher educational level are positively connected with overweight (Mitra et al, 2018). Socioeconomic position was recorded as one of the important factor related with obesity. In high income countries, there is a differing association between socioeconomic condition and obesity, and in middle and low income countries, there is a strong association between socioeconomic conditions with overweight/obesity among adult males and females (Rakic et al., 2018). There is a relationship of socio-economic conditions with measures of central adiposity and body mass index (Baltrus et al., 2010). Socio-economic conditions such as occupation, education and housing areas were found to be linked with obesity measured by waist circumference and body mass index individually (Lao et al., 2015). In India, the frequency of undernutrition depends on body mass index which were reported to be connected with income, social status, age, sex, education, family size and residence (Khongsdier, 2002). The prevalence of obesity among Indian adults population were influence of age, sex, income, education, residence, social status and rural-urban migration (Prasad et al., 2013). Several studies have found that married people are more often overweight and obese than those living single (Tzotzas et al., 2010).

Nutritional status with lifestyles and food habits

Salmon et al., (2000) found that BMI and the physical activity patterns were associated with the hours spent on watching television among the adult Australian population. Hill and Peters (1998) talks about increasing time spent on watching television, playing games and using the computer has played an important role in increasing the sedentary lifestyles of individuals, which has serious consequences on nutritional status. Philopson (2001) said that physical activity also plays an important factor in malnutrition. Increasing urbanization is associated with the decrease of physical activity and change in food habits in the population. In less developed nations, urban population has higher rates of obesity than the rural population (Rao, 2001). Okolo et al., (2014) found higher prevalence of overweight and obesity among the Sokoto trader of Nigeria who eats unhealthy foods. Lifestyle factors have a major impact on an individual's health status. Poor dietary behavior and low physical activity, which depends on individual health choices, are the most important threat factors for being overweight and obesity (Rychlik et al., 2022). The nutritional status of people is closely linked with dietary intake (Ahmed and Siwar, 2013). Consumption of dairy products can be of significance in the avoidance of weight increase in middle-aged and elderly women who are primarily normal weight (Rautiainen et al., 2016). A study done by Yoon et al., (2016) found that overweight or obesity is associated with consumption of alcohol on a regular basis. Mathew et al., (2016) stated that the prevalence of overweight and obesity is significantly higher among those who consumed alcohol than those who did not take alcohol. A sedentary lifestyle and poor eating behaviors are the main aspects contributing to the increased occurrence of obesity and other diet-associated diseases in north Indian adults (Garg and Shivani, 2014). Lukasiewicz et al., (2005) reported that alcohol is the most

energy-dense macronutrient, which has more appetite enhancing cause, which can direct for increase in energy consumption thereby higher chance for increase in body mass index.

WHO (2013) suggested that adults must consume less than 5 grams of salt per day. Recently, Marrero et al., (2008) study found that high salt consumption is linked with an increased risk of obesity because high salt consumption excites thirsty and increases fluid consumption thereby increasing sugar-sweetened beverage consumption. The intake design of Indian has shifted from traditional diet to a westernized diet, which leads to increase in energy intake (Garg and Shivani, 2014). High salt intake directs to water preservation in body which subsequently leads to weight increase (Kamari et al., 2010). The study conducted in UK shows that high salt intake is a possible threat factor for obesity (Ma et al., 2015).

Physical activity is one of the significant factors for malnutrition. The decline in work associated with physical activity causes overweight or obesity (Philopson, 2001). Several studies have found that lesser physical activity at sedentary work or low physical job demands the growing occurrence of obesity in many developed countries (Jeffery et al., 1991). The rest time physical activity was inversely connected with obesity and mean BMI in both men and women (Koski et al., 2002). Sedentary lifestyles such as inactive physical activity and watching television are well influenced on nutritional status (Salmon et al., 2000). According to WHO, sedentary lifestyle is measured to be the fourth top mortality risk factor. Inactive activities such as playing digital games, long time spent in work, spending time in television and use of a computer etc. decreases the physical activities (Hadi and Karim, 2021). Using of tobacco, alcohol and poor diets lacking fruits and vegetables were found to be linked with diseases like hypertension and obesity among adults from Gujarat and Assam

(Misra, 2014). Poor diets impact on health. Poor eating habits can also cause deficiency effect such as reduced stamina, fatigue upon exertion, stunted growth, and impair motor development and learning troubles in kids (Udensi et al., 2015). There are significant associations between overweight with shorter sleep period and longer sleep period (Mitra et al., 2018). Smokers were significantly at higher threat of being underweight and lower risk of being overweight (Mitra et al., 2018). Taking of Junk foods during consumption of alcohol where alcohol itself is high caloric drink causes malnutrition (Mathew et al., 2016). The fast food consumption linked with raising abdominal obesity among adults is an indicator of central fat deposition (Alkerwi et al., 2015). Salarinia et al., (2017) states that chronic sleep deprivation is also reason for fatigue and decrease physical activity in individuals. Study also reported that sleep time is associated with obesity.

Nutritional status and morbidity

Nutritional status influences the efficiency power of older people as it affects their everyday routine, be it psychological, physical, social or spiritual (Nambooze et al., 2013). Nutritional status of adults is delicate to evaluate than that of younger adults and is greatly affected by chronic health conditions and partial physical capacity (Bernhardt and Kasko, 2008). A study done in Bangladesh found that self-reported health status was significantly associated with measured physical routine among adult males and females aged 50 years and older (Rahman and Barsky, 2003). Self-reported health status was also associated with risk of undernutrition in older people in United Kingdom (Margetts et al., 2003). The relationship between obesity and cardiovascular diseases has been reported in the adult population where the high frequency of overweight in adults in urban areas were linked with high blood pressure and self -reported diabetes (Marques et al., 2013). Alam et al., (2021) study

talks about age, extreme body fat, depression, and joint complaints as the major factors for disability.

Excess body weight is a serious chronic disorder that has become a major health problem especially in North American and European countries as high BMI raise the risk of various diseases and mortalities (Knight, 2011). Lopez (2001) mentioned that illness load is changing from communicable diseases to lifestyle diseases. While communicable diseases are still prevalent, the frequency of non-communicable diseases likes diabetes, respiratory diseases, cardiovascular disease and cancer are continuously growing. Hanson and Glukman (2011) mentioned that non-communicable diseases such as diabetes, cardiovascular disease, osteoporosis, chronic lung disease, cognitive decline, allergy, cancer, and affective disorder are the main contributor of mortality in the world. Non-communicable diseases presently stand at 43 percent of the universal problems of disease, and are likely to account for 60 percent of the disease load and 73 percent of all death in the world by the year 2020 (Hanson and Glukman, 2011). The report of the Global Burden of Disease said that the share of non-communicable diseases has been growing rapidly from 31 percent in year 1990 to 45 percent in 2010 (Hanson and Glukman, 2011). Study by Critchley (2004) talks about the changes in the social environment, nutritional routine and acceptance of lifestyle has contributed to this growing trend of diseases.

Popkin (2001) reported that overweight and obesity may cause many health problems like diabetes, high blood pressure, back pain, high cholesterol, sleep apnea, cardiac problems and arthritis. Department of Health and Human Services (2008) found that regular physical activity reduces the risk and provides therapeutic benefits for people with heart attack, colon cancer, diabetes and high blood pressure. Obesity in older

persons is measured as one of the significant risk factors for cardiovascular diseases, diabetes mellitus, hypertension etc, (Felisa et al., 2020).

Several studies have exposed an important association between nutrition with diabetes, cardiovascular diseases, cancer, and further age connected and lifestyle diseases (Garg and Shivani, 2014). Lack of nutritional information, poor food quality, inadequate food consumption and frequent communicable diseases is accountable for malnutrition. The growth and development of any nation are partial by the health state of its population, and malnutrition can hamper the growth and development of the nation (Garg and Shivani, 2014). Undernutrition among adults actually reflects the nutritional status of a community (Shetty and James, 1994). Emerging nations with malnourished populations face the risk of low productivity and development. Additionally, undernutrition among women leads to poor reproductive health consequences leading to increased infant mortality, preterm births and maternal mortality (Nithya and Bhavani, 2018). The low value of body mass index among adults leads to reduced immune function and increased morbidity and mortality (Nithya and Bhavani, 2018).

Individuals with bigger waist sizes have increased risks of obesity related conditions. Many researchers have shown that fat placed around the waistline raises the risk of mortality and chronic illnesses like cardiovascular diseases and cancers (WHO, 2008). The current nutritional tendency has revealed that persons from the developing countries were observed to be mainly vulnerable to obesity associated diseases in addition to co-morbidities (Sen et al., 2018).

The prevalence of double burden of malnutrition results in rises of the burden of non-communicable diseases mostly in the developing countries and is contributing to high mortality and morbidities among the populations worldwide (Sen et al., 2018).

Undernutrition and overnutrition are connected through adverse health outcomes. It is accepted that overweight and obesity are important predictors in general mortality, chronic diseases like disabilities, cardiovascular diseases, diabetes etc. Likewise, underweight is strongly linked with early mortality, poor self-rated health and disabilities mainly in developing countries (Dutta et al., 2016). Underweight is associated with a number of co-morbidities which include asthma, infertility and osteoporosis, and overweight is linked with hypertension, cancer, cardiovascular diseases and diabetes (Mitra et al., 2018). Diabetes is one of the diseases which affect approximately 537 million people across the globe and also one of the major causes of death globally (Anjana et al., 2022).

Hypertension is the most important threat for cardiovascular diseases, chronic kidney diseases, brain diseases, and the main cause of early deaths universally (NFHS-5). There are several risk factors for rising hypertension such as alcohol and tobacco consumption, unhealthy diets, physical inactivity and excess body weight. NFHS-5 report shows that 25 percent of females and 35 percent of males aged 15-49 years in Sikkim are suffered from hypertension. NFHS-5 has further reported that 5 percent and 3 percent of females aged 15-49 years have high blood glucose level and very high glucose level respectively in Sikkim. Among males in Sikkim, 5 percent and 4 percent have high glucose level and very high blood glucose level respectively. Income difference or inequality between the diverse socio-economic conditions is connected with poor health result (Narain, 2016). The non-communicable diseases such as heart disease, cancer, diabetes and chronic pulmonary diseases contributes nearly 80 percent of all deaths shares four common risk factors like lack of physical activities, tobacco use, harmful use of alcohol and unhealthy diet (Narain, 2016).

CHAPTER-III

MATERIALS AND METHODS

Land and people

Sikkim is the 22nd State of the Indian Union situated in the southern mountain ranges of the Eastern Himalayas. It spreads under the world's third highest mountain range, Khangchendzonga whose height is 8585 m above sea level and respected by the Sikkimese as their protecting deity. Sikkim has total area of 7096 sq.km, which is situated between 27°04'46" to 28°07'48" North latitudes and 88°00'58" to 88°55'25" East longitudes. It is bounded by Tibet in the north-east, Bhutan in south-east, Nepal in west and Darjeeling and Kalimpong districts of West Bengal in the south. The Rangit and Rangpo rivers form the borders with the Indian State of West Bengal in the south (Government of Sikkim, 2018). The total population of the State is 6,10,577 according to Census of India (2011). Out of the total population, 74.85 percent lives in rural areas and 25.15 percent lives in urban areas. There is a growth of literacy rate in the recent decades. Sikkim lies at the top ten of literacy rate in the country. The male literacy rate was 87.30 percent and female literacy rate was 76.43 percent in 2011. The urban and rural literacy rates were recorded as 89.26 percent and 79.82 percent respectively. The raise in literacy was the result of the opening of a large number of schools with the help of different agencies like United Nations International Children's Emergency Fund, private societies, Non-Governmental Organizations and government policies towards the universalisation of education. The launched of Sarva Shiksha Abhiyan has also been one of the important steps in the field of growth rate in education (Sharma and Sharma, 2015).

Sikkim, a small hilly state is known as "*Nye-Mae-el*" (Paradise) by Lepcha, "*Beymal Denjong*" (the hidden valley of rice) by Bhutia and "*Su-Khim*" (new house by the Limbu group of Nepali (Chakraborty, 2011). Sikkim is a multi-ethnic state of the Indian Union having diverse cultures. The state has different attractive folk dances, customs and traditions of different tribes and castes. Lepcha, Bhutia and Nepali are the three major communities that comprise the population of Sikkim. Sikkim has always been regarded as a land of ethnic diversity with as many as 20 different sub-communities having their own custom, culture, language and tradition living in harmony. However, there is an established similarity among all communities that all invariably are descendants of forefathers who were nature worshippers (Government of Sikkim, 2018).

The only earliest authentic document on the demographic composition of the area shows the two-thirds of the population as Nepali community. In independent India, the Constitution (Scheduled Tribes) Order (1950) notified the list of tribes in India. It continues to do so today. In this list, the Bhutias and the Lepchas of Darjeeling were included but this did not apply to Sikkim, and the same categorization as Nepali, Bhutia and Lepcha continued. The earlier King of Sikkim was forced to recognize and considered the Bhutia, Lepcha and all the groups under Nepali. This arrangement continued till 1978, three years after the merger with India in 1975. It was only in 1978 when the Constitution (Scheduled Tribe) Order (1978) was issued enlisting only Bhutia and Lepcha as Scheduled Tribes in Sikkim (Government of Sikkim, 2018).

The term Bhutia is derived from the name of the place called Bhot i.e. Tibet, to which the Bhutias of Sikkim initially belong. The migration of the Bhutias into Sikkim most likely had begun during the period of 15^{th} and 16^{th} century (Gurung, 2011). The ethnic groups of Sikkim's Bhutias is very multifarious and comprise of Drukpas, people

from Drukyul/Bhutan, Chumbipas, people from *Chumbi* valley (Southern Tibet), Dhopthapas, inhabitants of *Dhoptha* (a place in South Tibet), Tromopas or Do-mu-pas, inhabitants of Du-mu, Lachenpas, the people of Lachen valley in Sikkim, and Lachungpas, the people of the *Lachung* valley in North Sikkim (Swami, 2006). *Pang Lha-sol* also known as *Nay-tso* is the local festival of Sikkim celebrated by the Bhutia community and observed every year on the 15th day of the 7th month of the lunar calendar. It marks the consecration of Mount Kangchendzonga into Buddhist religion. *Pang Lha-sol* signifies the people's sense of devotion and honour to the guardian spirits of the land for defending dharma, peace and prosperity of the country. *Losoong,* New Year is another main festival of Bhutia community in Sikkim which celebrates between 25th to 29th days of the tenth month of the Tibetan year. It is the time when farmers pay their obeisance to the Gods with the offerings of the first parts of crops and fruits, seeking protection and prosperity for the good harvests. Main attraction of *Losoong* is the *Chaam* dances that are performed in the monasteries. Men folk adorn attires of mystical forms and recreate Gods, and the dance performance symbolize the exorcizing of the evil and welcome good spirits of the New Year (Government of Sikkim, 2015).

Lepchas are the original inhabitants of Sikkim, and generally settled in northern part of Sikkim. Dzongu areas in north Sikkim is regarded as a Lepcha reserve areas where others are not allowed to settle. The Lepchas call themselves as 'Rong' or 'Rongkup' which means the son of the snowy peak. Lepchas have their own language and perhaps it is one of the oldest languages of the hill dialects (Gurung, 2011). *Tendong Lho Rum faat* is an important festival of the Lepcha community of Sikkim, which is celebrated annually in the month of July-August. The Lepchas worship mountains, rivers, lakes and caves as sacred through the festival period. Mount *Tendong*, which is

located at the heart of Sikkim, is considered a sacred hill by the Lepchas. The festival of *Tendong Lho Rum faat* is celebrated in remembering and paying homage to this sacred mountain. They also celebrate *Namsoong* or *Namboon* to welcome the New Year as per the '*Dungit Karchu'* or Lepcha calendar. It is generally falls every year in the month of December or January. This festival corresponds to the harvest and the advent of the New Year for the Lepcha people in Sikkim. *Namsoong* is based on the origin, struggle and existence of the Lepcha community. The festival of *Muk Zikding Rum Faat* strengthens the Lepcha faith that a balanced ecology and environment is essential for the survival of human being.

The Nepalis are migrated to Sikkim after the Lepcha and Bhutia. They migrated in large number and quickly became the dominant community of Sikkim. In the present scenario, the Nepalis comprise of 70-80 percent of the total population of Sikkim. They started terrace farming, and cardamom, which is now considered as main cash crop was cultivated by Nepalis. They follow both Hindu and Buddhist religion, and some of them follow Christianity (Arha and Singh, 2008). They were mainly brought to inhabit in Sikkim by the British for two main reasons-to speed up the economic growth and to neutralize the superiority of the Sikkimese royal family (Gurung, 2011). Gurung, Rai, Magars, Limbus and Tamang are similar in their physical features, but each group has their own distinctive culture.

Dasai, also known as *bara desai* is one the important festivals of Nepali community. This festival is being celebrated in the autumn season marking the end of monsoon season, and generally occurs during the month of October. *Tika* ceremony is the most important ritual in Dasai, where *Tika* made from mixture of curd, rice and vermillion is put on forehead of the younger members by the elders of the family as a mark of holy blessing. Barley seeds are sown in the soil on the first day of this festival and

their growth foretells good harvest. Festivities continue through *Phulpati* (day of flowers), followed by Maha Astami, Kala Ratri and Navami. As a culmination of rivalry, Vijay Dashmi falls on the 10th day of the festival symbolizing the victory of Lord Rama over Ravana (Government of Sikkim, 2015). *Tihar* is celebrated forth night after Dasai and it symbolizes the return of the epic hero Rama from his fourteen year exile. It falls in the month of *kartik* by the Nepali calendar. This festival is celebrated for five days. First day is devoted to crow (*Kag Tihar*) where people use to prepare food and give it to crows for feed. Second day is devoted for dog (*Kukoor Tihar*) where dogs receive the special attention as they were decorated by flower garlands. Third day is devoted for cow (*Gai Tihar*) where people worship cow and prepared special foods for cow. On the same day, every household worships the goddess Lakshmi by decorating houses, and on the evening, groups of girl visit houses for special cultural traditional song known as *Bhaileni.* Fourth day is devoted for ox (Goru Tihar) where people worship ox and provide them food, and at evening or night, groups of boy from various houses perform *Deusi* and plays folk musical instruments like *Madal.* The last day is devoted for brother, *Bhai Tika*, where sister puts a multicolored tika, usually of three or four colours on the forehead of the brother (Government of Sikkim, 2015). *Maghey Sankranti* or *Makar Sankranti* is another festival celebrated in the month of January every year. This festival is celebrated by all communities telling the change of a season when the sun shifts towards the tropic of cancer. Maghey Sankranti is observed on the first day on which the sun's position is over Maka Rashi (Government of Sikkim, 2015).

