NUTRITIONAL STATUS AND FOOD CONSUMPTION OF WORKING POPULATION OF DHARAN, NEPAL

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A dissertation submitted to the Department of Nutrition and Dietetics, Central Campus of Technology, Tribhuvan University, in partial fulfillment of the requirements for the degree of B.Sc. Nutrition and Dietetics

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Approval Letter

This *dissertation* entitled *Nutritional Status and Food Consumption of Working Population of Dharan, Nepal* presented by Jenisha Dahal has been accepted as the partial fulfillment of the requirement for the degree of B.Sc. in Nutrition and Dietetics.

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(Jenisha Dahal)

Abstract

Poor nutritional status due to improper intake is becoming one of the major public health problems in developing countries like Nepal. A cross sectional study was conducted to assess the nutritional status and food consumption of working population of Dharan municipality. Anthropometric measurement was used to determine Body Mass Index, Waist Circumference and Waist Hip Ratio. Data on socio-demographic, dietary and behavioral factors was collected using structured questionnaire. Microsoft excel and SPSS version 20 were used to analyze data and chi square test was performed to analyze the factors associated with BMI, WC and WHR cut-offs.

According to the result from the study, the percentage of people consuming pulses regularly were 80.5%, green leafy vegetables consuming were 34.5%, dairy consuming were 25.5%, fruits consuming were 19.5%, salads consuming were 17.5%, red meat consuming were 20.5%, tea consuming were 72.5%. This shows poor eating pattern of the study populations. The result revealed that 31.5% were underweight and 28% were overweight according to BMI. According to waist circumference and waist hip ratio, 34.5% and 65% were obese respectively. The factors like Marital status, occupation, eating time, preferences, watching TV/mobile, no. of children, calorie and protein intake, other vegetables, salads and red meat consumption were associated with BMI whereas the factors like Marital status, occupation, gender, age, watching TV/mobile, water intake, carbohydrates and fat intake, pulses, white meat, tea/coffee and fruits consumption were associated with waist hip ratio and occupation, gender, sleep, water intake, fruits, white meat, cold drinks consumption, carbohydrates and fat intake were associated with waist circumference. Therefore, we can say that poor eating pattern results in poor nutritional status of the populations.

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List of Abbreviations

Abbreviations	Full Forms
BMI	Body Mass Index
FAO	Food and Agriculture Organization
GLVs	Green Leafy Vegetables.
MoHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health survey
NIDDM	Non- Insulin Dependent Diabetes Mellitus
PHC	Primary Health Center
SEAR	South-East Asia Region
SPSS	Statistical Package for Social Science
TV	Television
UNDP	United Nations Development Program
WC	Waist Circumference
WFP	World Food Program me
WHO	World Health Organization
WHR	Waist Hip Ratio

PART I

Introduction

1.1 General Introduction

Nepal is one of the developing nations in South-East Asia Region (SEAR), which was ranked 146 among 187 countries in the Human Development Index (UNDP, 2018). It has a total land area of 1, 47, 181 Sq. Km and is bordered by India on east, west and south and China on north. According to the census of 2011, the estimated population of Nepal is 26.4 million and the growth rate is 1.35%. It is 48th largest country by population and 93rd largest country by area. It has 65.9% literate population, 21.6% are below poverty line and 40.34% are population between 16-40 age group (UNDP, 2018). The current nutritional status is 36% percent of children under age 5 are stunted, 10% are wasted, 27% are underweight, and 1% is overweight. Among the adults, 11% of women age 15-49 are short, and 17% are thin. Another 22% of women are overweight or obese. Among men, 17% percent are thin, and 17% are overweight or obese. (Population, 2016)

Nutrition is the science of foods, the nutrients and the substances therein, their action, interaction and balance in relation to health and diseases (Johnson, 1963). It can be defined as the science of food and its interaction with an organism to promote and maintain health (Joshi, 2015). Nutrition is the cornerstone of socioeconomic development of a country. Better nutrition means stronger immune systems, less illness, better health and productivity. Freedom from hunger and malnutrition is a basic human right and their alleviation is a fundamental prerequisite for human and national development (WHO, 2016)

Nutritional status is defined as the condition of the body resulting from the intake, absorption and utilization of food (Joshi, 2015). It is determined by a complex interaction between internal factors and external environmental factors: Internal or constitutional factors like: age, sex, nutrition, behavior, physical activity and diseases. External environmental factors like: food safety, cultural, social and economic circumstances (P. Joshi, 2012). The term malnutrition comprises of both over-nutrition as well as under-nutrition. Under-nutrition or poor nutrition is cited as the major factor in more than half of all child deaths in Nepal, a significantly higher proportion than those claimed by other infectious diseases. Malnutrition is not just a stark manifestation of poverty, it is also the non-income face of poverty and it helps perpetuate poverty (Bank, 2012).

Food consumption refers to the amount of food available for human consumption as estimated by the FAO Food Balance Sheets. The term food consumption or eating habits also can be stated as why and how people eat, which foods they eat, and with whom they eat, as well as the ways people obtain, store, use, and discard food. However the actual food consumption may be lower than the quantity shown as food availability depending on the magnitude of wastage and losses of food in the household, e.g. during storage, in preparation and cooking, as plate-waste or quantities fed to domestic animals and pets, thrown or given away (FAO, 2008). Several factors have been found to determine the dietary habits of the people. Food consumption pattern has dramatically changed in some countries as a result of sudden increase in income. Food consumption is influenced by gender, age, culture, environment, social and community networks, individual lifestyle factors, health behavior, food accessibility and knowledge. Individual, social, cultural, religious, economic, environmental, and political factors all influence people's eating habits.

There is a positive association between household food consumption score and lower prevalence of stunting, underweight, and wasting. Children in food-secure households have the lowest rates of stunting (33%), while children in food-insecure households have rates up to 49 percent. In order for a nation to develop, the basic needs of its people must be adequately met. One of the important of such needs is the need for adequate nutrition. The interrelation between household monetary availability and food consumption patterns provides relevant data to those involved in development issues. The data provided gives insight into existing situations on which policy makers, program planners, and more specifically health and economic planners can base their decisions (Wathome, 1990).

1.2 Statement of the problem

Food is essential to human life and survival and is considered a basic need and human right. It is molded according to culture and is affected by the organization and distribution of wealth in society. Even though food choices are not regulated only by economic factors, these include acquiring knowledge about food that is specific to distinct social classes; such choices suffer effects accruing from the capitalist mode of production and the organization of domestic units within society (Paula *et al.*, 2012).

Dietary intake assessment is essential to understand the nutritional status. Healthy eating pattern promotes optimal health, growth and intellectual development and prevents diseases,

boasts immunity while poor dietary eating choices may cause malnutrition (Otuneye, 2017). Unhealthy dietary habits are among the major risk factors for obesity and related chronic diseases in the later days of life. They are becoming more frequent due to the nutritional transition that is affecting populations across developing countries, where traditional healthy diets, including the Mediterranean diet, are being progressively replaced by more westernized dietary patterns (Musaiger *et al.*, 2016).

Based on the pattern of food production, it is clear that the major staples of the Nepali population include rice and wheat in the Terai; maize and millets in the hills; and millet, maize, and barley in the mountains. Potatoes are also an important part of the diet in the mountains. However, in recent years, more food has been imported from outside, resulting in changes in food habits of the people living in the remote hills and mountain districts. In addition, the Government of Nepal has been transporting rice and other food items to remote mountain districts since the establishment of Nepal Food Corporation (NFC) in1974-5 leading to an increase in rice consumption in those districts (USAID, 2010).

Nutritional deficiency is a major public health challenge in Nepal. Nutritional deficiencies are occurring varying degree of manifestations and have tremendous impact not only on the health of vulnerable population but to the national economy too. Even though quite adequate government policies and guidelines have been prepared, over the years, basic nutrition promotion strategies haven't been applied seriously at the community level. The major causes of nutritional deficiency in developing country like Nepal is poverty, lack of food security and nutrition education. Combating the deficiency seems a big challenge hence Government should develop more integrated and practical approaches to combat the deficiency. Nutrition promotion and support efforts should be ensured to reach specially to the needy, marginalized populations. Mere policy and strategy cannot yield foreseeable results. There is a strong need to improve the health service delivery systems which can ensure the desired change (Devkota *et al.*, 2015).

The study population that were chosen as the samples were beauticians, barbers, municipal waste workers and other working population like drivers and shopkeepers of Dharan. This population does not have any specific time for eating and due to the variable work load each day directly or indirectly affect their eating habits.

1.3 Objectives

1.3.1 General objective

The general objective of the study was to assess the nutritional status and food consumption of study population and direct and indirect factors related to nutritional status.

1.3.2 Specific objectives

- To study the Food consumption of different population group.
- To find the current nutritional status of the study population.
- To suggest the correct food consumption pattern to help maintain the nutritional status of an individual.

1.4 Significance of the study

- Provide information regarding the nutritional status of the study population to the governmental and non-governmental organization which will be helpful to initiate corrective measures for the problem.
- Encourage people to improve nutritional status by having correct food consumption.
- To provide necessary knowledge to each individual to improve the nutritional status.
- Act as guide for the development of proper nutritional program in this community by undertaking the discovered facts.
- Identify individual or group of people who are at risk of being malnourished and who need special care and attention among the sample.

1.5 Causes of malnutrition

The UNICEF conceptual framework, developed in the 1990s and shown below in Fig 1.1 summarizes the causes of malnutrition.

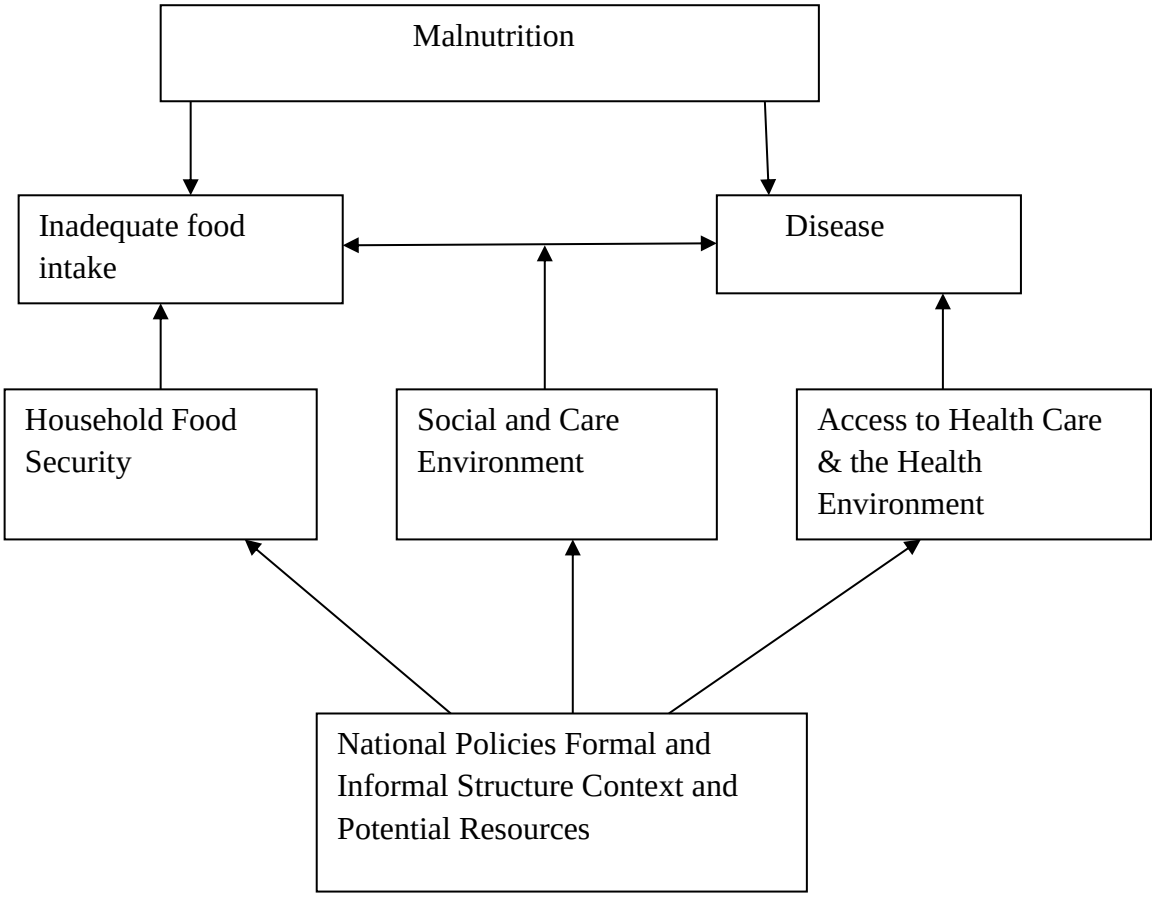

Fig: 1.1 UNICEF conceptual framework of Malnutrition (UNICEF, 2015)

1.6 Research Questions

- What kind of food consumption pattern is there?
- What is the nutritional status of the population in Dharan?
- What are the factors associated with Nutritional status?

1.7 Limitations

- Current data about the population, nutritional status and the state of malnutrition of the area is not available so information through the communication may not be accurate.
- This study is conducted with limited resources it makes impossible to include many important questions and many other clinical and biochemical assessment.

PART II

Literature review

2.1 Nutrition

The word nutrition first appeared in 1551 and comes from the Latin word ‘nutrire’, meaning “to nourish.” Nutrition is the sum of all processes involved in how organisms obtain nutrients, metabolize them, and use them to support all of life’s processes. Nutritional science is the investigation of how an organism is nourished, and incorporates the study of how nourishment affects personal health, population health, and planetary health. Nutritional science covers a wide spectrum discipline. As a result, nutritional scientists can specialize in particular aspects of nutrition such as biology, physiology, immunology, biochemistry, education, psychology, sustainability, and sociology (Zimmerman, 2012).

2.2 Malnutrition

The term malnutrition generally refers both to under nutrition and over nutrition, but the term to refer solely to a deficiency of nutrition. Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations. Inadequate diet and disease, in turn, are closely linked to the general standard of living, the environmental conditions, and whether a population is able to meet its basic needs such as food, housing and health care. Malnutrition is thus a health outcome as well as a risk factor for disease and exacerbated malnutrition, and it can increase the risk both of morbidity and mortality. Although it is rarely the direct cause of death (except in extreme situations, such as famine). Malnutrition that is the direct cause of death is referred to as “protein-energy malnutrition” in this guide (Blössner *et al.*, 2005).

Malnutrition is a serious condition that occurs when a person ‘s diet does not contain the right amount of nutrients. Malnutrition means poor nutritional status and can refer to under nutrition, when people don‘t get enough nutrition and over nutrition, when people get more nutrients than requirement. Under nutrition is caused by having an inadequate diet or a problem absorbing nutrients from food. There are many reasons why this might happen including having reduced mobility, a long-term health condition or a low income (NHS, 2015).

Every country is facing a serious public health challenge from malnutrition. One in three people is malnourished in one form or another. Malnutrition manifests itself in many forms: as children who do not grow and develop to their full potential, as people who are skin-and-bone or prone to infection, as people who carry too much weight or whose blood contains too much sugar, salt, or cholesterol (IFPRI, 2014).

2.2.1 Immediate causes of malnutrition

Lack of food intake and disease are immediate cause of malnutrition and create a vicious cycle in which disease and malnutrition exacerbate each other. It is known as the Malnutrition Infection Complex. Thus, lack of food intake and disease must both be addressed to support recovery from malnutrition (Reinhardt *et al.*, 2014).

2.2.2 Underlying causes of malnutrition

Three major underlying causes of malnutrition include (Veghari, 2013)

- Food: Inadequate household food security (limited access or availability of food).
- Health: Limited access to adequate health services and/or inadequate environmental health conditions.
- Care: Inadequate social and care environment in the household and local community, especially with regard to women and children.

2.2.3 Basic causes of malnutrition

The basic causes of malnutrition in a community originate at the regional and national level, where strategies and policies that affect the allocation of resources (human, economic, political and cultural) influence what happens at community level. Geographical isolation and lack of access to markets due to poor infrastructure can have a huge negative impact on food security. When conducting an assessment to determine the causes of malnutrition in a community, it is important to research the actions at each level and how these actions, or inactions, influence malnutrition rates (Gillespie *et al.*, 2001).