Sikkim economy is primarily based on agriculture, which is supported by the fully organized organic farming system (Chakraborty and Chakma, 2016). More than half of the population is engaged in agriculture. Maize, wheat, paddy, buckwheat and

barley are grown in terrace fields. Beans, ginger, potatoes, vegetables, fruits and tea are also produced. Cardamom is one of the cash crops of Sikkim (Sharma and Lokesh, 2020). A report of Human Development of Sikkim, 2014 claims that apart from the agriculture, the state's economy is sustained by the tourism sector which focus on the various aspect of tourism like pilgrimage, culture, tradition, heritage, adventure, eco-tourism and organic farming. Tourism has grown to a significant source of revenue in Sikkim. On the other hand, agriculture has begun to shift to a service mode by producing organic products and adopting organic farming practises. Floriculture, food production (cardamom cultivation), and fruit processing are all developing through organic farming methods that rely entirely on organic manure. Organic farming includes crop rotation, green manure, compost and biological pest control. This farming method has the potential to benefit the environment, conservation of non-renewable resources, and improve food quality. There are no chemical fertilisers, pesticides or other chemicals used in this method. Farmers' success in maintaining food security for their families is driven by efficient organic farming because food production requires low cost and low external inputs. Farmers achieved economic independence after switching from agriculture to organic farming. As a result, there is no such loan on the farmer's side (Economic Census, 2005).

Mountain agriculture on small landholdings on slopes and terraces in the hills predominates. In the field, farmers typically practice double or mixed cropping. In addition to horticultural crops, they grow a variety of other crops. Landless farmers can also borrow land from another landlord to cultivate. Traditional farming methods are used by marginal farmers who did not use modern technological tools, chemical fertilizers, pesticides or HYV seeds. As a result, total food grain production in the state has increased significantly in absolute terms. Sikkim is India's first fully organic

state with all agricultural products certified organic. As a result, the ever changing land regulation system not only broadens agricultural horizons but also improves the rural economy and people's livelihood opportunities.

Cash crops such as cardamom and ginger are currently the state's main cash crops. According to the 2011 Census of India, maize, cardamom and paddy are the most important agricultural commodities in the sub-rural division's areas. Apart from agriculture, raising livestock such as goats, chickens, cows, pigs, and so on also helps their economy. A large number of people also make a living from handicrafts. Daily workers and carpenters make significant contributions to their economy.

Home stay tourism has recently emerged as a viable alternative source of income throughout Sikkim. The development of home stays necessitates a significant investment at the outset. The Sikkim government paved the way by providing financial assistance to the local people through non-governmental organizations and schemes. A diverse range of employment opportunities are being created with a consistent flow of earnings, thereby improving the standard of living and income levels. The concept of developing the villages as an offbeat tourist destination in the form of eco-cultural tourism has transformed the local people's way of life. These accommodations provide tourists with opportunities to interact with local communities, and the tourists, in turn, bring back the flavor of the communities' traditional cultural heritage. Home stay generates income through tourists and allows people to share their traditional culture. The growth of tourism will not only create jobs, but will also benefit other industries such as transportation, telecommunications, and retail sales. If variables like transportation and communication, trade, hotels and restaurants, and banking and insurance are used as proxies for tourism growth, the

contribution of these sectors to the gross state domestic product will help to explain how tourism has contributed to revenue generation in the state over time.

Sikkim is recognized for its biological diversity, which is embodied by diverse eco-climatic conditions and wide altitudinal variation as well as a variety of forest types ranging from tropical to alpine (Singh and Chauhan, 2000). The State's terrain, climate and topography have resulted in the survival of various eco-zones in close proximity. The forested regions of the State exhibit a diverse range of fauna and flora. The state has wide variety of plants from tropical to temperate to alpine and tundra, and perhaps one of the few regions to exhibit such a diversity within such small areas (Arha and Singh, 2008). Sikkim holds nearly 4,458 plant species, out of the total 15,000 species of flowering plants in the country. These include 506 of the total 2302 species of lichens, 480 of the total 1200 species of ferns, 527 of the total 1229 species of orchids, 58 of the total 102 species of primulas, and 38 of the total 90 species of rhododendrons. Nearly 165 plant species have been named after the State as they were first collected from here (Singh and Chauhan, 2000). The State is home to roughly 31 percent of the country's mammals, 45 percent of the country's birds, and 50 percent of the country's butterflies. *Tso Lhamo* in Sikkim is home to the only population of the Southern Kiang in India, as well as significant populations of Tibetan gazelle and Tibetan argali. The avifauna of Sikkim is comprised of the impeyan pheasant, the crimson horned pheasant, the snow partridge, the snow cock, the lammergeyer and griffon vultures, golden eagles, quail, plovers, wood cook, sandpipers pigeons, old world flycatchers, babblers and robins etc. A total of 550 species of birds have been recorded in Sikkim and some of which have been declared endangered (Arha and Singh, 2008).

A vast protected network of sanctuaries and national parks now protects nearly one-third of the land areas. The State has a forest area of 82.31 percent, which is divided into reserve forests and protected forests and is administered by the Forest, Environment and Wildlife Management Department. The biodiversity is diverse due to the proximity of the Tibetan plateau and the Bay of Bengal, with affinities with tropical moist forests in the south and cold desert in the north. Heavy precipitation has resulted in lush green vegetation in both the winter and summer seasons. The State has a significant impact on the bio-geographic regions of the west and east Himalayas.

Data collection

The data for the present research was collected randomly from both adult Nepali males and females of the rural areas of Sikkim. The term 'Nepali' is an umbrella term used for various tribes and caste communities which include Bahun, Thakuri, Chettri, Newar, Rai, Gurung, Tamang, Limboo, Mangar, Jogi, Bhujel, Thami, Yolmo, Sherpa, Dewan, Mukhia, Sunar, Sarki, Kami and Damai (Hooker, 1969). For present study, data was collected randomly from four sub-castes of Nepali communities such as Chettri-Bahun, Rai, Limboo and Mangar. A total of 1208 data (600 males and 608 females) was collected from adult Nepali males and females aged between 20-60 years through random sampling method. Data for present study were collected randomly from different villages such as Darap, Timburbung, Daragaon and Dhodak of West district; Ruchung, Ketang, Karek and Yangyang of South district and Marmring, Kaizalay, Ganchung and Assam lingzey form East district of Sikkim. After the creation of new districts in 2022, Timburbung, Daragaon and Dhodak come under the newly created Soreng district. Marmring, Kaizalay, Ganchung and Assam lingzey are also come under the newly created Pakyong district.

The *Chettri-Bahun* of Sikkim is a composite group of the *Khas* community. Many practices separate and distinctive cultures and are different from traditional scripturally (Sapkota, 2015). The *Khas (Chettri-Bahun)* has many deities such as *Khola Maai*, *Dara Maai* and *Sansari Maai*, which are worshipped twice a year in a regular system of puja usually referred to as *Udhawli* and *Ubhawli*. The deities are believed to go to the Himalayas for meditation and they come down to bless the crops, sun and rain. These *Udhawli* and *Ubhawli* pujas are conducted routinely. *Sansari* Puja is conducted twice a year and earthly Gods are worshipped. These deities bless the villagers if worshipped properly and curse if there is disbelief committed by the people. Some of the causes for curses are promiscuity, illicit relationship with the members of the same clan, or non-performance of death rites of the deceased (Sapkota, 2015). The important festival which was celebrated by this community is Dasai, Tihar, Maghe Sankranti, Tij, Dewali and Vaisakhi. Rice, barley, millet, maize and buckwheat are the staple items of food. The *Khas (Chhetri-Bahun)* are mostly meat eaters. Their association with Bhutia and Lepcha encouraged them to take the food habits of the tribal. The Khas (*Chhetri-Bahun)* celebrates their festivals with traditional food items such as rice, *sale roti*, mutton etc. (Kharel, 2008).

Limboo is also referred as *Tshong*, Chong and *Yakthunbas*. This community inhabits the different areas in Sikkim such as Daramdin, Soreng, Hee, Dentam Lingchum, Khaniserbong, Samdong, Yuksam, Darap, Rabitar, Namphok, Assam Linzey, Aho etc. They followed Yuma religion and believe in goddess *Tagera Ningwaphuma*, and their own philosophy of karma (Government of Sikkim, 2008). The Limboos follow the social rules and regulations of *Mundhum* oral scripture. Their god *Tagera Ningwaphuma* is defined as a strong and powerful, and the creator of life on earth. The goddess Yuma, also known as *Yuma Samyo* or *Niwaphuma* is the most important

and popular among Limboo, and is worshiped at all the times. *Yuma* is the mother of all the Limboo, and one respects his or her mother as a goddess (Dutta, 2019). Most of the populations of Limboo are non-vegetarian, and alcohol is an important part of their cuisine. Rice is a staple food crop. Food products such as fermented foods, maize, millets and roots are the main source of items in this community.

Rai is also known as Jimdars as they are traditionally linked to the land. They consider themselves to be the descendants of the Kiratis/Kirats. In some places, they are known as Khambus. It may be mentioned that Jimdars, Khambus and Rai are synonymous. According to the SSEC 2006, the Rais are the largest community in Sikkim comprising 13.52 percent of the total population. Rai celebrates two main festivals such as *Sakkewa* and Sakela. *Sakkewa* is popularly known as Chandi Nach or Bhumi Puja or Baali Puja or land (Government of Sikkim, 2008). Kirats/Rais are the inhabitants of the mountain regions of India on the hills and foothills of the Himalayas (Singh, 1990). Kirat/Khambu/Rai has more than 24 sub-groups such as Chamling, Kulung, Thulung, Sotang, Bantawa, Khaling, Sampang, Bahing, Dungmagi, Lohorung, Mewahang, Nachiring, Rokdung, Dumi, Koyu, Athpariya, Chhiling, Chhintang, Chukwa, Puma, Lingkhim, Yamphu, Chaurasay, Jerung, Tilung, Wambule etc. These sub-groups have their own language. Millet and ginger are important crops for ritualistic purposes among Kirat/Rai irrespective of different sub-groups. Chicken, pig, cow and ox are common livestock that are reared both for personal consumption and for commercial purposes. Dairy farming for milk, butter, curd and *churpi* (strained boiled curd) is also practiced. Main foods of Kirat/Rai comprises of pounded and cooked corn, millet, buckwheat, yam and tubers. Rai do not follow any kind of religion in the strict sense of term. They are animist, ancestors' worshippers and nature worshippers. The most respected deities are *Sumnima* and *Paruhang*, who are

regarded as the creators of the Kirat/Rai people. The three sacred hearth stone is another symbolic and ritualistic aspect of community.

Magar/Mangar/Mongpa is one of the aborigines of Sikkim Himalayas (Hooker, 1848). They are known for bravery, pure heartedness, honesty, docility and simplicity. They belong to *Kirati* sub-cultural stock (Sinha, 1975) with a strong tribal ethos like Limboo, Lepcha, Gurung and Tamang etc. Essentially, Mangars are animists, which are reflected in their ritual practices indicating more of tribal traits of animism and nature worshippers despite their assimilation into Hindu mainstream. Mangars have a distinct dialect known as *Mangrati* and possess a distinctive socio-cultural features and practices. Because of their bravery and honesty towards their duty, they are regarded as highly esteemed and preferred community in military services who can defend the nation. There are tales and historical facts of their martyrdom, where they have fought the enemies in the snowy and rugged mountainous boundaries defending India's integrity. Mangars worship hosts of spirits, and most of the rituals associated with them are performed by their own shaman. Earlier, during the death rituals, Brahman priests were involved. However, in recent decades, same rituals are performed by Mangars' own shamans or *Sadhus* (Government of Sikkim, 2018). According to the data of SSEC 2006, the total population of Mangar is 15,702 comprising 2.70 percent of the total population of Sikkim. The community is divided into a number of exogamous and patrilineal thars. Each of these thars have one or more gotras. Marriage alliances are made on the basis of these patrilineal ancestral gotras. Mangars generally use the surname Thapa instead of Mangar. They are mainly a land owning community with terrace cultivation as their main occupation. Hunting and gathering are also their traditional occupation (Government of Sikkim, 2018).

Study areas

Data were collected randomly from different villages such as Mamring, Kaizalay, Ganchung and Assam lingzey of Pakyong. Pakyong lies at 27°22"N latitude and 88°58E longitudes at an elevation of 4421 feet above sea level. It is situated at a distance of 26 kilometers from Gangtok, capital of Sikkim. Pakyong is an important market center located at the junction of four main roads namely, the state highway from Ranipool, the road to Rongli and Rhenock via Rorathang, the road leading to Rango via Duga and another road connecting Gangtok via Assam Lingzey. It was one of the sub-divisional headquarters in the East district of Sikkim (Government, 2016). Now, it is converted into a new district. This place was used as a camp for British troops during the Anglo-Tibetan war in 1888. The famous Karthok Gonpa is situated near the town. The construction of the first airport (Green Field) in Pakyong is already completed. There is a small bazaar where a weekly *haat* assembles on Wednesday. The bazaar handles green vegetables, fruits, local food products, agricultural products, poultry and livestock brought in by the villagers during *haat* days. There is a primary health center, a police outpost, a post office, a fire station etc. (Government of Sikkim, 2016).

Data for the present study were also randomly collected from villages such as Timburbung, Daragaon and Dhodak of Soreng. Soreng is situated at about 19 kilometers away from Jorethang and 52 kilometers from Gyalshing. Soreng lies at 27°16′N latitude and 88°19'E longitude at an elevation of 4858 feet above sea level. Earlier, Soreng was a sub-divisional headquarters, now it is converted into a district. A trek to Jhandi Dara from Soreng is an important tourist attraction. A variety of birds and flowers can be seen along this trekking route. A monastery at Sreebadam and Durpiney Dara view point at Chakhung are few locations of tourist interest. There is a

government college, a few government and private schools, a police outpost, a post office, public and private banks etc. A *haat* assembles here on Thursday. The bazaar handles a variety of green vegetables, food products, fruits, agricultural products, poultry, livestock and other merchandise brought in for sale from the surrounding villages (Government of Sikkim, 2016).

Data was also collected randomly from Darap village of West district, Sikkim. It is located at approximately six kilometers away from tourist destination, Pelling and at the fringe of the Kanchenjunga National Park. The village of Darap clings to the foothills of the Sikkim Himalaya in the shadow of Kanchenjunga situated at an altitude of 1600 meters from sea level. Darap village had earlier faced a lot of challenges with livelihood where poverty was prevalent and people were engaged in cattle herding, poultry and resource extraction from forests such as edible herbs, timber for construction, charcoal, and fuel wood. Shifting cultivation was also largely prevalent for subsistence in the village (Cajee, 2018).

Further, data for present study were also collected randomly from Ruchung, Ketang, Karek and Yangyang village of South district of Sikkim. Ruchung, Ketang and Karek are villages of Namthang area of South district. It lies at 27°22'N latitude and 88°58'E longitude at an elevation of 4713 feet above sea level. It is located at about 24 kilometers away from the district headquarter, Namchi and 16 kilometers from Rangpo on the Namchi-Phongla-Rangpo state highway. There is a small market place with few shops and hotels. A weekly *haat* assembles here on Thursday. The market handles green vegetables, fruits, local food products, agricultural products, poultry and livestock, and other merchandise brought in for sale by the people from the neighboring villages during *haat* days. Namthang is famous for the 52 doors (Bawandhoka) mansion, which is now converted into a museum. The place hosts the

annual Indra jatra festival with colorful cultural programs. Five kilometers from Namthang located Nagi Dara, a beautiful spot that offers a breathtaking view of Darjeeling, Kalimpong, Mainam and Tendong hills. One can also have a panoramic view of Mount Khangchendzonga and the Singalila range from this place (Government of Sikkim, 2016). Yangyang is located in Ravong sub-division of South district with a total of 272 families residing there. The Yangyang village has a total population of 1505, of which 762 are males and 743 are females (Census, 2011). Yangyang has a Lepcha heritage centre, a museum dedicated to Lepcha art and culture. Tig Cho lake and the thick forest of Yangyang are charming. The place also hosts a helipad. Yangyang is the home of numerous beautiful avian species. The graceful Teesta River meanders nearby sketching a beautiful vista of nature. Yangyang is a heaven for bird watchers and some of the rarest birds of the State are found here.

Anthropometry

Data on anthropometric measurements such as height and weight were collected from each subject wearing light clothes. An anthropometric rod and a weighing scale to the nearest of 0.1 cm and 0.5 kg was used to measure the height and weight of the subjects following the standard technique of Lohman et al., (1998). Body mass index was used to categorize each subject as underweight, overweight and obesity. In present research, I used the world standard BMI classification recommended by the World Health Organization. According to the WHO classification, BMI of less than 18.5 kg/m^2 is considered as underweight, BMI in the range of 18.5-24.9 kg/m^2 is considered as normal, BMI in the range of 25.0-29.9 kg/m^2 as overweight and more than/equal to 30.0 kg/m^2 as obese (WHO, 2003). In addition to this, data on waist

circumference and hip circumference were also collected using the guidelines of World Health Organization (WHO, 2008).

Data on socioeconomic conditions

Data on various socioeconomic conditions such as age, sex, marital status, education, occupation, income, family type, house type, etc. were collected from each subject or head of the household using an appropriate schedule. The income was verified against the positive aspects of socioeconomic conditions like housing condition, kinds of occupation, land property, and monthly expenditures. The per capita monthly income of the households was classified into three income groups:

Above 75^{th} percentile= High income group (HIG)

50^{th} to 75^{th} percentile = Middle income group (MIG)

Below 50^{th} percentile =Low income group (LIG)

Educational qualification of the individuals were classified into five categories such as illiterate (those individuals who are not able to read and write), primary (individuals who studied up to class V), secondary (those who studied class VI to X), higher secondary (those who studied class XI to XII) and graduation and above (those who are pursuing graduation and higher studies). Since the numbers of illiterate and graduate are very negligible in number, I intentionally clubbed them together with primary education and higher secondary education respectively. Data on the occupation of each subject were classified into students, government employees, business, farmers and housewives. The occupations of males were classified as government employees, business, farmers and students. The occupations of the females were classified as government employees, business, housewife and students. Data on family type, house type and marital status were also collected for the present

study. Data on family type was classified as nuclear family and joint family. Data on marital status was divided as married and unmarried.

Data on lifestyles, food habits and self-reported morbidity

Data on physical activity, television viewing time, alcohol consumption, food habits and self-reported morbidities were collected from each subject. Data on hours of physical activity was classified into two groups such as less than/equal to one hour and two hours and above. The data on types of physical activity was classified into three categories such as mild, moderate and heavy. Data on types of physical activity was classified based on questionnaire laid down by World Health Organization (2005). Since the numbers of participant involved in heavy types of physical activity are negligible in number, I clubbed them together with moderate types of activity. Mild activities include household activities like cleaning, washing and cooking etc. Moderate activities include carrying light load, digging, agricultural activities etc. The television viewing time was divided into two groups namely, one to two hours and three hours and above. Sleeping duration was categorized into two groups such as less than/equal to seven hours and eight hours and above similar with the classification of Zhao et al., (2021). Use of mobile phone was categorized as less than/equal to one hour and two hours and above. Data on alcohol consumption was categorized as currently consumers and non-consumers.