2.3 Forms of malnutrition

Malnutrition has recently been defined as a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrient, this state being clinically manifested or detected only by biochemical, anthropometric or physiological tests. There are four forms of malnutrition (Jelliffe, 1996).

a. **Under nutrition:** The pathological state results from the consumption of an inadequate quantity of food over an extended period of time.
b. **Over nutrition:** It is the pathological state resulting from the consumption of an excessive quantity of food and hence a calorie excess, over an extended period of time.
c. **Specific deficiency:** It is the pathological state resulting from a relative or absolute lack of an individual nutrient.
d. **Imbalance:** This pathological state results from a disproportionate consumption of essential nutrients with or without the absolute deficiency of any nutrient as determined by the requirements of a balance diet.

Malnutrition can also be classified as Acute, Chronic and Acute and chronic malnutrition

- **Acute malnutrition**: Acute malnutrition relates to the present state of nutrition, for example, Weight for height (wasting or thinness).
- **Chronic malnutrition**: chronic malnutrition relates to the past state of nutrient, and the measurable parameters are height for age (stunting or shortness).
- **Acute and chronic malnutrition:** A combination measure, hence it could occur as a result of wasting, stunting or both (underweight).

2.4 Overview of Malnutrition in Nepal

Stagnant growth and political instability have contributed to acute food shortages and high rates of under nutrition, mostly affecting vulnerable women and children in the hills and mountains of the mid- and far-western regions. Though rates of stunting and underweight have decreased and the rate of exclusive breastfeeding has increased in the past seven years, 36 percent of children under five remain stunted, a rate that increases to 60 percent in the western mountains. There is a positive association between household food consumption score and lower prevalence of stunting, underweight, and wasting. Children in food-secure households have the lowest rates of stunting (33 percent), while children in food-insecure households have rates up to 49 percent. Maternal education and socio-economic status have an inverse relationship with childhood stunting. Micronutrient deficiencies are widespread, with almost half (46%) of pregnant women and children under five, as well as 43.6 percent of women of reproductive age being anemic. Only 24 percent of children consume iron-rich food, 24 percent of children meet a minimally acceptable diet, and only half of pregnant women take recommended iron supplementation during pregnancy. A contributing factor to

deteriorating nutrition is high diarrheal disease morbidity, exacerbated by the lack of access to proper sanitation and the common practice of open defecation (44 percent) in Nepal. 17% of women of reproductive age are thin or undernourished (BMI <18.5 kg/m^2), 17% of women are overweight (BMI 25-29 kg/m^2), and 5% are obese (BMI 30 kg/m^2 and above) (MoHP, 2016; USAID, 2018).

2.5 Food Consumption

According to the 1996 World Food Summit, "food security at the individual, household, national, regional and global levels is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"(FAO, 1996). Household food consumption has been defined as the total amount of food available for consumption in the household, generally excluding the food taken outside unless prepared at home. It serves as a direct indicator of food security as well as a distal proxy for a poverty indicator (WFP, 2007).

A food consumption survey is a survey to collect food consumption data of the population, such as the types and amount of food consumed by individuals. A population-based food consumption survey is crucial for establishing a comprehensive database for food safety risk assessment and enhancing the risk assessment. The food consumption data collected will be used to find out if the public is exposed to any potential dietary risks such as those from contaminants and food additives, and also to understand the size of the risk and which population groups may be most at risk. Such information is vital for the Government in formulating public policies and education strategies to promote food safety (Kong, 2017).

2.6 Factors affecting food consumption

2.6.1 Food security

Food insecurity appears to have a negative impact on various aspects of health and wellbeing. Individuals living in food insecure households are more likely than those in food secure households to rate their own health has poor or fair and have lower physical and mental health. Food insecure individuals, especially women, are more likely that their food secure counterparts to be obese, gain weight, and have cardiovascular disease and diabetes. Food insecure populations are also more likely to exhibit disordered eating patterns, have decreased household availability of healthful food groups and foods compared to food

secure. Additionally, food insecure populations are more likely to have increased intake of less healthful nutrients. Food insecurity and/or lack of resources experienced early in life increases the chances of obesity, disordered and unhealthy eating patterns and food insecurity in adulthood. Similarly to food insecurity, food insufficiency has been associated with poor health, chronic disease, poor functional health, depression, altered nutrition-related laboratory values and decreased intake of healthful food groups (Farrell, 2013).

2.6.2 Income

There is strong relationship between food supply, consumption and income, taking supply, meat and dairy, and consumption composition (in macronutrients) as indicator for income. For low income countries, GDP increase is accompanied by changes towards food consumption patterns with large gaps between supply and actual consumption. Total supply differs by a factor of two between low- and high-income countries. People in low income countries derive nutritional energy mainly from carbohydrates; the contribution of fats is small, that of protein the same as for high income countries and that of meat and dairy negligible. People in high income countries derive nutritional energy mainly from carbohydrates and fat, with substantial contribution of meat and dairy. Whenever and wherever economic growth occurs, food consumption shows similar change in direction (Gerbens-Leenesa *et al.*, 2010).

2.6.3 Gender and age

Gender refers to a social construct that is determined from the sex-based categories of female or male. The way to differ between female and male eating behavior are by roles, behavior and attitudes. Male and female always behave differently and have different consumptions pattern. The food preferences and eating styles are different between male and female. For example, female consume less calories than male which shows that females tend to eat in a more feminine style. This shows the behavior of different gender will affect the pattern of consuming food. Nowadays, there is a trend to be thin in body sizes to have a better physique in society. Women have more concern about their body weight and the way to control their food choice. They try to avoid foods that contain a lot of fats that results in disordered eating behavior and dieting behavior in females. Women are more concerned about healthy eating behavior compared to men. Eating out behavior is increasing among women and men. This may have an impact on their healthy eating behavior. Therefore, further studies of gender

and eating behavior are very important for understanding the eating styles and behavior between male and female (IJABM, 2016).

Age also plays an important role in consumption in the sense that, as people grow older; they tend to make choices based on health, weight watching (dieting), etc. Pagliarini, Gabbiadini and Ratti (2004) conducted a study focusing on children of different age groups in Italy. They concluded that the preference for most dishes among younger children (7 years old) differed from those of the older ones (10 years old). Based on their data, they showed that, as they grow older, children become increasingly aware of their preferences and become more critical in their choices (Madiba, 2006).

2.6.4 Culture

For most people food is cultural, not nutritional. A plant or animal may be considered edible in one society and inedible in another. Probably one of the most important things to remember in connection with the cultural factors involved in food habits is that there are many combinations of food which will give same nutritional results.

Culture consist of values, attitudes, habits and customs, acquired by learning which starts with the earliest experiences of childhood, much of which is not deliberately taught by anyone and which so thoroughly internalized that it is unconscious but 'goes deep'. Food habits are among the oldest and most deeply entrenched aspects of many cultures and cannot, therefore, be easily changed, or if forcibly changed, can produce a series of unexpected and unwelcome reactions. Food and food habits as a basic part of culture serve as a focus of emotional association, a channel of love, discrimination and disapproval and usually have symbolic references. The sharing of food symbolizes a high degree of social intimacy and acceptance. In many cultures' food has a social or ceremonial role. Certain foods are highly prized; others are reserved for special holidays or religious feasts; still others are a mark of social position. There are cultural classifications of food such as 'inedible', 'edible by animals', 'edible by human beings but not by one's own kind of human being', 'edible by human being such as self', 'edible by self'. In different cultures, certain foods are considered 'heavy', some are 'light' some as 'foods for strength'; some as 'luxury', etc. (Reddy *et al.*, 2015).

2.6.5 Social role

Man is primarily a social creature, and therefore all his activities, including food intake are influenced by human societies. His deeply rooted food habits have developed within a culture and they vary widely from one society to another. Food has always been the central part of our community, social, cultural and religious life. It has been an expression of love, friendship and happiness at religious, social and family get-togethers. Food is served almost on all social events like marriages, parties, get-together, official meetings etc., in the form of tea, breakfasts, banquet, dinner etc. On all these occasions, food indirectly serves as a powerful and effective instrument for developing social rapport (Farrell, 2013).

2.6.6 Individual Preferences

Humans are faced with several food choices each day and make decisions on what food to eat based on several criteria. The need for food is a basic, physiological need with a clear and simple goal and a seemingly straight forward solution on how to be satisfied. As simple as it may seem, food choices are multifaceted and are not necessarily straight forward. It can be considered as common knowledge that people have different food preferences. Some people like bell peppers while others don't. Some people like a variety of foods while others might be picky eaters. On the one hand, preference in the context of food can indicate a consumer's choice of one food product over another. Liking, on the other hand, reflects the assessment of quality of a product. What is interesting however, is what causes these differences and particularly why they occur. We already know that there are some biological differences in how we perceive the basic tastes and that what foods we end up liking is to some degree caused by learning experiences we start forming already as infants and continue to form throughout our lives. We all have different learning experiences with food, and this causes different food preferences. These learning experiences are highly individual in nature and can be defined as psychological factors affecting food preferences (Vabø, 2014).

2.6.7 Price of food and marketing

The impact of high food prices on nutrition begins with households and individuals. As purchasing power goes down, dietary quality and total energy intake are reduced, compromising child growth and cognitive development, increasing risk of micronutrient deficiencies for all family members, and increasing risk of infant and maternal mortality.

Intra household food allocation practices which reduce these effects for men and/or children almost always occur at the expense of women. Other coping mechanisms at household level include reduced utilization of health care services, decreased school enrolment, and increased participation by both women and children in the labor force. Women, the rural poor, and the urban poor are among those most vulnerable to malnutrition at all times, and hence are at particular risk during and after food price spikes (Meerman *et al.*, 2012).

2.6.8 Education

Nutrition education is an essential component of a successful wellness program; numerous studies have shown improvements in nutrition and weight loss outcomes in children and adolescents after receiving nutrition education. Nutrition education is especially vital for children and adolescents; 80% of children who are obese by the time they reach the eighth grade will remain obese into adulthood. When used as part of a comprehensive wellness strategy, group-based nutrition education is an effective tool for reducing obesity and promoting a healthier lifestyle (Ahuja, 2016).

Nutrition is a recognized determinant in 3 (i.e., heart diseases, malignant neoplasm's, cerebrovascular diseases) of the top 4 leading causes of death in the United States. However, many health care providers are not adequately trained to address lifestyle recommendations that include nutrition and physical activity behaviors in a manner that could mitigate disease progression. This contributes to a compelling need to markedly improve nutrition education for health care professionals and to establish curricular standards and requisite nutrition and physical activity competencies in the education, training, and continuing education for health care professionals. The present status of nutrition and physical activity education for health care professionals, evaluates the current pedagogic models, and underscores the urgent need to realign and synergize these models to reflect evidence-based and outcomes focused education (Kris-Etherton *et al.*, 2014).

2.6.9 Lifestyle

Lifestyles are group specific forms of how individuals live and interpret their lives in a social context. Lifestyle research needs a double perspective/methodology: observer and participant. We live our lives, and others observe it; but we need to make sense of our actions and frame them in a more or less personally interpreted (sub-) cultural framework. Macro-

data and micro-motives should thus be monitored together. Lifestyles link social structure to attitudes and behavior. The lifestyle perspective (mainly derived from market research and sociology) reveals the socio-cultural plurality of societies. Similar to the "American Way of Life", there might be an 'Indian Way of Life'; but even within the United States the market research institute Claritas Corp. has detected about 60 different lifestyle groups, identified their consumption behavior and their political preferences, and is able to locate them in a fine grained ZIP-code resolution. They found "The American Way of Life" is thus only an approximation of the US reality, and one can specify the concrete adherence (or distance) to this leading vision of Western culture. It would therefore be wrong to assume the one Way of Life concept for India also (Madhvapaty *et al.*, 2015).

2.7 Changing food consumption pattern

Unfortunately, today's world has been adapted to a system of consumption of foods which have several adverse effects on human health. Lifestyle changes has compelled us so much that one has so little time to really think what we are eating is a healthy diet. Globalization has seriously affected one's eating habits and enforced many people to consume fancy and high calorie fast foods, popularly known as Junk foods. Research into the possible health hazards on consumption of such high calorie foods has given an insight to avoid them, but unfortunately measures taken are not as effective as they need to be. Ailments like Obesity, food poisoning, dehydration, cardiac problems diabetes mellitus, and arthritis have seen a profound rise in developing countries and such unhealthy junk food, processed food, high fat calorie consumption are the notable factors to its contribution. This global problem of consuming unhealthy diet on a large scale and its impact on human health needs to be attended and inculcate health education which can greatly contribute to its limited consumption and switching over to healthy eating habits for the better living. Knowledge emphasizing about the eating habits, nutritional diet, and quality of unhealthy foods, their health impact and preventive measures should be given to create awareness and render health education for a change towards healthy food eating practices. Dietary fat has both suffered and enjoyed large swings in public and scientific consensus over past decades. The fat-reduction public education initiatives of the 1980's and 1990's, although credited with lower cardiovascular mortality, have also been linked to overconsumption of dietary carbohydrate and the obesity epidemic facing Western culture (Ashakiran *et al.*, 2012).

2.8 Modern diet

Basic nutrients, such as carbohydrates, fats, and proteins, are the basis of all life activities. They constitute the carbon skeleton of various functional molecules, and provide energy through oxidative decomposition. Traditionally, the main aim of nutrition is to prevent and treat nutritional deficiencies. However, when nutrition is adequate or excessive, the body faces the problems of quantitative control of the nutrient's absorption and storage. Over nutrition, especially absorption and storage of energy, can not only affect health but also cause many diseases such as diabetes, cardiovascular diseases, obesity, hypertension, and hyper lipidemia. Further, over nutrition reduces reproductive capacity and promotes the development of various cancers that will seriously affect quality of life, survival, and reproduction in human beings.

Modern diet relates to 'Junk food' that simply means an empty calorie food. An empty calorie food is a high calorie or calorie rich food which lacks in micronutrients such as carbohydrates, proteins, vitamins, minerals, or amino acids, and fiber but has high energy (calories). These foods do not contain the nutrients that your body needs to stay healthy. Hence, this food that has poor dietetic values is considered unhealthy and may be called as junk food. Junk food is an informal term applied to some foods which are perceived to have little or no nutritional value, but which also have ingredients considered unhealthy when eaten regularly, or to those considered unhealthy to consume at all (Shridhar *et al.*, 2015).

2.9 Healthy diet

Fruits, vegetables, legumes (e.g. lentils, beans), nuts and whole grains (e.g. unprocessed maize, millet, oats, wheat and brown rice) should be included in the diet. At least 400g (5 portions) of fruits and vegetables a day should be consumed. Potatoes, sweet potatoes, cassava and other starchy roots are not classified as fruits or vegetables (WHO, 2015).

Less than 10% of total energy intake from free sugars which is equivalent to 50 g (or around 12 level teaspoons) for a person of healthy body weight consuming approximately 2000 calories per day, but ideally less than 5% of total energy intake for additional health benefits. Most free sugars are added to foods or drinks by the manufacturer, cook or consumer, and can also be found in sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates (WHO, 2015).

Less than 30% of total energy intake should come from fats. Unsaturated fats (e.g. found in fish, avocado, nuts, sunflower, canola and olive oils) are preferable to saturated fats (e.g. found in fatty meat, butter, palm and coconut oil, cream, cheese, ghee and lard). Industrial trans fats (found in processed food, fast food, snack food, fried food, frozen pizza, pies, cookies, margarines and spreads) are not part of a healthy diet (WHO, 2015).

Less than 5 g of salt (equivalent to approximately1 teaspoon) per day and iodized salt should be used (WHO, 2015).

2.10 Assessment of nutritional status

The assessment of the Nutritional status of an individual member of a community is accomplished by carrying out clinical biochemical anthropometric and biophysical examination (Shrivastava *et al.*, 2014). The nutritional assessment may require encompassing nations, communities, vulnerable segments of communities or individuals. It may be done as a part of an exercise to document current status as compared with post status or as specific attempt to evaluate the, impact of an intervention program.