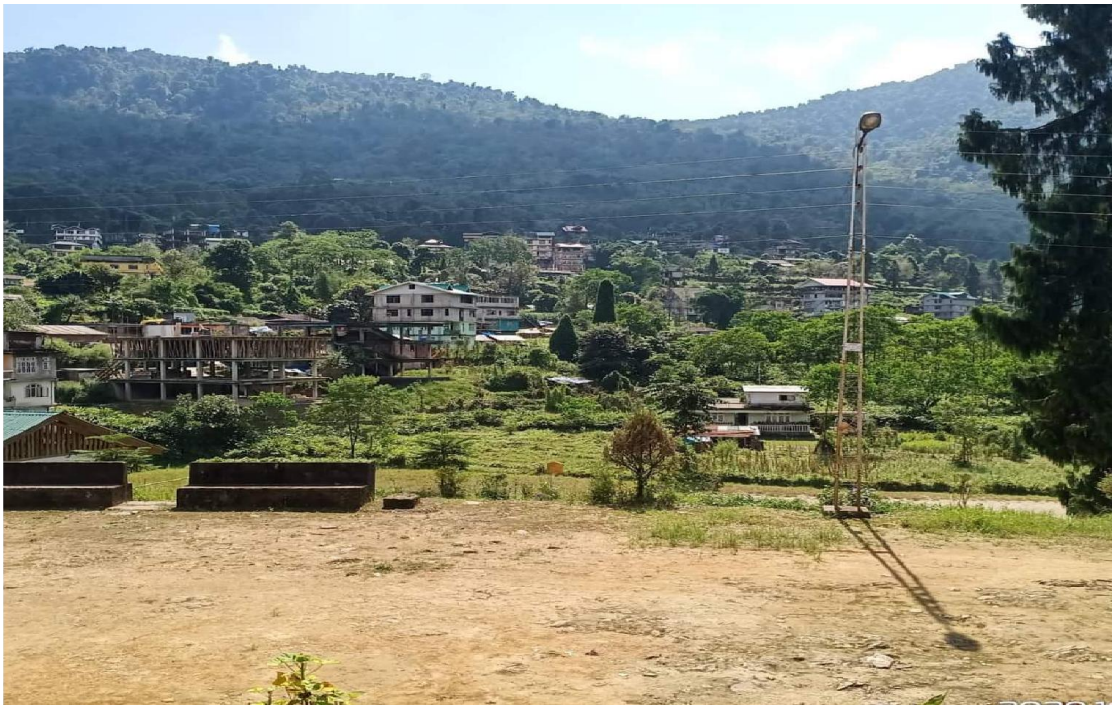
Data on consumption of non-vegetables, vegetables, fast foods and packet foods, salt tea, milk tea, butter consumption, numbers of meal per day etc. were also collected for the present study. Non-vegetables include chicken, meat (all types of meat), egg and fish etc. Vegetable foods include spinach, cabbage, cauliflower, pumpkin, cucumber, potato, onion, garlic, shallot etc. The consumption of non-vegetables was divided as one to two times per week and three times and above per week. Consumption of salt

tea was categorized as consumers and non-consumers. Consumption of milk tea was categorized as those who never consumed, one to two times and three times and above. Butter consumption was categorized as those who consume and those who did not consume. Milk consumption was categorized as regular consumers and irregular consumers. Data on numbers of meal intake per day was categorized as two times per day and three times per day. The data on self-reported morbidities were collected following four weeks recall method based on National Sample Survey (NSSO) 60^{th} round survey of morbidity and health care carried out in year 2004 (Dilip, 2007). Data on self-reported morbidity includes diabetes, hypertension, TB, joint/back pain etc. Data on self-reported morbidity was also classified as those who are suffering from self-reported morbidities and those who are not suffering from self-reported morbidities. Data on self-reported health status was classified as self-reported excellent health status, good health status and poor health status.

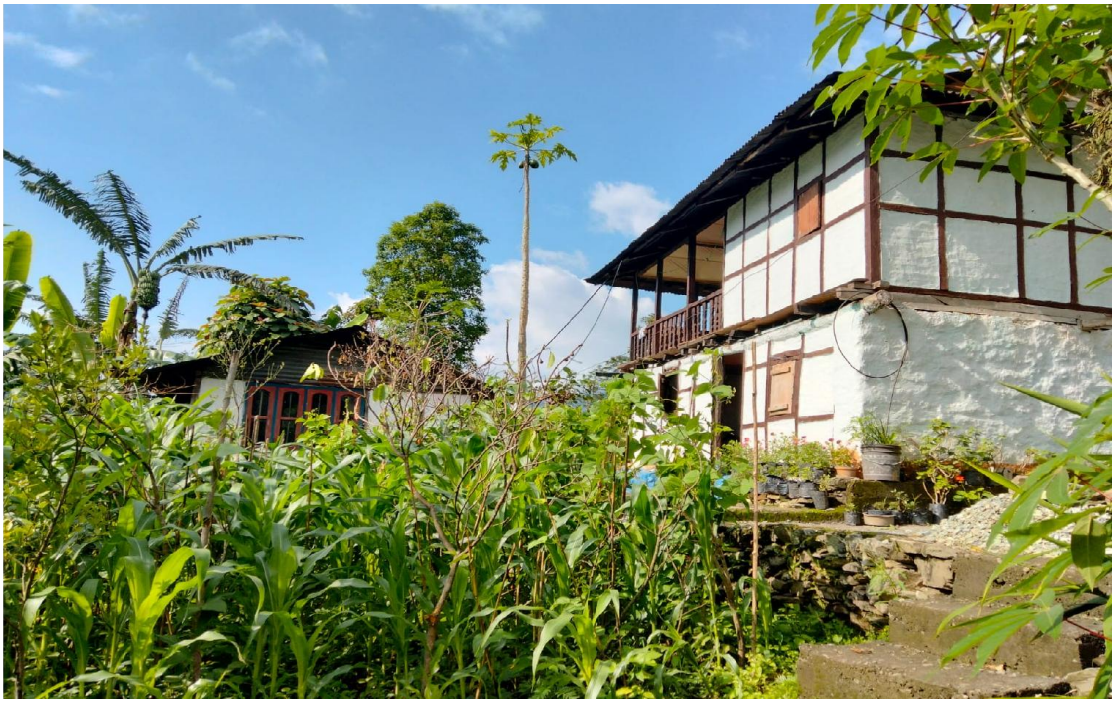
Statistical Analysis

The data collected were analyzed using MS-Excel software and SPSS software for the present research. The parameters taken were analyzed statistically to find out the mean and the standard deviation for the anthropometric measurements. The statistical analysis of p-value of <0.05, <0.01 and <0.001 were used as a statistically significant level. BMI was calculated to classify underweight, overweight and obesity. According to the WHO classification, BMI of less than 18.5 kg/m^2 is considered as underweight, BMI in the range of 18.5-24.9 kg/m^2 is considered as normal, BMI in the range of 25.0-29.9 kg/m^2 as overweight, and more than/equal to 30.0 kg/m^2 as obese (WHO, 2003). The prevalence of underweight, overweight and obesity was calculated in relation with different socio-economic conditions, lifestyles and food habits. The prevalence of underweight, overweight and obesity was also calculated in relation

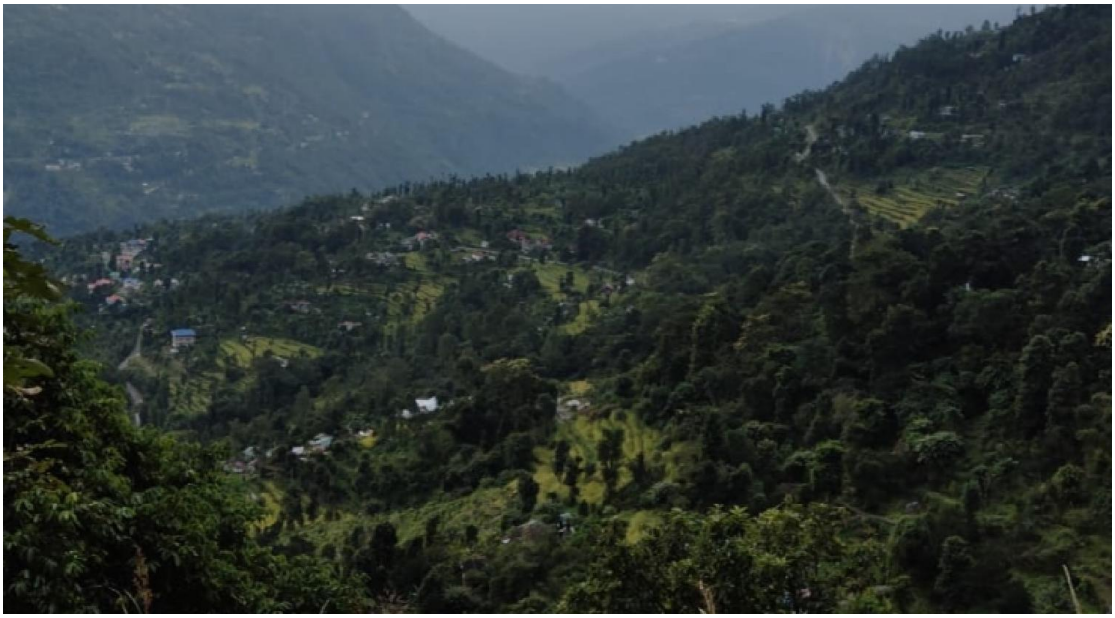
with different self-reported morbidities. In order to test the significance, t-test and chi-square were calculated in both adult males and females. Binary logistic regression was also carried out to find the risks of overweight/obesity with different socio-economic conditions, lifestyles and food habits.