The assessment of nutritional status can be done using the following information (WHO *et al.*, 2009).

a) Direct method: Deals with the individual and measures objective criteria. E.g. Anthropometric, Clinical examination, Biochemical and Bio- physical parameters.
b) Indirect method: Use community indices that reflect the community nutritional status or need. E.g. Dietary intake, morbidity and mortality rates, as specific mortality and vital statistics.
c) Ecological factors: E.g. Socio-economic status, housing and environmental hygiene, health and education services conditioning infection

2.11 Assessment of individual food consumption

Main methods for assessing present or recent diet as individual survey include food records, 24-hours recall, and food frequency questionnaires. In order to quantify the intake of foods, some estimate of the weight of consumed food is required. To convert food intake into nutrient intake, the availability of a food composition database/food table is essential. By combining the information of dietary intake and food composition databases/tables one can determine whether the diet is nutritionally adequate or not (FAO, 2009).

- Food records: A food record (also called a food diary) is a self-reported account of all foods and beverages (and possibly, consumed by a respondent over one or more days food record. Because the instrument is open-ended, there is no limit to the number of items that can be reported. Typically, respondents are requested to record foods and beverages as they are consumed throughout the reporting day (a "real-time" accounting). Respondents also may be asked to record dietary supplements consumed on the reporting day. Multiple administrations of n-day food records are often used (Institute, 2016).
- 24 hour diet recall: In a 24-hour recall, the individual is asked to provide estimates of the amount of food and drink they have consumed during the previous 24-hour period. The greatest value of the 24–hour recall method is its ability to estimate nutrient intakes of population groups. This method is used widely to compare nutrient intakes with specific dietary recommendations. Repeated 24-hour recalls are often used as a comparison method to represent usual intake in food frequency questionnaires (FFQ) validity studies. The major limitation of recalls is that they are seldom representative of usual intake (FAO, 2004).
- Food frequency questionnaire: The FFQ is the best available method for conducting studies on diet and disease relationships: it assesses habitual dietary intakes. The underlying principle of the food-frequency approach is that the average long-term diet (intake over weeks, months or years) is a more important exposure period than short-term intakes. The benefit of this method is that it can provide more representative information on usual intake than a few days of diet records or recalls. However, the method is limited in that it may not provide details of accurate quantities or portion sizes (FAO, 2004).

2.12 Indicators of nutritional status:

A variety of indicators can be used for the assessment of nutritional status. Of the many possible indicators of nutritional status only few are suitable for the evaluation of field program. The only indicator of nutritional status that are applicable in a large scale and for which a suitable experience if available are those based on anthropometric indicators are best applicable in the evaluation of nutritional status (Keller, 1982).

2.12.1 Body mass index:

A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in meters) (kg/m^2). A person with BMI below 18.5 is considered as underweight and above 18.5 to 24.5 is considered as healthy weight. A person with a BMI equal to or more than 25 is considered overweight and a person with a BMI of 30 or more is generally considered obese. BMI is a measure of generalized obesity (WHO, 2016). The BMI cuff-off given by WHO as shown in table 2.2.

Table 2.1 Classification of adult according to BMI

Classification	**BMI (kg/m^2)**	**Rate of co morbidities**
Underweight	<18.5	Low
Normal	18.5-24.9	Average
Overweight or pre obese	25-29.9	Increased
Obese I	30-30.9	Moderate
Obese II	35-39.9	Severe
Obese III	>40	Very severe

2.12.2 Waist Hip Ratio (WHR)

The 1997 WHO Expert Consultation on Obesity recognized the importance of abdominal fat mass (referred to as abdominal, central or visceral obesity), which can vary considerably within a narrow range of total body fat and BMI and suggested WHR as additional measure of body fat distribution. Abdominal obesity is defined as WHR greater than 0.9 for male and 0.85 for female. The ratio identifies individuals at increased risk of obesity related morbidity due to accumulation of abdominal fat. It also correlates with fertility and predicts mortality (Kankana, 2017; WHO, 2008). It can be measured more precisely than skin folds, and it provides an index of both subcutaneous and intra-abdominal adipose tissue (WHO, 2008). However due to the difficulty to measure hip circumference, waist circumference and BMI is highly appreciated (WHO, 2008).

2.12.3 Waist circumference

Waist circumference is an indicator of health risk associated with excess fat around the waist. In some populations, waist circumference may be a better indicator of risk than BMI e.g. in Asian people. Waist circumference should be measured at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest (WHO, 2008).

Waist circumference reflecting mainly subcutaneous abdominal fat storage has been shown to be positively, correlated to disease risk in individuals with a BMI of less than 35 kg/m2. However, there is a physical difficulty in measuring waist circumference in obese; >35 kg/m² and also there is little predictive power for disease risk for this BMI. Though visceral fat is more directly associated with metabolic risks, due to the difficulty in measuring the former, waist circumference remains the best for practical purpose (NHMRC, 2004)

The measurement of waist circumference gives an idea about the distribution of body fat and is also an indicator of metabolic syndrome. A waist circumference of 102 cm (40 inches)

or more in men, or 88 cm (35 inches) or more in women, is associated with health problems such as type 2 diabetes, heart disease and high blood pressure. Different researches have shown that fat deposited around waistline increases the risk of mortality because fatty tissue in this area secretes cytokines, hormones and metabolically active compounds that can contribute to the development of chronic diseases, particularly CVD and cancers (WHO, 2008).

PART III

Materials and methods

3.1 Study setting

The study was conducted at Dharan city of Sunsari district. Dharan is located at Sunsari district of Koshi Zone in eastern Nepal. It is surrounded by hills at three directions with Charkose forest enclosing it from the south and lie about 17 km north of Itahari.

3.2 Study population

Source population of the study were working population as barber, beautician, municipal waste worker and other working population residing in Dharan, Nepal

3.3 Selection criteria

i. Inclusion criteria:

Population residing in Dharan working as beauticians, barber and municipal waste workers and other working population were included in the study.

ii. Exclusion criteria

- Population who were below 18 years and above age 60.
- Population who were seriously ill, mentally unfit, pregnant and lactating women.
- Population residing in hospitals, prisons, nursing homes, etc.
- Population who were not available at work during the time of study.

3.4 Research Design

A community based cross-sectional and descriptive study was conducted in the survey area Dharan, Sunsari to find the food consumption and nutritional status which includes:

- Individual survey with the help of questionnaire
- Anthropometric measurements of the population: Height, weight, BMI, WHR and WC
- The food frequency questionnaire: In this method, the respondents were asked to remember how often they consume the certain food group.
- 24 hour diet recall: In this method, the respondents were asked to recall all food and beverages they consumed in last 24 hour.

3.5 Sampling technique

Stratified sampling technique followed by simple random sampling was used to select population from the study area. The study populations taken as sample were beauticians, barbers, municipal waste workers and other workers which were chosen from ward no. 13, 14, 15 and 16 by lottery method.

Based on the occupation, of the sample four strata were made. From the strata, sample populations were selected by randomly following North to South direction. Population who are mentally, physically and socially fit and who agreed to take part on the sampling were chosen as sample for the study.

3.6 Sample size

The sample size was determined by using a single proportional formula assuming the prevalence rate of malnutrition to be 50% in the survey area, 95% confidence interval (CI), 7.5 % margin of error (d) and 10% non-response rate was added to the total calculated sample size.

Prevalence of malnutrition (p) = 0.5

Z value at 95% level of significance (z) = 1.96

Margin of error (d) = 0.075

Sample size (N) = $Z^2 \times p\ (1-q) \div d^2$

$= 1.96^2 \times 0.5\ (1-0.5) \div (0.075)^2$
$= 170.74$
≈ 171

Considering non-response rate as 10%, Sample size = 171+17%

$= 200.07 \approx 200$

Therefore, the adjusted sample size is calculated to be 200.

3.7 Research instruments:

Data was collected using structured questionnaire and anthropometric measurement. Interview was conducted with the selected population to fill the questionnaire.