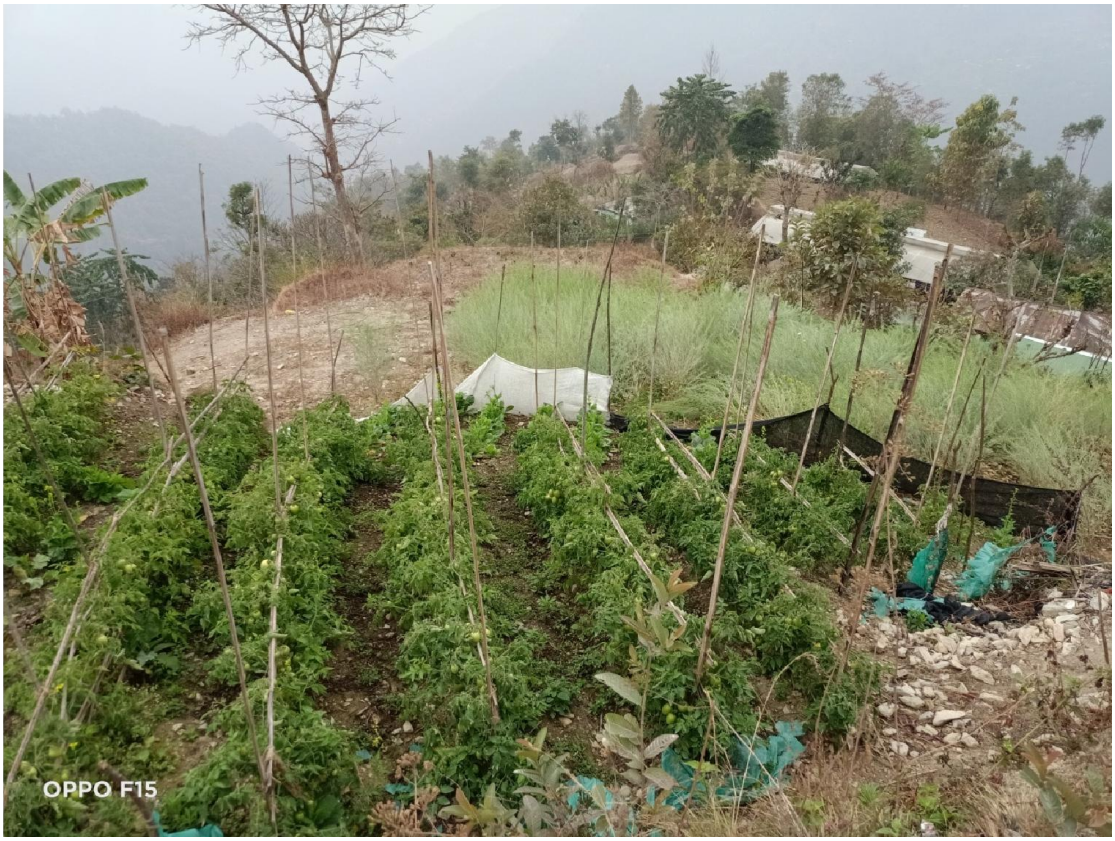
Fieldwork area, Darap, West Sikkim



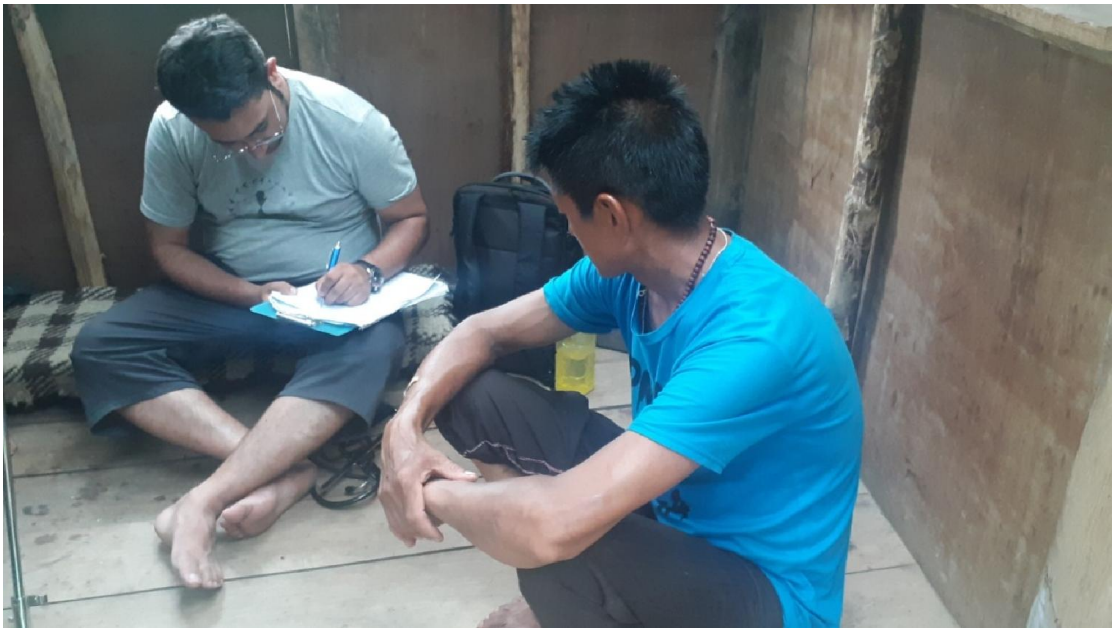
Fieldwork area, Kaizalay, Pakyong



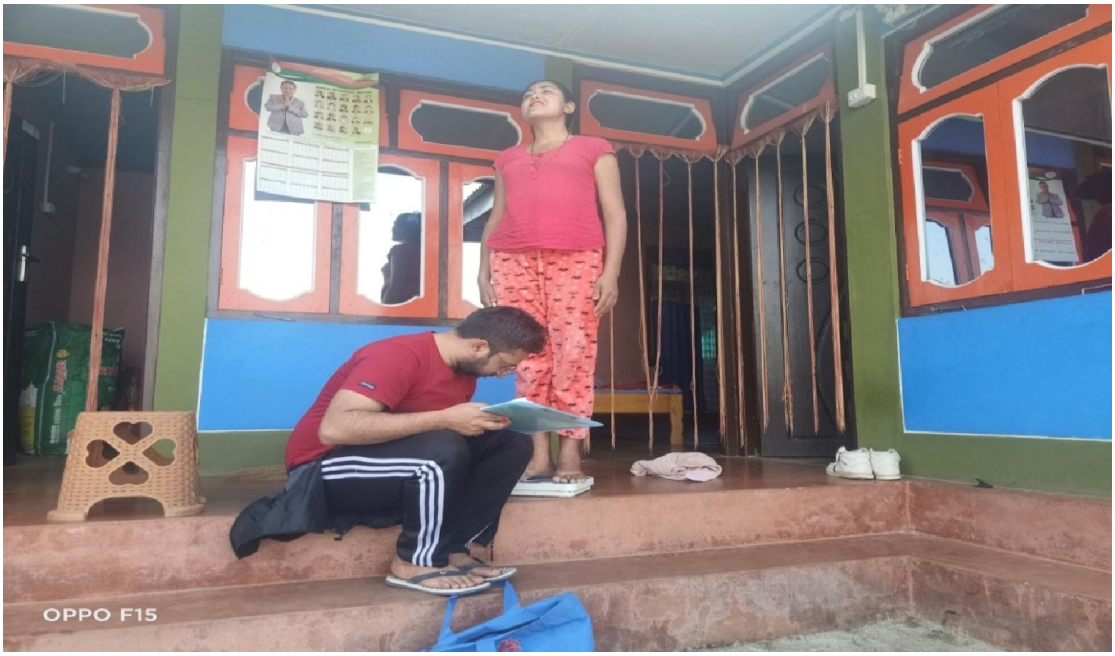
Fieldwork area, Yangyang, South Sikkim



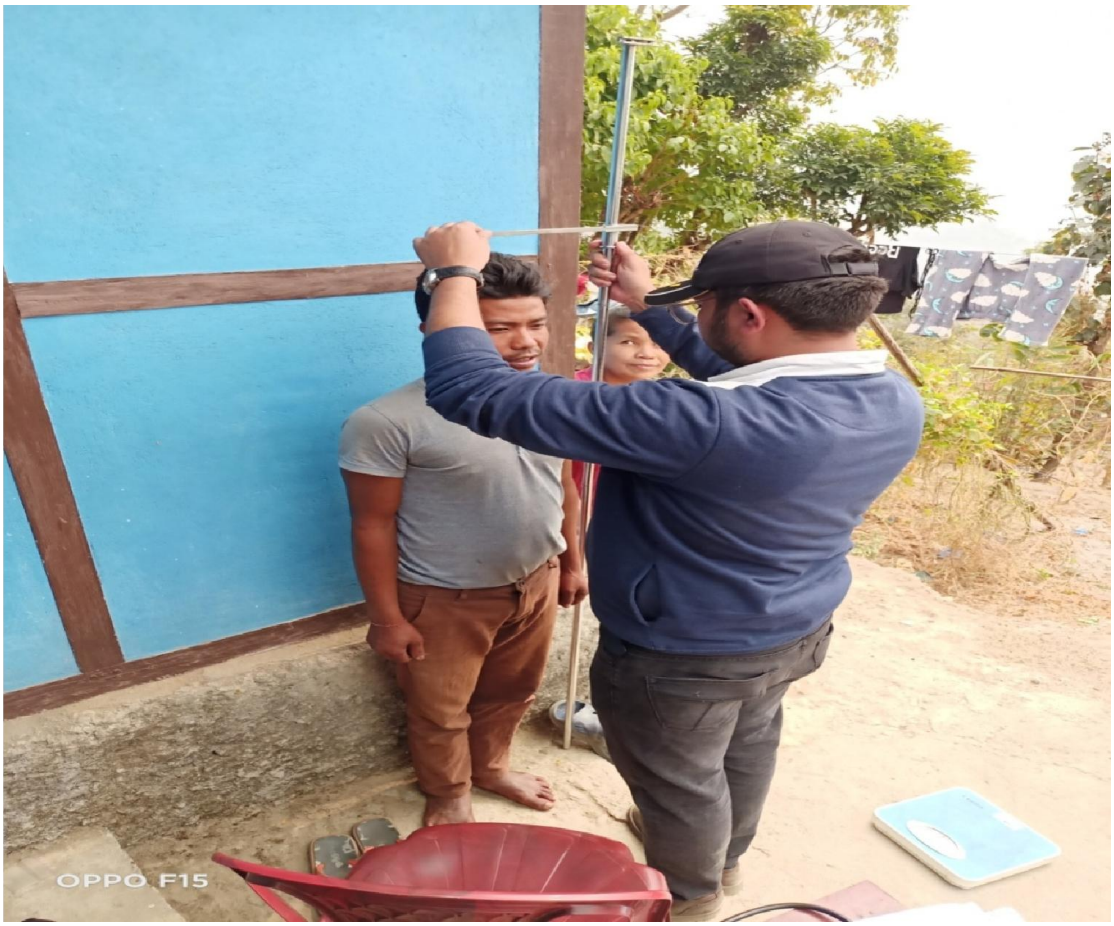
Fieldwork area, Ketang, South Sikkim



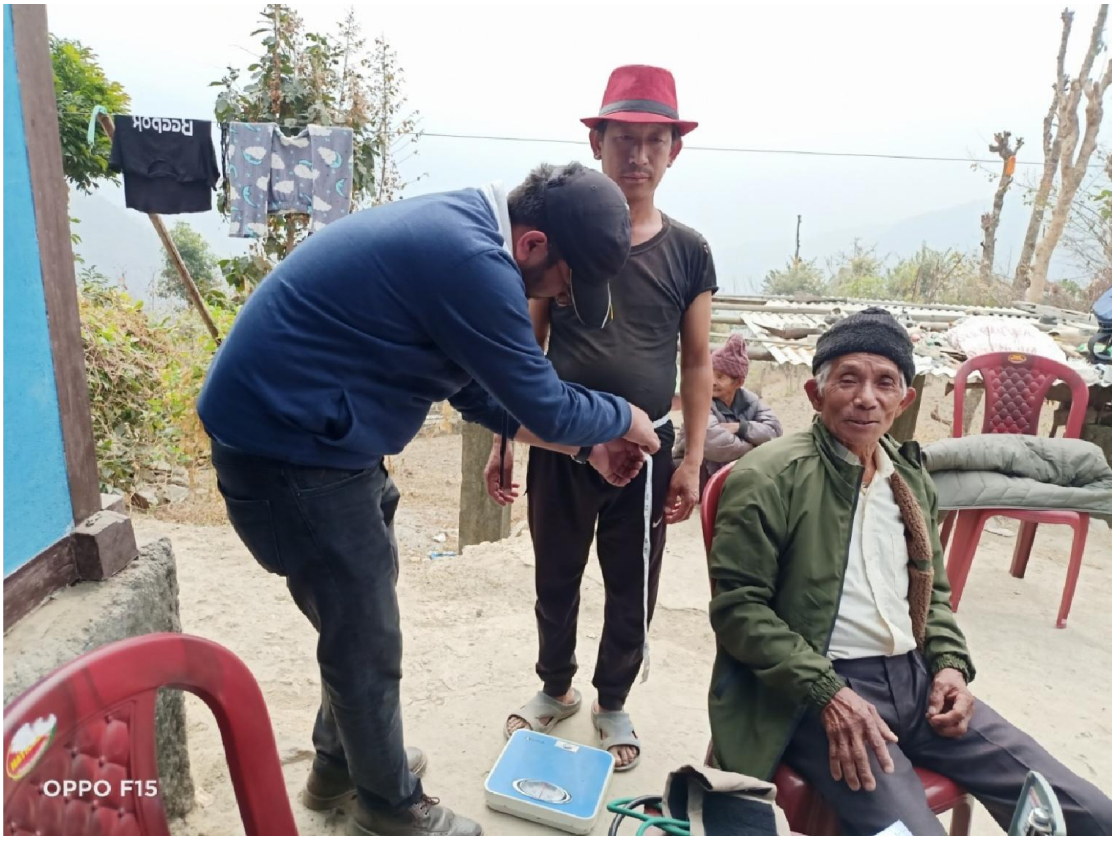
Data collection during fieldwork



Data collection during fieldwork



Data collection during fieldwork



Data collection during fieldwork

CHAPTER-IV

PREVALENCE OF NUTRITIONAL STATUS IN RELATION WITH SOCIO-ECONOMIC CONDITIONS

Table 1: Mean height, mean weight and mean BMI among the Nepali adult males and females

Category	Total	Mean height(cm) ± SD	Mean weight(kg) ±SD	Mean BMI±SD
Male	600	156.50± 6.50	57.10±9.88	23.26 ±3.37
Female	608	156.48 ± 6.47	57.09± 9.87	23.25± 3.36
		t = 22.17; p<0.05	t= 8.89; p<0.05	t = 6.86; p<0.05

Table 1 shows basic data on mean height, weight and BMI with standard deviation of Nepali adult males and females of rural areas of Sikkim. The table shows that the mean height was found more or less the same between adult males (156.50cm±6.50) and adult females (156.48cm±6.47). The differences in mean height were statistically significant (t=22.17; p<0.05). Similarly, the mean weight was also found the same between adult Nepali males (57.10kg±9.88) and adult Nepali females (57.09kg±9.87). The mean weight was statically significant (t=8.89; p<0.05). Table further shows that mean BMI of adult males (23.26±3.37) was also found the same with mean BMI of adult Nepali females (23.25±3.36). The mean differences in BMI were statistically significant (t=6.86; p<0.05).

Table 1.1 Mean waist circumference and hip circumference among Nepali adult males and females

Category	Total	Mean waist (cm) ± SD	Mean hip (cm)± SD
Male	600	79.31 ±9.28	84.22±9.30
Female	608	79.31 ±9.27	84.24±9.29
		t=2.69; p<0.05	t=2.54; p<0.05

Table 1.1 shows basic data on mean waist circumference and mean hip circumference with standard deviation of adult Nepali males and female of Sikkim. The table shows that the mean waist was found more or less the same between adult Nepali males (79.31±9.28) and adult Nepali females (79.31±9.27). The mean differences in waist circumference were statistically significant ($t=2.69$; $p<0.05$). Similarly, the mean hip circumference was also found the same between adult Nepali males (84.22± 9.30) and females (84.24± 9.29). The differences in mean hip circumference were statistically significant ($t=2.54$; $p<0.05$).

Table 2: Nutritional status among Nepali adult males and females of Sikkim

Sex	Total	Underweight	Normal	Overweight	Obesity
Male	600	43(7.17%)	378(63.00%)	160(26.67%)	19(3.16%)
Female	608	50(8.12%)	382(62.82%)	159(26.15%)	17(2.81%)

$\chi^2= 0.61$ df=3; $p>0.05$

Table 2 shows the nutritional status among Nepali adult males and females of rural areas of Sikkim. The table shows that the frequency of underweight was 7.17 percent and 8.12 percent among males and females respectively. The frequency of overweight and obesity among males was 26.67 percent and 3.16 percent respectively. Among females, frequency of overweight and obesity was 26.15 percent and 2.81 percent respectively.

Table 3: Nutritional status in relation with income group among the Nepali adult males

Income group	Total	Underweight	Normal	Overweight	Obesity
LIG	304	41(13.48%)	237(77.97%)	24(7.89%)	02(0.66%)
MIG	161	01(0.62%)	84(52.18%)	73(45.34%)	03(1.86%)
HIG	135	01(0.74%)	57(42.22 %)	63(46.67%)	14(10.37%)

$\chi^2=194.46$ df=6; $p<0.001$

Table 3 shows distribution of nutritional status in relation with income groups among adult males. Table shows that the frequency of underweight in lower income group, middle income group and high income group was 13.48 percent, 0.62 percent and 0.74 percent respectively. The frequency of overweight was found higher in higher income group (46.67%), followed by middle income group (45.34%) and low income group (7.89%). Obesity was also found higher in high income group (10.37%), followed by middle income group (1.86%) and low income group (0.66%). The distribution of nutritional status in relation with income groups among Nepali adult males was statistically significant (χ^2=194.46 df=6; p<0.001).

Table 3.1: Nutritional status in relation with income group among the Nepali adult females

Income group	Total	Underweight	Normal	Overweight	Obesity
LIG	303	46(15.18%)	234(77.22%)	21(6.93%)	02(0.67%)
MIG	160	04(2.50%)	81(50.31%)	70(43.75%)	05(3.13%)
HIG	145	00(0.00%)	67(46.21%)	68(46.89%)	10(6.90%)

χ^2=163.27 df=6; p<0.001

Table 3.1 shows distribution of nutritional status in relation to income groups among adult Nepali females. Table shows that the frequency of underweight in low income and middle income group was 15.18 percent and 2.50 percent respectively. The prevalence of both overweight (46.89%) and obesity (6.90%) was higher in high income group. This was followed by middle income group (overweight=43.75%, obesity=3.13%) and low income group (overweight=6.93%, obesity=0.67%). The distribution of nutritional status in relation to income group among Nepali females was statistically significant (χ^2=163.27; df=6; p<0.001).

Table 4: Nutritional status in relation with educational level among the Nepali adult males

Educational level	Total	Underweight	Normal	Overweight	Obesity
Primary	183	22(12.02%)	117(63.94%)	39(21.31%)	05(2.73%)
Secondary	225	09(4.00%)	146(64.89%)	63(28.00%)	07(3.11%)
H. Sec. +	192	12(6.25%)	115(59.91%)	58(30.20%)	07(3.64%)

χ^2=26.30; df=6; p<0.05

Table 4 shows the distribution of nutritional status in relation with educational levels among Nepali adult males. The table shows that the frequency of underweight, overweight and obesity was 12.02 percent, 21.31 percent and 2.73 percent respectively in primary level of education. In secondary level of education, the frequency of underweight, overweight and obesity was 4.00 percent, 28.00 percent and 3.11 percent respectively. Again, the frequency of underweight, overweight and obesity was 6.25 percent, 30.20 percent and obesity 3.64 percent respectively in higher secondary and above level of education. The differences in nutritional status in relation with education level were statically significant (χ^2=26.30; df=6; p<0.05).

Table 4.1: Nutritional status in relation with educational level among the Nepali adult females

Educational level	Total	Underweight	Normal	Overweight	Obesity
Primary	225	27(12.00%)	150(66.67%)	44(19.56%)	04(1.77%)
Secondary	174	12(6.90%)	110(63.23%)	40(22.99%)	12(6.88%)
H.sec+	209	11(5.26%)	122(58.37%)	75(35.90%)	01(0.47%)

χ^2=21.66; df= 6; p<0.05

Table 4.1 shows the distribution of nutritional status in relation with educational levels among Nepali adult females. The table shows that the frequency of

underweight in primary education, secondary education and higher secondary education was 12.00 percent, 6.90 percent and 5.26 percent respectively. The prevalence of overweight was higher among females who attained higher secondary education (35.90%), followed by secondary education (22.99%) and primary education (19.56%). Obesity was found higher in secondary education (6.88%), followed by primary education (1.77%) and higher secondary education (0.47%). The differences in nutritional status in relation with education level were statistically significant (χ^2=21.66; df=6; p<0.05).

Table 5: Nutritional status in relation with occupation among the Nepali adult males

Occupation	Total	Underweight	Normal	Overweight	Obesity
Govt.employ	159	1(0.63%)	66(41.50%)	76(47.81%)	16(10.06%)
Business	125	03(2.40%)	74(59.20%)	48(38.40%)	00(0.00%)
Farmer	234	32(13.67%)	171(73.09%)	28(11.96%)	03(1.28%)
Student	82	07(8.54%)	67(81.70%)	08(9.76%)	00(0.00%)

χ^2=140.94; df= 9; p<0.001

Table 5 shows distribution of nutritional status in relation with occupation among the Nepali adult males. The higher frequency of underweight was found among farmers (13.67%), followed by students (8.54%), business (2.40%) and government employees (0.63%). The table further shows that the frequency of both overweight (47.81%) and obesity (10.06%) was found higher among the government employees. It was followed by higher frequency of overweight (38.40%) among males engaged in business. Among farmers, the frequency of overweight and obesity was 11.96 percent and 1.28 percent respectively. Among students, the frequency of overweight was 9.76 percent. The distribution of nutritional status in relation with occupation among adult Nepali males was statistically significant (χ^2=140.94; df= 9; p <0.001).

Table 5.1: Nutritional status in relation with occupation among the Nepali adult females

Occupation	Total	Underweight	Normal	Overweight	Obesity
Govt.employ	87	02(2.29%)	36(41.38%)	41(47.13%)	08(9.20%)
Business	73	11(15.07%)	50(68.49%)	10(13.69%)	02(2.75%)
Housewife	357	32(8.96%)	232(64.98%)	86(24.11%)	07(1.95%)
Student	91	05(5.49%)	64(70.33%)	22(24.18%)	00(0.00%)

χ^2=60.64; df= 9; p<0.01

Table 5.1 shows the distribution of nutritional status in relation with occupation among the Nepali adult females. The higher frequency of underweight (15.07%) was found among females engaged in business. The frequencies of underweight among government employee, housewife and student were 2.29 percent, 8.96 percent and 5.49 percent respectively. The table further shows that the frequency of overweight (47.13%) and obesity (9.20%) was found higher among the government employees. The frequency of overweight among business, housewife and student was 13.69 percent, 24.11 percent and 24.18 percent respectively. Table further shows that the frequency of obesity among business and housewife was 2.75 percent and 1.95 percent respectively. The distribution of nutritional status in relation with occupation among Nepali adult females was statistically significant (χ^2=60.64; df=9; p<0.01).

Table 6: Nutritional status in relation with religion among the Nepali adult males

Religion	Total	Underweight	Normal	Overweight	Obesity
Hindu	473	39(8.25%)	307(64.90%)	115(24.31%)	12(2.54%)
Others	127	04(3.15%)	71(55.91%)	45(35.43%)	07(5.51%)

χ^2=5.22; df= 3; p>0.05

Table 6 shows the distribution of nutritional status in relation with different religions among the adult Nepali males. The table shows that the frequency of underweight

(8.25%) was higher in Hindu than other religions (3.15%). The frequency of both overweight (35.43%) and obesity (5.51%) was higher among other religions than Hindu (overweight=24.31%, obesity=2.54%). The distribution of nutritional status in relation with different religion was statistically insignificant (χ^2=5.22; df=3; p>0.05).

Table 6.1: Nutritional status in relation with religion among the Nepali adult females

Religion	Total	Underweight	Normal	Overweight	Obesity
Hindu	482	41(8.51%)	320(66.39%)	109(22.61%)	12(2.49%)
Others	126	09(7.14%)	62(49.20%)	50(39.66%)	05(4.00%)

χ^2=6.02; df= 3; p>0.05

The distribution of nutritional status in relation with different religions among adult Nepali females is given in table 6.1. The table shows that the frequency of underweight (8.51%) was slightly higher in Hindu than other religions (7.14%). The frequency of both overweight (39.66%) and obesity (4.00%) was higher among other religions than Hindu (overweight=22.61%, obesity=2.49%). The distribution of nutritional status in relation with different religions was statistically insignificant (χ^2=6.02; df=3; p>0.05).

Table 7: Nutritional status in relation with family type among the Nepali adult males

Family type	Total	Underweight	Normal	Overweight	Obesity
Joint	63	07(11.11%)	36(57.15%)	17(26.98%)	03(4.76%)
Nuclear	537	36(6.70%)	342(63.69%)	143(26.63%)	16(2.98%)

χ^2=2.48; df=3; p>0.05

Table 7 shows the distribution of nutritional status in relation with family type among the adult Nepali males. The table shows that the frequency of underweight was higher in joint family (11.11%) than nuclear family (6.70%). The frequency of overweight was found more or less the same between joint family (26.98%) and nuclear family

(26.63%). Table further shows that the frequency of obesity (4.76%) was slightly higher among joint family than nuclear family (2.98%). The distribution of nutritional status in relation with family type was statistically insignificant (χ^2=2.48; df=3; p>0.05).

Table 7.1: Nutritional status in relation with family type among the Nepali adult females

Family type	Total	Underweight	Normal	Overweight	Obesity
Joint	64	04(6.25%)	39(60.94%)	21(32.81%)	00(0.00%)
Nuclear	544	46(8.45%)	343(63.05%)	138(25.37%)	17(3.13%)

χ^2=2.48; df=3; p>0.05

Table 7.1 shows the distribution of nutritional status in relation with family type among adult Nepali females. The table shows that the frequency of underweight (8.45%) was higher in nuclear family than joint family (6.25%). The frequency of overweight (32.81%) was higher among joint family than the nuclear family (25.37%). Further, table shows that the frequency of obesity among joint family was 3.13 percent. The distribution of nutritional status in relation with family type was statistically insignificant (χ^2=2.48; df=3; p>0.05).

Table 8: Nutritional status in relation with family size among the Nepali adult males

Family size	Total	Underweight	Normal	Overweight	Obesity
≤4	121	14(11.57%)	62(51.24%)	41(33.89%)	04(3.30%)
5-6	219	11(5.02%)	147(67.12%)	53(24.20%)	08(3.66%)
≥7	260	18(6.92%)	169(65.00%)	66(25.38%)	07(2.70%)

χ^2=12.11; df= 6; p>0.05

Table 8 discusses about the distribution of nutritional status in relation with family size among the Nepali adult males. Table shows that the higher prevalence of

underweight was found in less than four family members (11.57%) followed by above seven family members (6.92%) and five to six family members (5.02%). The prevalence of overweight in less than four family members, five-six family members and above seven family members was 33.89 percent, 24.20 percent and 25.38 percent respectively. Table further shows that the prevalence of obesity in less than four family members, five-six family members and above seven family members was 3.30 percent, 3.66 percent and 2.70 percent respectively. The differences in nutritional status in relation with family size were statistically insignificant (χ^2=12.11; df=6; p>0.05).