Instruments and equipment necessary for the conduction of the survey are:

- Weighing Machine: - Weighing machine with the capacity of 180 kg and having the least count of 0.1Kg (1 piece)
- Height measuring scale (Stadiometer): - 1 Piece
- Measuring tape: 1 no.
- Measuring cups: 1 set
- Questionnaire: - A well designed and pretested set of questionnaires to collect individual information

3.8 Study variables

3.8.1 Dependent variables

The dependent variables under this study were defined as:

- Body mass index

BMI of <18.5 to 24.9 kg/m² was classified as underweight, 25.0 to 29.9 kg/m² were classified as overweight; while those with a BMI greater or equal to 30.0 kg/m² were classified as obese based on WHO standards of classification (WHO, 2016).

- Waist circumference in cm

Waist circumferences above 80 cm in female and 90 cm in male were identified as being abdominally obese (WHO, 2008).

- Waist to Hip ratio

Waist to hip ratio greater than 0.85 in female and 0.90 in male were considered as abdominally obese (WHO, 2012).

3.8.2 Independent variables

Independent variables included in this study were as follows:

- Socio-economic and demographic variables: Age, caste, religion, marital status, income, occupation, education, parity, family size.
- Dietary intake: With the help of information obtained from dietary assessment nutrients like fat, protein, calorie, carbohydrates were calculated. Nutrients like fat, protein, as well as total calorie were calculated and classified according to WHO recommendations.

It is recommended that 15-30 % of total calories should be included from fat (WHO, 2017). Similarly, it is recommended that 55-75% of total calories should be included from carbohydrate (Mann *et al.*, 2007). Protein intake should be 0.83gm/kg (WHO, 2016). Recommendation for total calories is based on the energy requirement of an individual.

- Behavioral characteristics: Watching TV while eating, sleep, stress, outside eating, smoking, alcohol intake.

3.9 Pre - testing the data collection tools

Pre- testing of the developed questionnaire was done in selected few populations of Dharan city. The pre- testing was conducted to validate accuracy of questionnaire and to check for consistency in the interpretation of questions and to identify ambiguous items. After reviewing, all suggested change was made before being administered in the actual study.

3.10 Validity and Reliability

The instruments were validated from Department of Nutrition and Dietetics of Central Campus of Technology to ascertain the degree to which the data collection instrument will measure the purposed measure. The questionnaire was pre-tested prior to data collection to ascertain content and face validity.

Reliability refers to quality control measure of data collected. Before data collection, the research team was trained on the objectives of the study and on data collection techniques. Instruments were set at 0 reading before taking measurements. Questionnaire was checked daily for completeness, consistency and clarity as mentioned earlier. In addition, the supervisor visited the research site periodically for regular monitoring of data collection.

3.11 Data Collection Techniques

Data collection was spread over two phases, namely, initial contact with the participant, completing the semi structured questionnaire and taking anthropometric measurements. The socio-demographic and economic variables part involved asking the respondents about their age, marital status and parity, income, education and occupation. Information on other variables and data on anthropometric measurements were obtained by following methods.

i. **Anthropometric measurements**: Anthropometric measurements were conducted by measuring height with the help of stadiometer, weight with the help of weighing balance and waist and hip with the help of non-stretchable measuring tape.

a. Waist circumference: It was measured at the mid-point between the lower border of the rib cage and the iliac crest. Waist circumference was measured using a non-stretchable tape halfway between the lower border of ribs and the iliac crest on a horizontal plane, while ensuring that the tape was level around the body and parallel to the floor. The tape was tightened around the body without depressing the skin (CDC, 2007). Two measurements to the nearest 0.1cm were taken and the mean recorded.

b. Hip circumference: It was measured around the highest point of hip. Hip circumference was measured using a non-stretchable tape (CDC, 2007). Two measurements to the nearest 0.1cm were taken and the mean was recorded.

c. Weight: Weight was measured to the nearest 100 grams (0.1kg) using a weighing scale with the capacity of 180 kg, after calibrating it to zero, and after removal of shoes and excess clothing. Both weight and height were taken twice. In order to ensure quality data, the weighing scale was calibrated before measuring of weight every day and after every five measurements during the data collection time (CDC, 2007).

d. Height: Height was measured using stadiometer with the capacity of 197 cm and to the nearest 0.1cm. The subject was told to stand (without shoes) on a horizontal platform with his heels together and with the Frankfurter plain horizontal. The subject draws himself to full height without raising the shoulders with arms and hands relaxed and with the feet flat on the ground (CDC, 2007).

ii. **Dietary intake**: Data was collected by using a food frequency questionnaire and the 24- hour recall method. The food frequency questionnaire was used to obtain information on the type of foods consumed by the respondents in the preceding days and the frequency of consumption of those foods. Various foods from different food groups were read out to the respondent, who in return was required to state the number of times they had consumed the food in the preceding days. The 24-Hour recall involved asking the participants to report on all the foods and drinks consumed in the previous 24 hours (the previous day), in direct chronological order from the first foods in the morning to the last foods before going to bed. Probing allowed us

to obtain information on forgotten foods. A range of standardized measuring cups were used for estimating the amount of foods and beverages actually consumed by the respondents. The gram equivalents of those foods were calculated which was used to calculate amounts of nutrients consumed.

3.12 Data analysis

The questionnaire was checked and rechecked at the end of each day. After the data are manually edited and coded, they are entered into a database immediately. Microsoft Excel 2010 and SPSS version 20 were used to analyze data. Descriptive analysis was used to describe percentage and distribution of respondents by socio demographic variables, , dietary patterns, medical characteristics and behavioral characteristics. Likewise, qualitative data were transcribed and coded by assigning labels to various categories. Verified test parameters were used to find the nutritional status and food consumption of the study population.

3.13 Logistic and ethical considerations

Permission to conduct study was received from Nutrition and dietetics department, Central Campus of Technology. Ethical approval was obtained from National Health and Research Council (NHRC). An informed written and verbal consent was obtained from all the participants. The objectives of the research were explained in simple language. Privacy and confidentiality of collected data was ensured.

PART IV

Result and Discussion

The cross-sectional study to assess the nutritional status and food consumption pattern of potentially risk population of Dharan, Nepal and result obtained are explained under following headings:

4.1 Demographic and socio-economic characteristics

The information on demographic and socio-economic characteristics is shown below:

4.1.1 Gender and age distribution

Out of total 200 selected populations, 52% (104) were male and 48% (96) were female. Among the total 200 populations, 37.0% (74) belong to age group 19-29, 34.5% (69) belong to age group 30-39 whereas 23.0% (46) belong to age group 40-49 and the least 5.5% (11) belong to age group more than 50.

Table 4.1 Gender and age of the study population (n=200)

Variable	Frequency	Percentage (%)
Gender		
Male	104	52.0
Female	96	48.0
Age		
19-29	74	37.0
30-39	70	35.0
40-49	43	21.5
>50	13	6.5

4.1.2 Ethnicity distribution

Dharan is a melting pot of many cultures, representing a mix of diverse cultures of Nepal. Out of the total population, 11.5% (23) were bhramin, 8% (16) were chhetri, 26% (52) were dalit, 28.5% (57) were janajati and 26% (52) were madeshi. The ethnicity distribution of the study population is shown below.

Table 4.2 Ethnicity of the study population (n=200)

Variables	Frequency	Percentage (%)
Ethnicity		
Bhramin	23	11.5
Chhetri	16	08.0
Dalit	52	26.0
Janajati	57	28.5
Madeshi	52	26.0

4.1.3 Marital status and parity distribution

The majority of the study population were married i.e. 74% (148) and only 26% (52) were single or unmarried. Among the 74% married population, 30.5% (61) had no child whereas 28.5% (57) were parents of 1 or 2 children and 41% (82) were parents of more than 2 children.

Table 4.3 Marital status and no. of children of the study population (n=200)

Variable	Frequency	Percentage (%)
Marital status		
Married	148	74.0
Single	52	26.0
No. of children		
None	61	30.5
1-2	57	28.5
More than 2	82	41.0

4.1.4 Socioeconomic factors

The occupation type determines the income and type of physical activity performed during the work. The selected 200 populations were equal divided to each group of barbers, beauticians, waste workers and other i.e. 50 on each group. The population with annual income lo less than 1 lakh were 26% (52), annual income between 1-3 lakhs were 45.5% (91) and income more than 3 lakhs were 28.5% (57). The educational level of the study population was found to be poor. 19% (38) were illiterate whereas 66% (132) were under SLC and only 15% (30) were educated.

Table 4.4 Socio economic factor of the study population (n=200)

Variables	Frequency	Percentage (%)
Occupation		
Beauticians	50	25.0
Barbers	50	25.0
Municipal waste workers	50	25.0
Others	50	25.0
Income		
<1 lakh	52	26.0
1-3 lakhs	91	45.5
>3 lakhs	57	28.5
Education		
Illiterate	38	19.0
Primary	36	18.0
SLC and intermediate	96	48.0
High school	30	15.0

4.1.5 Type of family

According to the house type distribution of the study population, more than half i.e. 53.5% (107) lived in their own house whereas 46.5% (93) lived in rented house. Also, most of the families were nuclear family i.e., 78.0% (156) and only 22.0% (44) were joint family. As per family size, a majority of population lived with family members less than 6 i.e. 69.5% (139) and only 30.5% (61) lived with more than 6 family members.

Table 4.5 Type of family of the study population (n=200)

Variables	Frequency	Percentage (%)
House type		
Own	107	53.5
Rented	93	46.5
Family type		
Nuclear	156	78.0
Joint	44	22.0
Family size		
>6	139	69.5
<6	61	30.5

4.2 Behavioral factors

As we all know, enough sleep is essential for mental, physical and emotional well-being. According to the behavioral factors of the study population, 37.5% (75) sleeps for less than 7 hours per day whereas more than half of the population i.e. 38.5% (77) sleeps for about 7-9 hours per day and only 24% (48) sleeps for more than 9 hours per day. Because the study populations are everyday workers, they certainly have high stress level. 22% (44) have stress frequently in a week whereas 58% (116) for a few times in a week and 20% (40) have it very few times in a week. Stress is directly associated with the consumption of junk food, over eating or completely avoiding food or taking stress relieving food like alcohol or smoking. In the study population, very few, only of 20% (40) are involved in exercise daily and a large number of 80% (160) do not follow any kind of exercise routine. As per the habit of watching television or using mobile while eating, half of the population said yes and half denied. 23.0% (46) always watches television while eating and 27.5% (55) do it frequently while 49.5% (99) do not watch TV or use mobile while eating.

Table 4.6 Behavioral factors of the study population (n=200)

Variables	Frequency	Percentage (%)
Sleep		
Less than 7 hrs	75	37.5
7-9 hrs	77	38.5
More than 9 hrs	48	24.0
Stress		
Frequently	44	22.0
Sometimes	116	58.0
Rarely	40	20.0
Exercise		
Yes	40	20.0
No	160	80.0
Watching TV/mobile		
Always	46	23.0
Frequently	55	27.5
Never	99	49.5

4.3 Eating behavior

Table 4.7 shows the distribution of the eating behavior of the study population. According to the table, 8% (16) were vegan while majority of the study population were non vegan i.e. 88.5% (177) and only 3.5% (7) were ovo vegan. The food choice people make, vegetarian or non-vegetarian, play an important role in the food eating pattern.

Talking about having breakfast, only 38.5% (77) have breakfast daily while 14.5% (29) have only few times a week and 47.0% (94) have habit of having breakfast. Many studies have linked eating breakfast to good health, including better memory and concentration, lower levels of "bad" LDL cholesterol, and lower chances of getting diabetes, heart disease, and being overweight (Betts *et al.*, 2015). In the same way, 67.5% (135) have snacks daily while 9.5% (19)

have it few times a week and 23.0% (46) do not have snacks at all.

Due to the busy schedule of the study population, skipping meal was quite common. 35.5% (71) of them used to skip their meal frequently while 40.5% (81) used to skip for few times a week and only 24.0% (48) never skip their meal. Among the study population, 63.5% (127) preferred homemade food whereas 36.5% (73) preferred food made outside. Due to the work load half of the population 51.5% (103) had different eating time and 48.5% (97) had same eating time every day.

Feasts generally mean 'eat and drink sumptuously'. The populations that have feasts frequently or once a week are 16.5% (33) and 53.0% (106) have it sometimes or twice or thrice a month and 30.5% (61) have it very rarely.

The number of meals eaten per day plays special role on nutritional status. In the study, people having only 2 meals per day were 32% (64), 3 meals per day were 52% (104) and having 4 or more were 16% (32).

Table 4.7 Eating behavior of the study population (n=200)

Variables	Frequency	Percentage (%)
Vegetarianism		
Vegan	16	8.0
Non veg	177	88.5
Ovo vegan	7	3.5
Breakfast		
Daily	77	38.5
Sometimes	29	14.5
No	94	47.0
Snacks		
Daily	135	67.5
Sometimes	19	9.5
No	46	23.0
Skipping meal		
Frequently	71	35.5
Sometimes	81	40.5
Rarely	48	24.0
Preferences		
Outside	73	36.5
Home	127	63.5
Eating time		
Same	97	48.5
Different	103	51.5
Feasts		
Frequently	33	16.5
Sometimes	106	53.0
Rarely	61	30.5
No. of meals		
2	64	32.0
3	104	52.0
4	32	16.0

4.4 Dietary intake

4.4.1 Food consumption pattern

Dietary practices of the respondents were assessed using the food frequency questionnaire. The consumption of food was considered "frequent" if ingested at least once a day, "regular" when ingested 2-4 times a week and "rare" if ingested once a week or less (Sato et al., 2010).

According to the table 4.8, 80.5% (161) of the total population consumed pulses frequently while only 8% (16) consumed it regularly and remaining 11.5% (23) rarely consumed pulses. Most of the population did not know about the importance of daal and pulses in the diet.

The percentage of population consuming green leafy vegetables frequently was only 34.5% (69) while 21.5% (43) consumed it regularly and 44% (88) consumed it rarely. The consumption of other vegetables of the study population was, 57% (114) was frequent, 24.5% (49) was regular and remaining 18.5% (37) was rare. Due to the seasonal variations, price and lack of the knowledge of importance vegetables they do not pay much attention of regular consumption of vegetables.

The consumption of dairy products like milk, curd, etc. was very poor on the study population, only 25.5% (51) consumed it frequently and only 29.0% (58) consumed it regularly and remaining almost half i.e. 45.5% (91) consumed it rarely. The study population complained about the higher prices of the dairy products and had low knowledge about the importance of dairy in the diet.

The consumption of raw vegetables as salads which is rich in fiber was found to be low. Only 17.5% (35) consumed it frequently whereas 16% (32) consumed it regularly and remaining majority of the population, 66.5% (133) consumed salads rarely. Also, the consumption of fruits was very poor. Only 19.5% (39) consumed it frequently while 32.0% (64) consumed it regularly but almost half of the study population consumed it rarely i.e. 48.5% (97). They believed that consumption of fruits every day is not necessary which played a role in lower consumption of fruits.

The consumption of red meat like mutton, buff, pork was quite satisfactory, 20.5% (41) consumed it frequently and 38.0% (76) consumed it regularly and the remaining 41.5% (83) consumed it rarely. The higher consumption was found to be pork, as it is cheaper and easily

available. The consumption of white meat was lower than red meat i.e. only 8% (16) consumed it frequently while 33% (66) consumed it regularly and remaining 59% (118) consumed it rarely. The consumption of eggs was also found as follows. Only 14% (28) consumed it every day and 38.5 % (77) consumed it regularly and remaining 47.5% (95) rarely consumed eggs. The consumption of tea or coffee was found to be higher in the population. Almost 2/3rd of the population, 72.5% (145) consumed frequently and only 7% (14) consumed it regularly and 20.5% (41) rarely consumed tea or coffee.

The consumption of products made up of refined flour was higher as the population had to depend on quick and easy snacking. 24.5% (49) consumed it almost every day, 26% (52) consumed sometimes and 45.5% (99) consumed it rarely. Because of the summer season during the survey, consumption of cold drinks to cool down immediately, it was found higher. 18.5% (36) consumed cold drinks frequently, 38.5% (77) consumed it regularly and remaining 43.5% (87) rarely consumed cold drinks. The consumption of fast food was also found higher in the study population. 28% (56) consumed it frequently while 15% (30) consumed it sometimes and rest 57% (114) rarely consumed junk food.