Table 8.1: Nutritional status in relation with family size among the Nepali adult females

Family size	Total	Underweight	Normal	Overweight	Obesity
≤4	114	14(12.28%)	65(57.01%)	31(27.19%)	04(3.52%)
5-6	212	21(9.90%)	135(63.67%	50(23.59%)	06(2.84%)
≥7	282	15(5.31%)	182(64.54%)	78(27.65%)	07(2.50%)

χ^2=20.85; df= 6; p<0.05

Table 8.1 discusses the distribution of nutritional status in relation with family size among the Nepali adult females. Table shows that the prevalence of underweight was higher in less than four family members (12.28%), followed by five to six family members (9.90%) and above seven family members (5.31%). The prevalence of overweight in less than four family members, five-six family members and above seven family members was 27.19 percent, 23.59 percent and 27.65 percent respectively. Table further shows that the prevalence of obesity in less than four family members, five-six family members and above seven family members was 3.52 percent, 2.84 percent and 2.50 percent respectively. The differences in nutritional

status in relation with family size were statistically significant (χ^2=20.85; df=6; p<0.05).

Table 9: Nutritional status in relation with marital status among the Nepali adult males

Marital status	Total	Underweight	Normal	Overweight	Obesity
Married	421	32(7.60%)	245(58.19%)	125(29.70%)	19(4.51%)
Unmarried	179	11(6.14%)	133(74.30%)	35(19.56%)	00(0.00%)

χ^2=20.90; df=3; p<0.01

The distributions of nutritional status in relation with marital status among the Nepali adult males are given in table 9. The table shows that the frequency of underweight was slightly higher in married males (7.60%) than unmarried males (6.14%). The frequency of overweight was higher in married males (29.70%) than unmarried males (19.56%). The frequency of obesity in married males was 4.51 percent. The distribution of different nutritional status in relation with marital status among Nepali males was statistically significant. (χ^2=20.90; df=3; p<0.01).

Table 9.1: Nutritional status in relation with marital status among the Nepali adult females

Marital status	Total	Underweight	Normal	Overweight	Obesity
Married	418	39(9.33%)	251(60.04%)	114(27.27%)	14(3.36%)
Unmarried	190	11(5.79%)	131(68.95%)	45(23.68%)	03(1.58%)

χ^2=7.53; df=3; p>0.05

Table 9.1 shows the distribution of nutritional status in relation with marital status among Nepali adult females. The frequency of underweight was higher among married females (9.33%) than unmarried females (5.79%). The frequency of overweight was found higher among the married females (27.27%) than unmarried

females (23.68%). Similarly, obesity was higher among the married females (3.36%) than unmarried females (1.58%). The distribution of different nutritional status in relation with marital status among the Nepali females was statistically insignificant (χ^2=7.53; df=3; p>0.05).

Table 10: Risks of overweight/obesity in relation with socioeconomic conditions among adult Nepali males

Variables	N	Overweight/ obesity	OR(95% CI)	Significance level
Income group				
LIG	304	26(8.55%)	1	
MIG	161	76(47.20%)	9.560(5.757-15.877)	0.001
HIG	135	77(57.03%)	14.195 (8.381-24.034)	0.001
Family type				
Nuclear	537	159((29.61%)	1	
Joint	63	20(37.74%)	1.106(0.630-1.939)	0.726
Education				
Primary	183	44(24.04%)	1	
Secondary	225	70(31.11%)	1.406(0.904-2.188)	0.131
H.secondary+	192	65(33.33%)	1.642(1.046-2.577)	0.031
Occupation				
Students	82	08(9.75%)	1	
Govt.employee	159	92(57.86%)	12.701(5.739-28.112)	0.001
Business	125	48(38.40%)	5.766(2.556-13.009)	0.001
Farmer	234	31(13.24%)	1.413 (0.621-3.212)	0.410
Religion				
Others	127	52((40.94%)	1	
Hindu	473	127(26.84%)	0.529(0.352-0.763)	0.002
Marital status				
Unmarried	179	35(19.55%)	1	
Married	421	144(34.20%)	2.139(1.404-3.257)	0.001

OR= odd ratio; Cl=confidence interval; 1=reference value

The risk of overweight/obesity was significantly (p<0.001) higher among males from higher income group (OR=14.195; C.I=8.381-24.034), followed by males from middle income group (O.R=9.560; C.I=5.757-15.877). The prevalence of overweight/obesity was higher in joint family (37.74%) but statistically insignificant (p=0.726). The risk of overweight/obesity was higher among males who attained higher secondary education (OR=1.642; C.I=1.046-2.577; p<0.05), followed by secondary level of education (O.R=1.406; C.I=0.904-2.188). Table further shows that

the risk of overweight/obesity was higher among government employees (OR=12.701; C.I=5.739-28.112; p<0.001), followed by business (O.R=5.766; C.I=2.556-13.009; p<0.001). Males who followed Hindu religion also shows significantly (p<0.002) higher risks of overweight/obesity (OR=0.529; C.I=0.352-0.763). The risk of overweight/obesity was significantly (p<0.001) higher among married males (OR=2.139; C.I=1.404-3.257).

Table 10.1: Risks of overweight/obesity in relation with socioeconomic conditions among adult Nepali females

Variables	N	Overweight/ obesity	OR(95% CI)	Significance level
Income group				
LIG	303	24(7.59%)	1	
MIG	160	76(46.88%)	10.742(6.345-18.185)	0.001
HIG	145	77(53.79%)	14.173(8.292-24.224)	0.001
Family type				
Joint	64	21(32.81%)	1	
Nuclear	544	155(28.49%	0.816(0.469-1.420)	0.472
Education				
Primary	225	48(21.33%)	1	
Secondary	174	52(29.88%)	1.572(0.997-2.477)	0.051
H.secondary+	209	76(36.36%)	2.107 (1.377-3.225)	0.001
Occupation				
Students	91	22(24.17%)	1	
Business	73	12(21.43%)	0.990(0.992-2.220)	0.981
Housewives	357	95(26.61%)	1.016(0.596-1.733)	0.953
Govt.employee	87	49(56.32%)	4.044(2.132-7.676)	0.001
Religion				
Others	126	55(43.63%)	1	
Hindu	482	121(25.10%)	0.433(0.288-0.651)	0.001
Marital status				
Unmarried	190	48(25.26%)	1	
Married	418	128(30.62%)	1.306(0.886-1.924)	0.177

OR= odd ratio; Cl=confidence interval; 1=reference value

The risk of overweight/obesity was significantly (p<0.001) higher among females from higher income group (OR=14.173; C.I=8.292-24.224), followed by middle income group (O.R=10.742; C.I=6.345-18.185). The prevalence of overweight/obesity was higher in joint family (32.81%) but statistically insignificant (p=0.472). The risk of overweight/obesity was significantly (p<0.001) higher among

females who attained higher secondary level of education (OR=2.107; C.I=1.377-3.225) and government employee (OR=4.044; C.I= 2.132-7.676). The prevalence of overweight/obesity was higher among females who followed other religions (43.63%). The prevalence of overweight/obesity (30.62%) was higher among married females.

Table 11: Risks of underweight in relation with socioeconomic conditions among adult Nepali males

Variables	Number	Underweight	OR(95% CI)	Significance level
Family type				
Joint	537	07(11.11%)	1	
Nuclear	63	36(6.70%)	0.575(0.244-1.352)	0.205
Education				
H. secondary+	192	12(6.25%)	1	
Primary	183	22(12.02%)	2.061(0.989-4.297)	0.054
Secondary	225	09(4.00%)	0.631(0.260-1.532)	0.309
Religion				
Hindu	473	39(8.24%)	1	
Others	127	04(3.15%)	1.688(0.923-3.086)	0.089
Marital status				
Unmarried	179	11(6.17%)	1	
Married	421	32(7.60%)	1.256(0.619- 2.552)	0.528

OR= odd ratio; Cl=confidence interval; 1=reference value

The prevalence of underweight was higher among males from joint family (11.11%). The table further shows that the prevalence of underweight was higher among males who attained primary level of education (12.02%) and followed Hindu religion (8.24%). Married males (7.60%) show slightly higher prevalence of underweight.

Table 11.1: Risks of underweight in relation with socioeconomic conditions among adult Nepali females

Variables	Number	Underweight	OR(95% CI)	Significance level
Family type				
Joint	64	04(6.25%)	1	
Nuclear	544	46(8.45%)	0.722(0.251-2.075)	0.545
Education				
H. secondary+	209	11(5.26%)	1	
Primary	225	27(12.00%)	2.455(1.185-5.084)	0.016
Secondary	174	12(6.90%)	1.333(0.573-3.101)	0.504
Religion				
Hindu	482	41(8.51%)	1	
Others	126	09(7.14%)	0.827(0.391-1.751	0.620
Marital status				
Unmarried	190	11(5.79%)	1	
Married	418	39(9.33%)	1.675(0.838-3.346)	0.144

OR= odd ratio; Cl=confidence interval; 1=reference value

The prevalence of underweight was slightly higher among females from nuclear family (8.45%). The risk of underweight (12.00%) was significantly (p=0.016) higher among females who attained primary level of education (O.R=2.455; C.I=1.185-5.084). Table further shows that underweight was slightly higher among females who followed Hindu religion (8.51%) and married (9.33%).

CHAPTER-V

NUTRITIONAL STATUS IN RELATION WITH LIFESTYLES, FOOD HABITS AND SELF-REPORTED MORBIDITIES

Table 12: Nutritional status in relation with television time among the Nepali adult males

TV time	Total	Underweight	Normal	Overweight	Obesity
1-2 hrs.	402	43(10.50%)	316(78.63%)	42(10.45%)	01(0.42%)
3+ hrs.	198	00(0.00%)	62(31.31%)	118(59.59%)	18(9.10%)

χ^2=275.46; df=3, p<0.001

Table 12 shows the distribution of different nutritional status in relation with television watching time among the Nepali adult males. The prevalence of underweight was 10.50 percent among males watching television for one to two hours per day. The prevalence both overweight (59.59%) and obesity (9.10%) was higher among males watching television above three hours than watching television for one to two hours (overweight=10.45%, obesity=0.42%). The distribution of different nutritional status in relation with television watching was statistically significant (χ^2=275.46; df=3, p<0.001).

Table 12.1: Nutritional status in relation with television time among the Nepali adult females

TV time	Total	Underweight	Normal	Overweight	Obesity
1-2hrs	414	50(12.07%)	316(76.33%)	47(11.36%)	1(0.24%)
3+ hrs	194	00(0.00%)	66(34.02%)	112(57.73%)	16(8.25%)

χ^2=211.23; df=3, p<0.001

Table 12.1 shows the distribution of different nutritional status in relation with television watching time among Nepali adult females. Table shows that the

prevalence of underweight was 12.07 percent among females watching television for one to two hours per day. The prevalence of both overweight (57.73%) and obesity (8.25%) was higher among females watching television above three hours than watching television for one to two hours (overweight=11.36%, obesity=0.24%). The distribution of different nutritional status in relation with television watching was statistically significant (χ^2=211.23; df=3, p<0.001).

Table 13: Nutritional status in relation with using mobile phone among the Nepali adult males

Using phone	Total	Underweight	Normal	Overweight	Obesity
≤1hr	340	40(11.77%)	252(74.11%)	47(13.82%)	01(0.30%)
≥2hr	260	03(1.16%)	126(48.46%)	113(43.46%)	18(6.92%)

χ^2=146.22; df= 3; p<0.001

Table 13 shows the distribution of different nutritional status in relation with using mobile phone among Nepali adult males. Table shows that the higher prevalence of underweight was found among those who used mobile phone for one hour (11.77%) than two hours and above (1.16%). The higher prevalence of both overweight (43.46%) and obesity (6.92%) was found among those who used mobile phone two hours than one hour (overweight=13.82%, obesity=0.30%). The distribution of nutritional status in relation with using mobile phone among the adults Nepali males was statistically significant (χ^2=146.22; df=3; p<0.001).

Table 13.1: Nutritional status in relation with using mobile phone among the Nepali adult females

Using phone	Total	Underweight	Normal	Overweight	Obesity
≤hr	376	47(12.50%)	275(73.14%)	51(13.56%)	03(0.80%)
≥2hr	232	03(1.29%)	107(29.74%)	108(47.84%)	14(21.13%)

χ^2=125.67; df= 3; p<0.001

Table 13.1 shows the distribution of different nutritional status in relation with using mobile phone among Nepali adult females. Table shows that the higher prevalence of underweight was found among those who used mobile phone for one hour (12.50%) than two hours and above (1.29%). The higher prevalence of both overweight (47.84%) and obesity (21.13%) was found among those who used mobile phone two hours than one hour (overweight=13.56%, obesity=0.80%). The distribution of nutritional status in relation with using of mobile phone among the adults Nepali females was statistically significant (χ^2=125.67; df=3; p<0.001).

Table 14: Nutritional status in relation with sleep time among the Nepali adult males

Sleep time	Total	Underweight	Normal	Overweight	Obesity
≤7hrs	117	13(11.11%)	95(81.19%)	09(7.70%)	0(0.00%)
≥8hrs	483	30(6.22%)	283(58.59%)	151(31.26%)	19(3.93%)

χ^2=73.15; df=3; p<0.05

Table 14 discusses about the distribution of nutritional status in relation with sleep time among the Nepali adult males. Table shows that the higher prevalence of underweight (11.11%) was found among those who sleep for less than/equal to seven hours than eight hours and above (6.22%). The prevalence of overweight (31.26%) was higher among those who sleep eight hours and above than those who sleep less than/equal to seven hours (7.70%). The table further shows that the prevalence of obesity was 3.93 percent among those who sleep eight hours and above. The differences in nutritional status in relations with sleep time were statically significant (χ^2=73.15; df=3; p<0.05).

Table 14.1: Nutritional status in relation with sleep time among the Nepali adult females

Sleep time	Total	Underweight	Normal	Overweight	Obesity
≤7hrs	122	20(16.39%)	88(72.13%)	14(11.48%)	0(0.00%)
≥8hrs	486	30(6.17%)	294(60.49%)	145(29.84%)	17(3.50%)

χ^2=76.15; df=3; p<0.05

Table 14.1 discusses about the distribution of nutritional status in relation with sleep time among the Nepali adult females. The table shows that the higher prevalence of underweight (16.39%) was found among those who sleep for less than/equal to seven hours than eight hours and above (6.17%). The prevalence of overweight (29.84%) was higher among those who sleep eight hours and above than those who sleep less than/equal to seven hours (11.48%). The table further shows that the prevalence of obesity was 3.50 percent among those who sleep eight hours and above. The differences in nutritional status in relations with sleep time were statically significant (χ^2=76.15; df=3; p<0.05).

Table 15: Nutritional status in relation with vegetarian and non-vegetarian among the Nepali adult males

Category	Total	Underweight	Normal	Overweight	Obesity
Vegetarian	188	9(4.80%)	114(60.64%)	53(28.18%)	12(6.38%)
Non- veg.	412	34(8.25%)	264(64.07%)	107(25.97%)	07(1.71%)

χ^2=3.62; df=3; p>0.05

Distribution of different nutritional status in relation with vegetarian and non-vegetarian among Nepali adult males is shown in table 15. The table shows that the prevalence of underweight was higher among males who are non-vegetarian (8.25%) than vegetarian (4.80%). The prevalence of overweight was higher among the

vegetarian (28.18%) than non-vegetarian (25.97%). Similarly, the prevalence of obesity was found higher among vegetarian (6.38%) than the non-vegetarian (1.71%). The distribution of different nutritional status in relation with vegetarian and non-vegetarian was statistically insignificant (χ^2=3.62; df=3; p>0.05).

Table 15.1: Nutritional status in relation with vegetarian and non-vegetarian among the Nepali adult females

Category	Total	Underweight	Normal	Overweight	Obesity
Vegetarian	207	26(12.56%)	113(54.59%)	64(30.92%)	04(1.93%)
Non-veg.	401	24(5.98%)	269(67.08%)	95(23.69%)	13(3.25%)

χ^2=8.90; df=3; p<0.05

Table 15.1 shows the distribution of different nutritional status in relation vegetarian and non-vegetarian among the adults Nepali females. The table shows that the prevalence of underweight was higher among females who are vegetarian (12.56%) than non-vegetarian (5.98%). The prevalence of overweight was higher among vegetarian (30.92%) than the non-vegetarian (23.69%). However, the prevalence of obesity was found slightly higher non-vegetarian (3.25%) than vegetarian (1.93%). The distribution of different nutritional status in relation with vegetarian and non-vegetarian was statistically significant (χ^2=8.90; df=3; p<0.05).

Table 16: Nutritional status in relation with non-vegetarian consumption per week among the Nepali adult males

Non-veg. intake	Total	Underweight	Normal	Overweight	Obesity
1-2times	218	32(14.68%)	176(80.72%)	08(3.66%)	02(0.94%)
3+times	194	02(1.03%)	89(45.87%)	98(50.52%)	05(2.58%)

χ^2=172.01; df=3; p<0.001

The distribution of different nutritional status in relation with non-veg intake among the adults Nepali males is shown in table 16. The table shows that the prevalence of underweight was higher among males who took non-veg one to two times (14.68%) per week than three times and above (1.03%). The prevalence of both overweight (50.52%) and obesity (2.58%) was higher among males who took non-veg three times and above per week than one to two times per week (overweight=3.66%, obesity=0.94%). The distribution of different nutritional status in relation with non-veg intake was statistically significant (χ^2=172.01; df=3; p<0.001).

Table 16.1: Nutritional status in relation with non-vegetarian consumption per week among the Nepali adult females

Non-veg. intake	Total	Underweight	Normal	Overweight	Obesity
1-2times	203	21(10.34%)	163(80.29%)	17(8.38%)	02(0.99%)
3+times	198	03(1.52%)	106(53.54%)	78(39.39%)	11(5.55%)

χ^2=95.59; df=3; p<0.001

Table 16.1 discusses the distribution of different nutritional status in relation with non- veg intake among the adults Nepali females. The table shows that the prevalence of underweight was higher among females who took non-veg one to two times (10.34%) per week than three times and above (1.52%) per week. The prevalence of both overweight (33.39%) and obesity (5.55%) was higher among females who took non-veg three times and above per week than one to two times per week (overweight=8.37%, obesity=0.99%). The distribution of different nutritional status in relation with non-veg intake was statistically significant (χ^2=95.59; df=3; p<0.001).

Table 17: Nutritional status in relation with consumption of milk tea per day among the Nepali adult males

Milk tea	Total	Underweight	Normal	Overweight	Obesity
Never	122	15(12.29%)	100(81.97%)	07(5.74%)	00(0.00%)
1-2times	306	27(8.82%)	214(69.94%)	59(19.28%)	06(1.96%)
≥3times	172	01(0.58%)	64(37.20%)	94(54.65%)	13(7.56%)

χ^2=135.17; df=6; p<0.001

Table 17 shows the distribution of different nutritional status in relation with consumption of milk tea among the adults Nepali males. The prevalence of underweight was higher among males who never took milk tea (12.29%), followed by males who took milk tea one to times (8.82%) and above three times (0.58%). The prevalence of both overweight (54.65%) and obesity (7.56%) was higher among males who took milk tea three times and above per day, followed by males who took milk tea one to two times (overweight=19.28%, obesity=1.96%) and never (overweight= 5.74%). The distribution of different nutritional status in relation with consumption of milk tea was statistically significant (χ^2=135.17; df=6; p<0.001).

Table 17.1: Nutritional status in relation with consumption of milk tea per day among the Nepali adult females

Milk tea	Total	Underweight	Normal	Overweight	Obesity
Never	135	15(11.11%)	112(82.97%)	06(4.44%)	02(1.48%)
1-2times	292	34(11.64%)	195(66.79%)	55(18.83%)	08(2.74%)
≥3times	181	01(0.55%)	75(41.44%)	98(54.15%)	07(3.86%)

χ^2=128.22; df=6; p<0.001

Table 17.1 shows the distribution of different nutritional status in relation with consumption of milk tea among the adult Nepali females. The higher prevalence of

underweight was found more or less the same among females who never consumed milk tea (11.11%) and who took milk tea one to two times per day (11.64%). It was found 0.55 percent among females who took milk tea three times and above per day. The prevalence of both overweight (54.15%) and obesity (3.86%) was higher among the females who took milk tea three times and above per day. Overweight was found 18.83 percent and obesity was found 2.74 percent among females who took milk tea one to two times per day. The table further shows that the prevalence of overweight and obesity was 4.44 and 1.48 percent respectively among females who never took milk tea. The distribution of different nutritional status in relation with consumption of milk tea was statistically significant (χ^2=128.22; df=6; p<0.001).

Table 18: Nutritional status in relation with consumption of milk among the Nepali adult males

Milk intake	Total	Underweight	Normal	Overweight	Obesity
Regular	348	18(5.17%)	173(49.71%)	139(39.95%)	18(5.17%)
Irregular	252	25(9.92%)	205(81.35%)	21(8.33%)	01(0.40%)

χ^2=104.69; df=3; p<0.001

Table 18 shows the distribution of different nutritional status in relation with consumption of milk among the adult Nepali males. The prevalence of underweight was found higher among males who consumed milk irregularly (9.92%) than regularly (5.17%). However, the prevalence of both overweight (39.95%) and obesity (5.17%) was found higher among the males who took milk regularly than irregularly (overweight=8.33%, obesity=0.40%). The distribution of different nutritional status in relation with consumption of milk was statistically significant (χ2=104.69; df=3; p<0.001).

Table 18:1 Nutritional status in relation with consumption of milk consumption among the Nepali adult females

Milk intake	Total	Underweight	Normal	Overweight	Obesity
Regular	349	14(4.01%)	172(34.67%)	149(42.69%)	14(18.63%)
Irregular	259	36(13.89%)	200(71.44%)	10(12.74%)	03(1.93%)

χ^2=149.38; df=3; p<0.01

Table 18.1 shows the distribution of different nutritional status in relation with consumption of milk among the adult Nepali females. The prevalence of underweight was found higher among females who consumed milk irregularly (13.89%) than regularly (4.01%). However, the prevalence of both overweight (42.69%) and obesity (18.63%) was found higher among the females who took milk regularly than consumed milk irregularly (overweight=12.74%, obesity=1.93%). The distribution of different nutritional status in relation with consumption of milk was statistically significant (χ^2=149.38; df=3; p<0.001).

Table 19: Nutritional status in relation with consumption of butter among the Nepali adult males

Butter intake	Total	Underweight	Normal	Overweight	Obesity
No	314	38(12.10%)	242(77.93%)	33(10.51%)	01(0.32%)
Yes	286	05(1.75%)	136(47.33%)	127(44.41%)	18(6.29%)

χ^2=132.68; df=3; p<0.001

The distribution of different nutritional status in relation with consumption of butter among the adult Nepali males is given in table 19. The table shows that the prevalence of underweight was higher among males who never consumed butter (12.10%) than who consumed butter (1.75%). However, the prevalence of both overweight (44.41%) and obesity (6.29%) was found higher among the males who consumed butter than

those who never consumed butter (overweight=10.51%, obesity=0.32%). The distribution of different nutritional status in relation with consumption of butter was statistically significant (χ^2=132.68; df=3; p<0.001).

Table 19.1: Nutritional status in relation with consumption of butter among adult Nepali females

Butter intake	Total	Underweight	Normal	Overweight	Obesity
No	308	45(14.61%)	240(77.93%)	18(5.84%)	05(1.62%)
Yes	300	05(1.67%)	142(47.33%)	141(47.00%)	12(4.00%)

χ^2=149.38; df=3; p<0.001

Table 19.1 shows the distribution of different nutritional status in relation with consumption of butter among the adult Nepali females. The table shows that the prevalence of underweight was found higher among females who never consumed butter (14.61%) than who consumed butter (1.67%). However, the prevalence of both overweight (47.00%) and obesity (4.00%) was found higher among the females who consumed butter than those who never consumed butter (overweight=5.84%, obesity=1.62%). The distribution of different nutritional status in relation with consumption of butter was statistically significant (χ^2=149.38; df=3; p<0.001).

Table 20: Nutritional status in relation with consumption of fast food among the Nepali adult males

Fast food	Total	Underweight	Normal	Overweight	Obesity
Yes	350	03(0.86%)	182(52.00%)	146(41.71%)	19(5.43%)
No	250	40(16.00%)	196(78.40%)	14(5.60%)	00(0.00%)

χ^2=60.46; df=3; p<0.001

Table 20 shows the distribution of different nutritional status in relation with consumption of fast foods among the adult Nepali males. The higher prevalence of

underweight (16.00%) was found among those who never consumed fast foods than those who consumed fast foods (0.86%). The prevalence of both overweight (41.71%) and obesity (5.43%) was higher among those who consumed fast foods than those who never consumed fast foods (overweight=5.60%). The distribution of different nutritional status in relation with consumption of fast foods was statistically significant (χ^2=60.46; df=3; p<0.001).

Table 20.1: Nutritional status in relation with consumption of fast food among the Nepali adult females

Fast food	Total	Underweight	Normal	Overweight	Obesity
Yes	370	07(1.89%)	194(52.43%)	152(41.08%)	17(4.59%)
No	238	43(18.06%)	188 (78.99%)	07(2.95%)	00(0.00%)

χ^2=76.15; df=3; p<0.001

Table 20.1 shows the distribution of different nutritional status in relation with consumption of fast foods among the adult Nepali females. The higher prevalence of underweight (18.06%) was found among those who never consumed fast foods than those who consumed fast foods (1.89%). The prevalence of both overweight (41.08%) and obesity (4.59%) was found higher among those who consumed fast foods than those who never consumed fast foods (overweight=2.95%). The distribution of different nutritional status in relation with consumption of fast foods was statistically significant (χ^2=76.15; df=3; p<0.001).

Table 21: Nutritional status in relation with consumption of packet food among the Nepali adult males

Packet food	Total	Underweight	Normal	Overweight	Obesity
Yes	538	23(4.27%)	338(62.83%)	158(29.37%)	19(3.53%)
No	62	20(32.25%)	40(64.52%)	02(3.23%)	00(0.00%)

χ^2=14.15; df=3; p<0.05

Table 21 shows the distribution of different nutritional status in relation with consumption of packet foods among the adult Nepali males. The higher prevalence of underweight (32.25%) was found among those who never consumed packet foods than those who consumed packet foods (4.27%). However, the prevalence of both overweight (29.37%) and obesity (3.53%) was found higher among those who consumed packet foods than those who never consumed packet foods (overweight=3.23%). The distribution of different nutritional status in relation with consumption of packet foods was statistically significant (χ^2=14.15; df=3; p<0.05).

Table 21.1: Nutritional status in relation with consumption of packet food among the Nepali adult females

Packet food	Total	Underweight	Normal	Overweight	Obesity
Yes	547	34(6.23%)	338(61.79%)	158(28.88%)	17(3.10%)
No	61	16(26.23%)	44(72.13%)	01(1.64%)	00(0.00%)

χ^2=18.04; df=3; p<0.05

Table 21.1 shows the distribution of different nutritional status in relation with consumption of packet foods among the adult Nepali females. The higher prevalence of underweight (26.23%) was found among those who never consumed packet foods than those who consumed packet foods (6.23%). However, the prevalence of both overweight (28.88%) and obesity (3.10%) was found higher among those who consumed packet foods than those who never consumed packet foods (overweight=1.64%). The distribution of different nutritional status in relation with consumption of packet foods was statistically significant (χ^2=18.04; df=3; p<0.05).

Table 22: Nutritional status in relation with number of meals intake among the Nepali adult males

Meals per day	Total	Underweight	Normal	Overweight	Obesity
2times	89	26(29.21%)	61(68.54%)	02(2.25%)	00(0.00%)
3times	511	17(3.37%)	317(62.03%)	158(30.92%)	19(3.68%)

χ^2=29.17; df=3; p<0.01

Table 22 shows the distribution of different nutritional status in relation with meals intake among the adult Nepali males. The higher prevalence of underweight (29.21%) was found among those who took meals two times per day than those who took meals three times per day (3.37%). However, the prevalence of both overweight (30.92%) and obesity (3.68%) was found higher among those who took meals three times per day than who took meals two times per day (overweight=2.25%). The distribution of different nutritional status in relation with number of meals intake was statistically significant (χ^2=29.17; df=3; p<0.01).

Table 22.1: Nutritional status in relation with number of meals intake among the Nepali adult females

Meals per day	Total	Underweight	Normal	Overweight	Obesity
2times	100	17(17.00%)	82(82.00%)	01(1.00%)	00(0.00%)
3times	508	33(6.49%)	300(59.05%)	158(31.10%)	17(3.39%)

χ^2=43.05; df=3; p<0.001

Table 22.1 shows the distribution of different nutritional status in relation with number of meals intake among the adult Nepali females. The higher prevalence of underweight (17.00%) was found among those who took meals two times per day than those who took meals three times per day (6.49%). However, the prevalence of both overweight (31.10%) and obesity (3.39%) was found higher among those who

took meals three times per day than who took meals two times per day (overweight=1.00%). The distribution of different nutritional status in relation with number of meals intake was statistically significant (χ^2=43.05; df=3; p<0.001).

Table 23: Nutritional status in relation with salt tea intake among the Nepali adult males

Salt tea	Total	Underweight	Normal	Overweight	Obesity
No	189	23(12.17%)	105(55.55%)	55(29.10%)	06(3.17%)
Yes	411	20(4.86%)	273(66.42%)	105(25.55%)	13(3.16%)

χ^2=35.17; df=3; p<0.01

Table 23 shows the distribution of different nutritional status in relation with consumption of salt tea among the adults Nepali males. The prevalence of underweight (12.17%) was higher among males who never took salt tea than those who took salt tea (4.86%). The prevalence of overweight (29.10%) was found higher among males who did not take salt tea than those who took salt tea (25.55%). However, the prevalence of obesity was found more or less the same among those who never took salt tea (3.17%) and those who took salt tea (3.16%). The distribution of different nutritional status in relation with consumption of salt tea was statistically significant (χ^2=35.17; df=3; p<0.01).

Table 23.1: Nutritional status in relation with salt tea intake among the Nepali adult females

Salt tea	Total	Underweight	Normal	Overweight	Obesity
No	204	18(8.85%)	111(54.41%)	74(36.27%)	01(0.47%)
Yes	404	32(7.92%)	271(59.65%)	85(21.04%)	16(3.96%)

χ^2=26.37; df=3; p<0.01

Table 23.1 shows the distribution of different nutritional status in relation with consumption of salt tea among the adults Nepali females. The prevalence of

underweight (8.85%) was slightly higher among females who never took salt tea than those who took salt tea (7.92%). Similarly, the prevalence of overweight (36.27%) was found higher among females who never took salt tea than those who took salt tea (21.04%). However, the prevalence of obesity was found higher among those who took salt tea (3.96%) than those who never took salt tea (0.47%). The distribution of different nutritional status in relation with consumption of salt tea was statistically significant (χ^2=26.37; df=3; p<0.01).

Table 24: Nutritional status in relation with physical activity among the Nepali adult males

Physical activity	Total	Underweight	Normal	Overweight	Obesity
≤ 1hrs	288	4(1.40%)	143(49.65%)	125(43.40%)	16(5.55%)
≥2 hrs	312	39(12.50%)	235(75.32%)	35(11.22%)	03(0.96%)

χ^2=125.24; df=3, p<0.001

The distribution of different nutritional status in relation with physical activity among adult Nepali males is given in table 24. This table shows that the higher prevalence of underweight was found among those who exercised two hours and above (12.50%) than those who exercised one hour (1.40%). However, the prevalence of both overweight (43.40%) and obesity (5.55%) was reported higher among those who exercised less than/equal to one hour than those who exercised two hours and above (overweight=11.22%, obesity=0.96%). The distribution of different nutritional status in relation with physical activity was statistically significant (χ^2=125.24; df=3, p<0.001).

Table 24.1: Nutritional status in relation with physical activity among the Nepali adult females

Physical activity	Total	Underweight	Normal	Overweight	Obesity
≤1hrs	299	06(2.00%)	153(51.17%)	130(43.45%)	10(3.38%)
≥2hrs	309	44(14.23%)	229(74.11%)	29(9.38%)	07(2.28%)

χ^2=86.98; df=3, p<0.001

Table 24.1 shows the distribution of different nutritional status in relation with physical activity among adult Nepali females. The table shows that the higher prevalence of underweight was found among those who exercised two hours and above (14.23%) than those who exercised less than/equal to one hour (2.00%). However, the prevalence of both overweight (43.45%) and obesity (3.38%) was reported higher among those who exercised less than/equal to one hour than those exercised two hours and above (overweight=9.38%, obesity=2.28%). The distribution of different nutritional status in relation with physical activity was statistically significant (χ^2=86.98; df=3, p<0.001).

Table 25: Nutritional status in relation with types of work among the Nepali adult males

Types of work	Total	Underweight	Normal	Overweight	Obesity
Mild	450	14(3.11%)	258(57.33%)	160(35.56%)	18(4.00%)
Moderate	150	29(19.33%)	120(80.00%)	00(0.00%)	01(0.67%)

χ^2=130.56; df=3; p<0.001

Table 25 shows the distribution of nutritional status in relation with types of work among the adult Nepali males. The table shows that the higher prevalence of underweight was recorded among males who engaged in moderate types of work (19.33%) than mild works (3.11%). However, the higher frequency of both

overweight (35.56%) and obesity (4.00%) was found among males who engaged in mild types of work than moderate works (obesity=0.67%). The distribution of different nutritional status in relation with types of work among adult Nepali males was statistically significant (χ^2=130.56; df=3; p<0.001).

Table 25.1: Nutritional status in relation with types of work among the Nepali adult females

Types of work	Total	Underweight	Normal	Overweight	Obesity
Mild	511	28(5.47%)	308(60.27%)	158(30.93%)	17(3.33%)
Moderate	97	22(22.68%)	74(76.28%)	01(1.01%)	01(1.03%)

χ^2=82.98; df=3; p<0.001

The distribution of nutritional status in relation with types of work among adult Nepali females is given in table 25.1. Table shows that the higher prevalence of underweight was found among those who engaged in moderate types of work (22.68%) than mild works (5.47%). However, the higher prevalence of both overweight (30.93%) and obesity (3.33%) was found among those who engaged in mild types of work than moderate works (overweight=1.01%, obesity=1.03%). The distribution of different nutritional status in relations with physical activity among adult Nepali females was statistically significant (χ^2=82.98; df=3; p<0.001).

Table 26: Nutritional status in relation with alcohol consumption among Nepali adult males

Alcohol consumption	Total	Underweight	Normal	Overweight	Obesity
No	401	32(7.98%)	241(60.11%)	114(28.43%)	14(3.43%)
Yes	199	11(5.52%)	137(68.83%)	46(23.13%)	05(2.52%)

χ^2=3.11; df= 3; p>0.05

Distribution of nutritional status in relation with alcohol consumption among adult Nepali males is discussed in table 26. The table shows that the prevalence of underweight was slightly higher among those who never consumed alcohol (7.98%) than those who consumed alcohol (5.52%). Table further shows that the prevalence of overweight was also higher among those who never consumed alcohol (28.43%) than those who consumed alcohol (23.13%). Similarly, the prevalence of obesity was slightly higher among those who never consumed alcohol (3.43%) than those who consumed alcohol (2.52%). The distribution of different nutritional status in relation with alcohol consumption among adult Nepali males was statistically insignificant (χ^2=3.11; df=3; p>0.05).

Table 26.1: Nutritional status in relation with alcohol consumption among Nepali adult females

Alcohol consumption	N	Underweight	Normal	Overweight	Obesity
No	466	44(9.44%)	273(58.59%)	139(29.83%)	10(2.14%)
Yes	142	06(4.22%)	109(76.76%)	20(14.08%)	07(4.93%)

χ2=13.33; df=3; p<0.05

Table 26.1 shows the distribution of nutritional status in relation with alcohol consumption among adult Nepali females. The table shows that the prevalence of underweight was higher among those who never consumed alcohol (9.44%) than those who consumed alcohol (4.22%). Table further shows that the prevalence of overweight was also higher among those who never consumed alcohol (29.83%) than those who consumed alcohol (14.08%). However, obesity was found slightly higher among those who consumed alcohol (4.93%) than those who never consumed alcohol (2.14%). The distribution of different nutritional status in relation with alcohol

consumption among adult Nepali females was statistically significant (χ^2=13.33; df= 3; p<0.05).

Table 27: Nutritional status in relation with self-reported morbidities among Nepali adult males

Self-reported morbidity	Total	Underweight	Normal	Overweight	Obesity
Yes	165	18(10.90%)	89(53.94%)	48(29.10%)	10(6.06%)
No	435	25(5.74%)	289(66.44%)	112(25.75%)	09(2.07%)

χ^2=12.19; df=3; p<0.05

Table 27 shows the distribution of nutritional status in relation with self-reported morbidities among the Nepali adult males. The prevalence of underweight was found higher among those who are suffering from morbidities (10.90%) than those who are not suffering from morbidities (5.74%). Overweight (29.10%) and obesity (6.06%) was also found higher among males who are suffering from morbidities than those who are not suffering from morbidities (overweight=25.75%; obesity=2.07%). The distribution of nutritional status in relation with self-reported morbidities among Nepali adult males was statistically significant (χ^2=12.19; df=3; p<0.05).

Table 27.1: Nutritional status in relation with self-reported morbidities among Nepali adult females

Self-reported morbidity	Total	Underweight	Normal	Overweight	Obesity
Yes	124	12(9.68%)	64(51.61%)	39(31.45%)	09(7.26%)
No	484	38(7.85%)	318(65.71%)	120(24.79%)	08(1.65%)

χ^2=20.86; df=3; p<0.01

The distribution of nutritional status in relation with self-reported morbidities among the Nepali adult females is given in table 27.1. The prevalence of underweight was found higher among those who are suffering from morbidities (9.68%) than those who

are not suffering from morbidities (7.85%). Similarly, the prevalence of overweight (31.45%) and obesity (7.26%) was also found higher among females who are suffering from morbidities than those who are not suffering from morbidities (overweight=24.79%; obesity=1.65%). The distribution of nutritional status in relation with self-reported morbidities among Nepali adult females was statistically significant (χ^2=20.86; df=3; p<0.01).

Table 28: Nutritional status and types of self-reported morbidities among Nepali adult males

Types of morbidities	Total	Underweight	Normal	Overweight	Obesity
Diabetics	22	00(0.00%)	09(40.92%)	12(54.54%)	01(1.54%)
Hypertension	86	09(10.46%)	49(59.03%)	23(26.74%)	05(5.81%)
Joint/back pain	52	08(15.38%)	27(51.92%)	13(25.00%)	04(7.69%)
TB	5	01(20.00%)	04(80.00%)	00(0.00%)	00(0.00%)

χ^2=129.92;df=9; p<0.001

Table 28 shows the nutritional status and types of self-reported morbidities among the Nepali adult males. The frequency of TB (20.00%) was found higher among underweight males, followed by back pain (15.38%) and hypertension (10.46%). Among overweight males, the frequency of diabetes (54.54%) was found higher, followed by hypertension (26.74%) and back pain (25.00%). Table further shows that the frequency of back pain (7.69%) was found higher among obese males followed by hypertension (5.81%) and diabetics (1.54%). The distribution of nutritional status and types of self-reported morbidities among Nepali adult males was statistically significant (χ^2=129.92; df=9; p<0.001).

Table 28.1: Nutritional status and types of self-reported morbidities among Nepali adult females

Types of morbidities	Total	Underweight	Normal	Overweight	Obesity
Diabetics	23	1(4.34%)	14(60.87%)	08(34.78%)	00(0.00%)
Hypertension	70	08(11.43%)	33(47.14%)	23(32.85%)	06(8.57%)
Joint /back pain	25	03(12.00%)	12(48.00%)	06(24.00%)	04(16.00%)
TB	06	0(0.00%)	05(83.33%)	1(16.67%)	00(0.00%)

χ^2=4.78; df=9; p>0.05

Table 28.1 shows the nutritional status and types of self-reported morbidities among Nepali adult females. The frequency of back pain (12.00%) was found higher among underweight females, followed hypertension (11.42%) and diabetes (4.34%). Among overweight females, the frequency of diabetics (34.78%) was found slightly higher, followed by hypertension (32.85%), back pain (24.00%) and TB (16.67%). Table further shows that the frequency of back pain (16.00%) was found higher among obese females, followed by hypertension (8.57%). The distribution of nutritional status and types of self-reported morbidities among Nepali adult females was statistically insignificant (χ^2=4.78; df=9; p>0.05).

Table 29: Nutritional status in relation with self-reported health status among Nepali adult males

Health status	Total	Underweight	Normal	Overweight	Obesity
Excellent	306	11(3.59%)	180(58.82%)	105(34.31%)	10(3.28%)
Good	174	17(9.77%)	134(77.01%)	20(11.49%)	03(1.73%)
Poor	120	15(12.50%)	64(55.33%)	35(29.17%)	06(5.00%)

χ^2=48.37; df=6; p<0.01

Table 29 shows the nutritional status in relation with self-reported health status among adult Nepali males. The prevalence of underweight was found higher among males

who have poor health status (12.50%), followed by good health status (9.77%) and excellent health status (3.59%). The prevalence of overweight was found higher among males who have excellent health status (34.31%), followed by poor health (29.17%) and good health (11.49%). However, the prevalence of obesity was found higher among males who have poor health status (5.00%), followed by excellent health (3.28%) and good health (1.73%). The distribution of nutritional status and self-reported health status among Nepali adult males was statistically significant (χ^2=48.37; df=6; p<0.01).

Table 29.1: Nutritional status in relation with self-reported health status among Nepali adult females

Health status	Total	Underweight	Normal	Overweight	Obesity
Excellent	315	19(6.03%)	184(58.41%)	104(33.01%)	08(2.55%)
Good	177	20(11.30%)	134(75.71%)	20(11.30%)	03(1.69%)
Poor	116	11(9.48%)	64(55.17%)	35(30.17%)	06(5.18%)

χ^2=36.68; df=6; p<0.01

Table 29.1 shows the nutritional status and self-reported health status among adult Nepali females. The prevalence of underweight was found higher among females who have good health status (11.30%), followed by poor health status (9.48%) and excellent health (6.03%). The prevalence of overweight was found higher among females who have excellent health status (33.01%), followed by poor health (30.17%) and good health (11.30%). However, the prevalence of obesity was found higher among females who have poor health (5.18%), followed by excellent health (2.55%) and good health (1.69%). The distribution of nutritional status and self-reported health status among adult Nepali females was statistically significant (χ^2=36.68; df=6; p<0.01).

Table 30: Risks of overweight/obesity in relation with lifestyles among adult Nepali males

Variables	N	Overweight/ obesity	OR(95% CI	Significance level
Television time				
1-2hours	402	43(10.69%)	1	
3+hours	198	136(68.68%)	18.314(11.840-28.327)	0.001
Physical activity				
≥2 hours	312	38 (12.17%)	1	
≤ 1hours	288	141(48.95%)	6.916(4.588-10.426)	0.001
Types of work				
Moderate	150	01(0.67%)	1	
Mild	450	178(39.55%)	0.010(0.001-0.074)	0.001
Sleeping time				
≥8hours	483	170(35.19%)	1	
≤7hours	117	09(7.69%)	0.153(0.76-0.311)	0.001

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 30 shows that the risk of overweight/obesity was significantly ($p<0.001$) higher among males who watched television three hours and above (OR=18.314; C.I=11.840-28.327), exercised less than/equal to one hour (OR=6.916; C.I=4.588-10.426) and involved in mild physical activity (OR=0.010; C.I=0.001-0.074). The prevalence of overweight/obesity was found higher among males who sleep for eight hours and above (35.19%).

Table 30.1: Risks of overweight/obesity in relation with lifestyles among adult Nepali females

Variables	N	Overweight/ obesity	OR(95% CI)	Significance level
Television time				
1-2hours	414	48(11.59%)	1	
3+hours	194	128(65.98%)	11.727(7.782-17.672)	0.001
Physical activity				
≥2 hours	309	36 (11.65%)	1	
≤1hours	299	140(46.82%)	6.677(4.408-10.114)	0.001
Types of work				
Moderate	97	01(1.03%)	1	
Mild	511	175(34.24%)	50.00(6.913-361.63)	0.001
Sleeping time				
≥8hours	486	162(33.33%)	1	
≤7hours	122	14(11.47%)	0.259(0.144-0.467)	0.001

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 30.1 shows that the risk of overweight/obesity was significantly (p<0.001) higher among females who watched television three hours and above (OR=11.727; C.I=7.782-17.672), exercised less than/equal to one hour (OR=6.677; C.I=4.408-10.114) and involved in mild physical activity (OR=50.00; C.I=6.913-361.63).The table further shows that the prevalence of overweight/obesity was found higher among females who sleep for eight hours and above (33.33%).

Table 31: Risks of underweight in relation with lifestyles among adult Nepali males

Variables	N	Underweight	OR(95% CI	Significance level
Physical activity				
≥1 hours	288	4(1.40%)	1	
≤ 2hours	312	39(12.50%)	8.902(4.571-17.355)	0.001
Types of work				
Moderate	150	29(19.33%)	1	
Mild	450	14(3.11%)	0.176(0.114-0.272)	0.001
Sleeping hour				
≥8hours	483	30(6.28%)	1	
≤7hours	117	13(11.11%)	1.887(0.952-3.744)	0.690

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 31 shows that the risk of underweight was significantly (p<0.001) higher among males who engaged in physical activity for two hours and above (OR=8.902; C.I=4.571-17.355) and moderate types of works (19.33%). Table further shows that the prevalence of underweight was higher among those who sleep less than/equal to seven hours (11.11%).

Table 31.1: Risks of underweight in relation with lifestyles among adult Nepali females

Variables	N	Underweight	OR(95% CI)	Significance level
Physical activity				
≥2 hours	309	44(14.23%)	1	
≤ 1hours	299	06(2.00%)	0.213(0.530-0.847)	0.028
Types of work				
Moderate	97	22(22.68%)	1	
Mild	511	28(5.47%)	0.198(0.107-0.363)	0.001
Sleeping time				
≥8 hours	486	30(6.17%)	1	
≤7hours	122	20(16.39%)	2.980(1.627-5.459)	0.001

Table 31.1 shows that the prevalence of underweight was higher among females who engaged in physical activity for two hours and above (14.23%) and moderate types of work (22.68%). Table further shows that the risk of underweight was significantly ($p<0.001$) higher among females who sleep for less than/equal to seven hours (OR=2.980; C.I=1.627-5.459).

Table 32: Risks of overweight/obesity in relation with food habits among adult Nepali males

Variables	N	Overweight/ obesity	OR(95% CI)	Significance level
Food habit				
Vegetarian	188	65(34.57%)	1	
Non-vegetarian	412	114(27.66%)	0.724(0.500-1.048)	0.870
Fast food				
No	250	14 (5.60%)	1	
Yes	350	165(47.14%)	15.035(8.430-26.814)	0.001
Packet food				
No	62	02(3.22%)	1	
Yes	538	177(52.36%)	14.709(3.555-60.868)	0.001
Salt tea				
Yes	411	118(28.71%)	1	
No	189	61(32.28%)	1.183(0.815-1.717)	0.376

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 32 shows that the prevalence of overweight/obesity was higher in vegetarian males (34.57%) than non-vegetarians (27.66%). The risk of overweight/obesity was significantly ($p<0.001$) higher among males who eats fast foods (OR=15.035; C.I= 8.430-26.814) and packet foods (OR=14.709; C.I=3.555-60.868). The prevalence of overweight/obesity was higher among males who did not consume salt tea (32.28%) than who consumed salt tea (28.71%).

Table 32.1: Risks of overweight/obesity in relation with food habits among adult Nepali females

Variables	N	Overweight/ obesity	OR(95% CI	Significance level
Food habit				
Vegetarian	207	68(32.85%)	1	
Non -vegetarian	401	108(26.93%)	0.753(0.523-1.085)	0.128
Fast food				
No	238	07(2.94%)	1	
Yes	370	169(45.67%)	28.352(13.088-62.200)	0.001
Packet food				
No	61	01 (1.63%)	1	
Yes	547	175(32.00%)	28.226(3.880- 205.329)	0.001
Salt tea				
Yes	404	101(25.00%)	1	
No	204	75(36.76%)	1.744(1.213-2.507)	0.003

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 32.1 shows that the prevalence of overweight/obesity was higher among females who are vegetarians (32.85%) than non-vegetarians (26.93%). The risk of overweight/obesity was significantly ($p<0.001$) higher among females who eats fast foods (OR=28.352; C.I=13.088-62.200) and packet foods (OR=28.226; C.I=3.880-205.329). The prevalence of overweight/obesity was significant ($p<0.003$) higher among females who did not consuming salt tea (OR=1.744; CI=1.213-2.507).

Table 33: Risks of underweight in relation with food habits among adult Nepali males

Variables	N	Underweight	OR(95% CI)	Significance level
Fast food				
Yes	350	03(0.86%)	1	
No	250	40(16.00%)	0.070(0.036-0.136)	0.001
Packet food				
Yes	538	23(14.27%)	1	
No	62	20(32.25%)	0.134(0.084-0.215)	0.001
Meals per day				
3times	511	17(3.37%)	1	
2times	89	26(29.21%)	5.708(3.664-8.891)	0.001
Alcohol consumption				
Yes	199	11(5.52%)	1	
No	401	32(7.98%)	0.544(0.316-0.934)	0.270
Salt tea				
Yes	411	20(4.86%)	1	
No	189	23(12.17%)	2.709(1.448-5.066)	0.002

Food habits				
Veg	188	9(4.80%)	1	
Non-veg	412	34(8.29%)	0.559(0.262-1.990)	0.132

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 33 shows that the risk of underweight was significantly (p<0.001) higher among males who never consumed fast foods (OR=0.070; C.I=0.036-0.136) and packet foods (OR=0.134; C.I=0.084-0.215). Table further shows that the risk of underweight was significantly (p<0.001) higher among males who consumed meals two times per day (OR=5.708; C.I=3.664-8.891). The prevalence of underweight was slightly higher among males who never consumed alcohol (7.98%). The risk of underweight was significantly (p<0.002) higher among males who did not consume of salt tea (OR=2.709; C.I=1.448-5.066). The prevalence of underweight was higher males who are non-vegetarian (8.29%) than vegetarian (4.80%).

Table 33.1: Risks of underweight in relation with food habits among adult Nepali females

Variables	N	Underweight	OR(95% CI)	Significance level
Fast food				
Yes	370	07(1.89%)	1	
No	238	43(18.06%)	0.217(0.040-0.203)	0.001
Packet food				
Yes	547	34(6.23%)	1	
No	61	16(26.23%)	0.186(0.096-0.363)	0.001
Meals per day				
3times	508	33(6.49%)	1	
2times	100	17(17.00%)	2.948(1.570- 5.535)	0.001
Alcohol consumption				
Yes	142	06(4.22%)	1	
No	466	44(9.44%)	0.419(0.175-1.005)	0.510
Salt tea				
Yes	404	18(7.92%)	1	
No	204	32(8.85%)	1.125(0.615- 2.057)	0.702
Food habits				
Veg	207	26(12.56%)	1	
Non-veg	401	24(5.98%)	0.443(0.248-0.793)	0.006

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 33.1 shows that the risk of underweight was significantly (p<0.001) higher among females who never consumed fast foods (OR=0.217; C.I=0.040-0.203) and packet foods (OR=0.186; C.I=0.096-0.363). Table further shows that the risk of underweight was significantly (p<0.001) higher among females who consumed meals two times per day (OR=2.948; C.I=1.570-5.535). The prevalence of underweight was higher among females who never consumed alcohol (9.44%). The prevalence of underweight was slightly higher among females who did not consume salt tea (8.85%) than who consumed salt tea (7.92%). The risk of underweight was significantly (p<0.006) higher among females who are non-vegetarian (OR=0.443; C.I=0.248-0.793).

Table 34: Overweight/obesity in relation with self-reported morbidities and self-reported health status among adult Nepali males

Variables	N	Overweight/ obesity	OR(95% CI	Significance level
Self-reported Morbidity				
Yes	165	58(35.15%)	1	
No	435	121(27.81%)	1.407(0.960-2.062)	0.080
Self-reported health status				
Excellent	306	115(37.58%)	1	
Good	174	23 (13.21%)	1.078(0.719-1.619)	0.717
Poor	120	41 (34.17%)	0.299(0.169-0.530)	0.001

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 34 shows that the prevalence of overweight/obesity was higher among males who are suffering from self-reported morbidities (35.15%) and have self-reported excellent health status (37.58%). The prevalence of overweight/obesity among males who have reported self-reported good health and self-reported poor health was 13.21 percent and 34.17 percent respectively.

Table 34.1: Overweight/obesity in relation with self-reported morbidities and self-reported health status among adult Nepali females

Variables	N	Overweight/ obesity	OR(95% CI)	Significance level
Self-reported Morbidity				
Yes	124	48(38.70%)	1	
No	484	128(26.44%)	1.258(0.636-2.485)	0.510
Self-reported health status				
Excellent	315	112(35.56%)	1	
Good	177	23 (12.99%)	1.009(0.647-1.575)	0.968
Poor	116	41 (35.34%)	0.273(0.193-0.488)	0.001

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 34.1 shows that the prevalence of overweight/obesity was higher among females who are suffering from self-reported morbidities (38.70%). The higher prevalence of overweight/obesity was found more or less the same among females who have self-reported excellent health (35.56%) and self-reported poor health status (35.34%).

Table 35: Underweight in relation with self-reported morbidities and self-reported health status among adult Nepali males

Variables	N	Underweight	OR(95% CI)	Significance level
Self-reported Morbidity				
Yes	165	18(10.90%)	1	
No	435	25(5.74%)	2.008(1.065- 3.788)	0.031
Self-reported health status				
Excellent	306	11(3.59%)	1	
Good	174	17(9.77%)	0.384(0.172-0.857)	0.019
Poor	120	15(12.50%)	1.254(0.602-2.609)	0.546

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 35 shows that the prevalence of underweight was higher among males who are suffering from self-reported morbidities (10.90%) and have self-reported poor health status (12.50%). The prevalence of underweight among males who have self-reported

excellent health status and self-reported good health status was 3.59 percent and 9.77 percent respectively.

Table 35.1: Underweight in relation with self-reported morbidities and self-reported health status among adult Nepali females

Variables	N	Underweight	OR(95% CI)	Significance level
Self-reported Morbidity				
Yes	124	12(9.68%)	1	
No	484	38(7.85%)	1.258(0.636-2.485)	0.510
Self-reported health status				
Excellent	315	19(6.03%)	1	
Good	177	20(11.30%)	0.613(0.282-1.330)	0.216
Poor	116	11(9.48%)	1.216(0.560-2.642)	0.621

OR= odd ratio; Cl=confidence interval; 1=reference value

Table 35.1 shows that the prevalence of underweight was higher among females who are suffering from self-reported morbidities (9.68%) and have self-reported good health status (11.30%). The prevalence of underweight among females who have self-reported excellent health status and self-reported poor health status was 6.03 percent and 9.48 percent respectively.

CHAPTER-VI

DISCUSSION AND CONCLUSION

Nutritional status is associated with various socio-economic conditions like sex, education, occupation, religion, family income, marital status and types of family. Both underweight and overweight are linked with poor health outcome. It is well familiar that overweight or obesity is a major predictor for every reason of mortality, chronic diseases like cardiovascular diseases, diabetics, multi-morbidity conditions and disabilities. Whereas, underweight is strongly linked with impulsive mortality, disabilities, poor self-rated physical condition and wellbeing (Dutta et al, 2019). While India has decreased under nutrition in the past decades, wealth inequality inside residential places and the quick growing of adult overweight and obesity are most important challenges (Nguyen et al, 2021). There is a large reduction in underweight in the year between 2006-2016 among the adult men and women especially in urban slum and rural areas, and at the same time growing in overweight/obesity is also higher (Nguyen et al, 2021). Internationally, among the adult population, the prevalence of undernutrition was 8.8 percent among males and 9.7 percent among females. Further, the prevalence of obesity was 10.8 percent among males and 14.9 percent among females (Pengpid, 2021). As per the World Health Organization report, the mean occurrence of underweight/thinness in adult over 18 years of age was 17.1 percent in both males and females. The mean frequency of overweight among the adults aged above 18 year was 20.4 percent in both males and females in 2015 (WHO, 2015). In year 2016, above 1.9 billion adult peoples were overweight and obese. This figure has tripled from 1975. According to 2018 global nutrition report, undernutrition has slightly turned down whereas anemia has increase to 32.8 percent

among women (Das et al., 2022). The prevalence of obesity has been raise from 3.2 percent to 10.8 percent among men and from 6.4 percent to 19.9 percent among women from 1975 to 2014 (NCD, 2016). On the other hand, underweight remains a most important problems for developing country including India with a inadequate decrease from 13.8 percent to 8.8 percent in males and 14.6 percent to 9.7 percent in females from the years 1975 to 2015 (NCD, 2016).

Recent data shows that India recorded the maximum number of malnourished people in the globe, and 50 percent proportionately greater than China (FAO, 2014). Undernutrition level stays high in India than most nations in sub-Saharan Africa in spite of low public health infrastructure, levels of economic growth and higher infant and child death rates (Deaton and Dreze, 2009). The increase years of education extensively decrease the probability of being underweight (Siddiqui and Donato, 2017). The states which at the peak of undernutrition in India such as Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh and Orissa recorded higher incidence of poverty (Himanshu, 2010). Hazarika et al., (2012) reported that among Indian men and women, the main risk factors of undernutrition are educational level, age and standard of living. Undernutrition affects all ages and particularly among the poor peoples, and those absence of clean water and good hygiene. Famines, conflicts and wars also contribute to under nutrition (Moore et al., 2010). Evaluation of the socio-economic disparities in underweight, overweight and obesity is important to deal with the troubles of chronic diseases (Moore et al., 2010). Some studies have reported that the determination and occurrence of undernutrition in India has in part been accredited to the lack of social infrastructure linked with hygiene and sanitation (Jose, 2014). Income disparity apply an independent influence on the threat of being

underweight (Siddiqui and Donato, 2015). Undernutrition is often measured together as result and symptom of poverty (Osmani, 1992).

The present study shows the socio-economic disparities, lifestyles and food habits in relation with nutritional status among adult Nepali males and females of rural areas of Sikkim. It also discusses the relationship between the self-reported morbidity and nutritional status. The mean height, mean weight, mean BMI, mean waist circumference and mean hip circumference are found more or less the same between adult males than adult females. The study further shows that the prevalence of underweight is slightly higher in adult Nepali females than adult males. Overweight is found more or less the same between adult males and adult females. However, the prevalence of obesity is slightly higher in adult Nepali males than adult females in the present study. The growing occurrence of overweight and obesity along with undernutrition is major health problem in the low and middle income country. The progress in economic condition, sedentary lifestyles, urbanisation and dietary change causes the steady increase of overweight and obesity. However, many south Asian countries and sub-Sahara African nations are facing the challenges of underweight and related consequences (Akombi et al., 2017). India's share of adult underweight is maximum in the world with the partial increase of overweight and obesity. Likewise, south Asian countries such as Bangladesh and Nepal also have higher share of adult underweight along with rising occurrence of overweight and obesity (Dutta et al, 2019). BMI was associated with socio-economic conditions among women in India and elsewhere (Subramanian and Smith, 2006). Recently, Indian states with high frequency of overweight and obesity covers rich and poor of urban and rural groups (Subramanian and Smith, 2006).

The present study indicates that the frequency of underweight is higher among the lower income group in both males and females. In country like India, the occurrence of undernutrition based on body mass index has been associated with age, sex, land own, education, residence, family size, social status, occupation and income (Khongsdier, 2002). Some other studies reported that there is connection between low income, farming, household food distribution with undernutrition (Barker et al., 2006). The occurrence of undernutrition in developing nations is recognized to poor socio-economic situations, environmental issues and nutrients deficiency (Bhutta et al., 2013).

In present study, the higher prevalence overweight/obesity in adult Nepali males and females is observed from higher income group followed by middle income group. It shows that the prevalence of overweight and obesity increases with the increase in income level in both the sexes. Higher income family can relatively afford and easily provide good nutrition and health care facilities as compared to other income groups. Purchasing capacity serves as a major determinant of capability to access good nutritious foods (FOA, 2021). Study by Black et al., (2008) shows that poverty is mainly linked with the insufficient diet and disease which leads to malnutrition. Another study shows that higher income people can simply afford to get good foods and access better health facilities (Schmeisher, 2008). It is generally highlighted that low to middle income country shows the co-existence of underweight and overweight (Popkin, 1994). Higher socio-economic status are significantly more likely to be overweight and lower socio-economic status are more prone to underweight (Subramanian et al, 2009). A study done in urban population in Imphal shows that higher education and higher income is directly associated with increased prevalence of overweight and obesity (Devi, 2007). Persons with higher education, income and

working have more sedentary life that might have led to higher prevalence of overweight (Devi, 2007). Women with low household wealth, low educational level and backward classes had positive association with underweight (Hansan et al, 2019). The higher prevalence of underweight, overweight and obesity is higher among the married males and females. There is positive relationship between marital status and overweight/obesity. Married peoples are less physically active, change dietary patterns and less attention for good looking or attractive (Janghorbani et al., 2008; Coll et al., 2015). Majority of cross-sectional studies show that married persons are more often overweight/obese than those living alone (Sobal et al., 2003). Both men and women are more overweight/obese and abdominally obese then the unmarried ones (Tzotzas et al., 2010). Married peoples have more responsibility towards family, less time for physical activity, change in dietary habits and weight control could become less consistent (Chai et al., 2021). The prevalence of overweight among adult Nepali males is same in both joint and nuclear family but obesity is higher in joint family than nuclear family in the present study. Study further indicates that the frequency of underweight is higher among adult Nepali males from joint family. In case of adult Nepali females, the prevalence of overweight is higher in joint family and obesity is higher in the nuclear family. The present study also shows that the frequency of underweight is higher in nuclear family among adult Nepali females.

Among adult Nepali males in present study, the prevalence of overweight and obesity is higher in the government employees, and followed by those who are engaged in business, agriculture and students. The frequency of underweight is higher among the farmers followed by students and those who are engaged in business. In adult Nepali females, the prevalence of overweight and obesity is higher among the government employees, and followed by housewives, students and business women. The

frequency of underweight shows fluctuation among different occupational groups. The higher prevalence of overweight/obesity was observed among the government employees in both adult Nepali males and females in present study. A study found that the ratio of underweight is relatively higher among the non-working group in both urban and rural areas (Dutta and Sengupta, 2019). Government employees are engaged in less physically active work as they spend relatively more time on sitting while working, which may increase sedentary lifestyles. A study shows that employees who are involved in low level of physical activity are more expected to increase overweight in compare to those who are involved in high level of physical activity (Nega and Beyene, 2019). Occupations are closely associated with precise socio-economic factors and behavioral characters that are possible for influencing obesity (Berlin and Mercan, 2016). Socio-economic forces like age, marital status and wealth index are connected with the chances of having overweight/obesity (Rana et al., 2021). The occurrence of obesity is more common in the middle aged individuals and from higher socio-economic conditions (Mondal et al., 2015). Sedentary lifestyles have contributed to an increase prevalence of overweight/obesity.

The prevalence of underweight is higher among adult Nepali males and females who have attained primary level of education in the present study. However, the prevalence of overweight/obesity is higher among adult Nepali males who have attained higher secondary and above level of education. Among adult Nepali females, the higher prevalence of overweight and obesity is observed among those who attained higher secondary and secondary level of education respectively. The present study indicates that the prevalence of overweight/obesity shows positive relationship with education in both adult Nepali males and females. Higher educated peoples spent more time in front of computer, reading, writing etc, which is relatively more

sedentary in lifestyles. A study shows that the higher educated peoples spent most of their time in writing, reading, and used up extra time in front of computer, laptop etc, which causes less physical movement leading to accumulate more fats (Devanx et al., 2011). Higher educated peoples are likely to have sedentary profession which needs lower level of physical activity than labour intensive occupation. The influence of education on obesity might transform with time depending on the socio-economic progress of a nation (Rana et al., 2021). In middle income society, higher educational level can perform as a defensive aspect for obesity though higher income may still act as a threat for obesity (Rana et al., 2021).

Food habit is also one of the important factors affecting body weight. Food is major source of energy and its energy is utilized for daily activity. In the present study, the consumption of vegetables and non-vegetables show fluctuation in both Nepali adult males and females. Present study further shows that the prevalence of underweight is higher in adult Nepali males and females who are non-vegetarian and vegetarian respectively. The prevalence of overweight is higher in both adult Nepali males and females who are vegetarian. However, obesity is higher among adult Nepali males and females who are vegetarian and non-vegetarians respectively.

In present study, the prevalence of overweight and obesity is higher in both adult Nepali males and females who consumed non-vegetables more than three times per week. However, the prevalence of underweight is higher in both adult Nepali males and females who consumed non-vegetables one to two times per week. Wang and Beydoun (2009) reported that eating meat is most essential predictor for prevalence of overweight and obesity. Eating more meat has been associated with increase threat for several chronic diseases, and eating vegetables, fruits, cereals and nuts have been associated with lesser chances for numerous chronic diseases (Wang and Beydoun,

2009). A study shows that vegetarians have lower body mass index as compared to the non-vegetarians in India (Agrawal et al., 2014). Diet plays a most important role in developing the nutritional disorder like overweight, obesity and type II diabetes (Gupta et al., 2016). Diets high in energy density are connected with raise body weight, and diets low in energy density support weight maintenance or even weight loss (Hebestreit et al., 2014). Meat and alcohol consumption have related with overweight and obesity (Kim et al., 2019). Eating high fat foods has expected future raise in body mass index among adults (Stice et al., 2010) and main predictor of weight gain (Rautianen et al., 2016). The prevalence of overweight/obesity is higher in both adult Nepali males and females who eat meals three times per day in the present study. Present study also shows that the prevalence of overweight/obesity is higher in both adult Nepali males and females who eat fast foods and packet foods regularly. However, underweight is higher among adult Nepali males and females who never eat fast foods and packet foods. Several studies found that the Europeans who take fast food are risks for obesity (Basuny and Qtaibi, 2019). The incidence of fast food eating is high in Michigan which is linked with obesity (Anderson et al., 2011). Kelishadi et al., (2015) study found that eating junk foods was found to be related with abdominal obesity.

The present study shows that the prevalence of overweight/obesity is higher among adult Nepali males and females who took milk and butter regularly. Whereas, the frequency of underweight is higher among adult Nepali males and females who took milk and butter irregularly. Dairy product is a main supply of calcium, high value protein and various extra nutrients, which play a latent role in the metabolic way of obesity (Xiaoyun et al., 2022). The consequence of dairy product on obesity has been extensively examined in the United States and European countries. Some studies have

shown that there is negative relationship between dairy product consumption with overweight and obesity, while some other studies have reported that there is no association between nutritional status and dairy product (Xiaoyun et al, 2022). Consumption of dairy products can be significant in prevention of weight gain in middle age and elderly who are at first normal weight (Rautianen et al., 2016). The present study shows that the prevalence of overweight is higher among adult Nepali males who consumed salt tea. However, obesity is found the same in adult Nepali males who consumed and who never consumed salt tea. Further, the study shows that the prevalence of overweight is higher among adult Nepali females who never consumed salt tea, and obesity is higher among those who consumed salt tea. The frequency of underweight is higher among those who never consumed salt tea. A study shows that high salt intake leads to water maintenance in the body which later directs to weight gain (Kamari et al., 2010). High salt intake is identified to raise adiponectin stage in body which then increases fat in body (Kamari et al., 2010).

Physical activity plays an important role for determining the body weight of an individual. The higher frequency of underweight is recorded among adult Nepali males and females who exercised above two hours and engaged in moderate types of work in the present study. However, the higher prevalence of overweight and obesity is found among the adult Nepali males and females who exercised less than/equal to one hour and involved in mild types of work. Sedentary lifestyle causes less physical activity and less chance for body movement, which may results in the deposition of extra fat in the body. The decline in work related activity seems to be a prime suspect in the growth of overweight and obesity (Philopson, 2001). Several studies have investigated the role of low physical activity as cause of increasing prevalence of obesity (Jeffery et al., 1991). Globally, more than 60 percent of people are not

involved in enough level of physical movement and did not exercised in free time, which may leads to spend more time on sedentary behaviors such as excessive use of passive modes of transport, watching television and using computer which has contributed to the problem of overweight and obesity (WHO, 2003). Rguibi and Belahsen (2004) reported that females who spend extra time in sedentary behaviour are more obese compare with those who did not spent their time in sedentary behaviour. Dietary habits and physical activity level powerfully influence the energy equilibrium equation (WHO, 2000). More physical activity may necessary for weight management (WHO, 2004).

The higher frequency of underweight is recorded among adult Nepali males and females who watched television one to two hours per day in the present study. However, the higher prevalence of overweight and obesity is found among the adult Nepali males and females who watched television for three hours and above per day. Spending more time watching television may relatively decrease the physical activity and increase in sedentary lifestyle. A study reported that television viewing is considered to shift in physical activity and is linked with increased snacking and used of nutritionally poorer diets (Kaur et al., 2003). Tucker and Bagwell (1991) reported that there is positive linked of overweigh and obesity with television watching. The prevalence of underweight, overweight and obesity are higher among adult Nepali males who never consumed alcohol in the present study. Similarly, among adult Nepali females, the prevalence of underweight and overweight is higher among those who never consumed alcohol. However, obesity is higher among adult Nepali females who consumed alcohol. Consumption of alcohol can affect nutritional status by displacing healthier foods from diet (Toffolo et al., 2012). Excessive use of alcohol can satisfy caloric requirement but easily leads to malnutrition (Smit, 2012).

The present study shows that the prevalence of overweight and obesity is higher among adult Nepali males and females who sleep eight hours and above. Study further shows that the frequency of underweight is higher among the males and females who sleep less than or equal to seven hours. Recent study found that overweight and obese adult reports low level of physical activity, high television viewing and poor sleeping duration (Cassidy et al., 2017). These lifestyle behaviours may jointly expose persons to bigger threat of obesity (Cassidy et al., 2017). Sleeping duration has a direct and indirect outcome on weight. Sleeping period is connected to metabolic changes leading to weight gain, behavioral changes such as higher caloric intake and less physical activity (Sleddens et al., 2018).

Nutritional status of an individual causes different types of morbidities. The present study shows that the prevalence of underweight, overweight and obesity is higher among adult Nepali males and females who are suffering from different self-reported morbidities. It further shows that the prevalence of overweight is higher among adult Nepali males and females who are suffering from diabetics, followed by those who are suffering from hypertension and joint pain. However, obesity is higher among adult Nepali males and females who are suffering from joint pain followed by those who are suffering from hypertension and diabetics. The frequency of underweight is higher among adult Nepali males and females suffering from TB and joint pain respectively. Overweight/obesity is leading threat for global death and disability, and is associated with various non-communicable diseases such as hypertension, diabetics, cancer, cardiovascular disorders etc. (Hansan et al., 2019). About one-thirds of adults are overweight/obese and 10 percent of adults are underweight (Hansan et al., 2019). Studies have found that undernutrition, overnutrition, poverty, improper education, risky working situation and poor health care facilities are often associated

with poor health (Andre et al., 1993). Another study reported that the higher prevalence of morbidities like joint pain, hypertension, diabetics, osteoarthritis and cardiovascular disease are the measured diseases related with the nutritional health problems (Arlappa et al., 2018). Overweight and obesity are threat for early death, but it is also linked with a number of additional serious medical situations (WHO, 2000). Physical activity is likely to comprise a protective consequence, and as far as weight increase, additional results like systolic and diastolic blood pressure increase (Ntandou et al., 2009).

In conclusion, the present study highlights the socio-economic disparities and nutritional status among the adult Nepali males and females of rural areas of Sikkim. Socio-economic disparities, food habits and lifestyles are measured as main determining factors for nutritional status in the present study. Nowadays, every person is in the threat of being underweight, overweight and obesity because of various associated factors such as socio-economic conditions, sedentary lifestyles and food habits etc. The prevalence of underweight, overweight and obesity is slightly higher in adult Nepali males than females. The frequency of underweight is found higher in both the sexes from lower income family. However, the prevalence of overweight and obesity is higher in both the sexes from high income family. The study further highlights that the prevalence of underweight is found higher in primary level of education in both adult Nepali males and females. Overweight/obesity is higher in secondary and higher secondary level of education in both adult Nepali males and females respectively. Study further shows that overweight and obesity is higher among government employees, and who are married in both males and females in the present study.

The differences in lifestyles like television watching, physical activity, sleeping duration and alcohol consumption also influences the nutritional status in both adult Nepali males and females. The prevalence of overweight and obesity is higher among adult Nepali males and females who spent more time in television watching. There is direct relationship between the physical activity and nutritional status in the present study. The prevalence of overweight and obesity is higher among those who spent less time in physical activity and engaged in mild types of work in both sexes in the present study.

The consumption of non-vegetables and number of meals per day shows the positive relationship with nutritional status in present study. The study indicates that the prevalence of overweight/obesity is higher among adult Nepali males and females who consumed non-vegetables more frequently. However, underweight is higher in both adult Nepali males and females who consumed non-vegetables less frequently. Further, the prevalence of overweight/obesity is higher among adult Nepali males and females who consumed meals three times per day. The milk products also play an important role in determining nutritional status in the present study. Study indicates that underweight is higher among those who consumed milk irregularly. The present study also found that underweight is higher among those who never consumed butter in both the sexes. It also shows that the frequency of underweight is higher among those who did not consume fast foods and packet foods. However, overweight/obesity is found higher among adult Nepali males and females who consumed fast foods and packet foods regularly. The study also found that the overweight and obesity is higher in both adult Nepali males and females who consumed salt tea regularly. Self-reported morbidity also shows association with nutritional status among the adult Nepali males and females of rural areas of Sikkim. Present study highlights various types of self-

reported morbidities like diabetics, hypertension, joint pain/back pain, TB and cardiovascular diseases etc. associated with nutritional status in both the sexes.

The prevalence of overweight and obesity is continued to increase in Sikkim as compare with NFHS-3 and NFHS-4 reports, and the problems of underweight also co-exist. The population faces the double burden of nutritional problems in person, household and entire populations from the developing nations (Dutta and Kropi, 2019). Urgent attention needs to be taken for preventing this rising burden of overweight and obesity. To overcome this problem, there is an instant necessity for suitable actions to be taken to get better nutritional status. This is the high time to take up proper steps for awareness and preventive measures to control the double burden of malnutrition. It is necessary to educate people and conduct awareness programs in rural as well as in urban areas. Training in nutritional education and physical exercise through experts will also be helpful to manage nutritional problems. This kind of program will also helps in policy making to control the double burden of malnutrition. Therefore, it is necessary to provide awareness about the short term and long term consequences of underweight and overweight/obesity to both males and females in the study population.

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