Table 4.8 Food consumption pattern of the study population (n=200)

Variables	**Frequently Frequency (%)**	**Regular Frequency (%)**	**Rare Frequency (%)**
Pulses	161 (80.5)	16 (8.0)	23 (11.5)
GLVs	69 (34.5)	43 (21.5)	88 (44.0)
Other vegs	114 (57)	49 (24.5)	37 (18.5)
Dairy	51 (25.5)	58 (29.0)	91 (45.5)
Salads	35 (17.5)	32 (16)	133 (66.5)
Fruits	39 (19.5)	64 (32.0)	97 (48.5)
Red meat	41 (20.5)	76 (38.0)	83 (41.5)
White meat	16 (8)	66 (33)	118 (59)
Eggs	28 (14)	77 (38.5)	95 (47.5)
Tea/coffee	145 (72.5)	14 (7.0)	41 (20.5)
Refined flour	49 (24.5)	52 (26.0)	99 (45.5)
Cold drinks	36 (18.5)	77 (38.5)	87(43.5)
Fast food	56 (28.0)	30 (15.0)	114(57.0)

4.4.2 Dietary intake in preceding one day

Food consumption of the participants was assessed using 24-hour dietary recall to report on all the foods and drinks consumed in the previous 24 hours (the previous day). Table 4.9 shows distribution of intake of nutrients like carbohydrate, protein and fat of the populations.

The result of this study showed that 38.0% (76) had adequate calorie intake while 32.5% (65) of the study population had high calorie intake and 29.5% (59) had low calorie intake.

This study concluded that 36.0% (72) had adequate carbohydrate intake while 34.5% (69) had high carbohydrate intake while only 29.5% (59) had low carbohydrate intake. According to FAO and WHO intake of total carbohydrate should be 55-75% of the total energy (FAO, 2008; Shrivastava *et al.*, 2014).

A source of protein is an essential element of a healthy diet, allowing both growth and maintenance of the 25,000 proteins encoded within the human genome, as well as other nitrogenous compounds, which together form the body's dynamic system of structural and functional elements that exchange nitrogen with the environment (Shrivastava *et al.*, 2014). The result of this study showed that 46.0% (92) respondents consumed adequate protein while 17.0% (34) had high intake and 37.0% (74) had low protein intake.

Fats enhance the taste and acceptability of foods. Lipid components largely determine the texture, flavor and aroma of foods. In addition, fats slow gastric emptying and intestinal motility, thereby prolonging satiety. Dietary fats provide essential fatty acids (EFA) and facilitate the absorption of lipid-soluble vitamins. It is recommended that 15-30 % of total calories should be included from fat (WHO, 2016). In this study 46.0% (92) of the respondents consumed high fat diet, 43.0% (86) had normal fat intake while only 11.0% (22) of female consumed low fat diet.

Daily intake of salt should be restricted to less than 5 grams per day (FAO, 2008).This study revealed that majority of population i.e. 56.5% (113) had high salt intake. It might be due to lack of knowledge regarding the appropriate amount of salt consumption.

Table 4.9 Dietary intake of preceding one day of the study population (n=200)

Variables	Frequency	Percentage (%)
Calorie intake		
Adequate	76	38.0
High	65	32.5
Low	59	29.5
Carbohydrate intake		
Adequate	72	36.0
High	69	34.5
Low	59	29.5
Protein		
Adequate	92	46.0
High	34	17.0
Low	74	37.0
Fat		
Adequate	86	43.0
High	92	46.0
Low	22	11.0
Salt		
High	113	56.5
Moderate	87	43.5

4.5 Hygiene and sanitation:

Safe drinking water and proper sanitation and hygiene practices are basic necessities for good health. Table 4.9 shows that the main source of drinking water used was tap water, 97.5% (195) while only 2.5% (5) used other sources of water. 72.0% (144) use water purification methods to purify water and remaining 28.0% (56) do not drink purified water.

Every household had toilet facilities of their own (100%).

Table 4.10 Hygiene and Sanitation characteristics of the study population (n=200)

Variables	Frequency	Percentage (%)
Water sources		
Jar	5	2.5
Tap	195	97.5
Purification		
Yes	144	72.0
No	56	28.0
Toilet facilities		
Yes	200	100

4.6 Nutritional status of the study population

4.6.1 Nutritional status based on International BMI classification

The result of this study was analyzed according to International BMI categorization as given by WHO. Out of total population, 31.5% (63) were underweight, 40.5% (81) were normal and remaining 28% (56) were overweight.

According to the WHO BMI classification in context of males, 34.61% (36) were found to be underweight, 32.69% (34) were normal and remaining 32.69% (34) were found to be overweight or obese. The percentage of underweight male and overweight male i.e. 34.61% and 32.69% varied a lot with the prevalence of underweight male and overweight male i.e. 15.83% and 28.77% in Nepalese adults (Lal B. Rawal *et al.*, 2016). According to NDHS 2016, 17% of male are thin and 17% are overweight. The data varied a lot in the study with NDHS, 2016 which is 34.61% and 32.69%.

In case of females, 28.125% (27) were found underweight, 48.95% (47) were normal and 22.91% (22) were overweight. The percentage of underweight male and underweight female i.e. 28.125% and 22.91% also varied with the prevalence of underweight female and overweight female i.e. 18.30% and 32.87% in Nepalese adults (Lal B. Rawal *et al.*, 2016). According to NDHS 2016, 17% of women are thin and 22% are overweight in Nepal. The case of overweight female was quite similar with NDHS which is 22.91% but varied massively in case of underweight which is 28.125%.

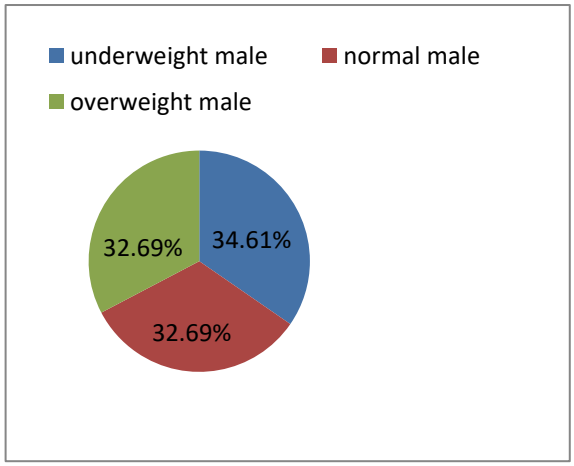

Fig: 4.1 Nutritional status based on BMI of male study population

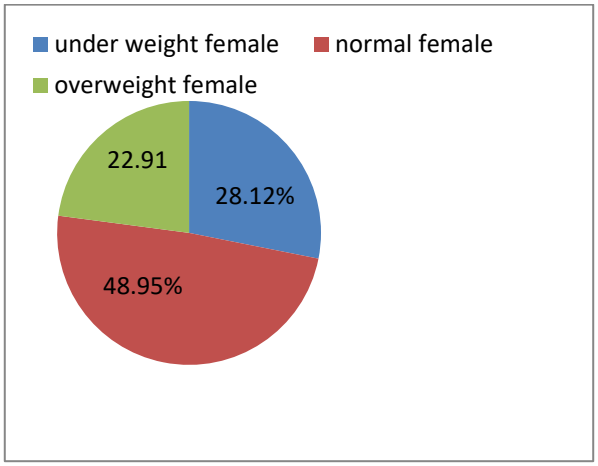

Fig: 4.2 Nutritional Status based on BMI of female study population

4.6.2 Nutritional status based on waist circumference

The result of this study was analyzed according to International WHR categorization as given by WHO. Out of total population, 65.5% (131) were normal and 34.5% (69) were centrally obese.

According to WHO waist circumference categorization of males, large number of males was found to be normal i.e. 70.2% and remaining 29.8% were found to be abdominally obese. In context of females, 60.42% were found normal and remaining 39.58% were abdominally obese. A survey done in 2007 showed that approximately 37% and 55 % of men and women, respectively, were classified as abdominally obese, which proves that abdominal obesity is higher in women than men. Another survey done in Chinese adult also shows higher rate of abdominal obesity in women than men i.e. 35.3% in men and 51.7% in women. The changes with age in the sex hormone levels of both men and women are associated with changes in body fat distribution (Sidik, 2009).

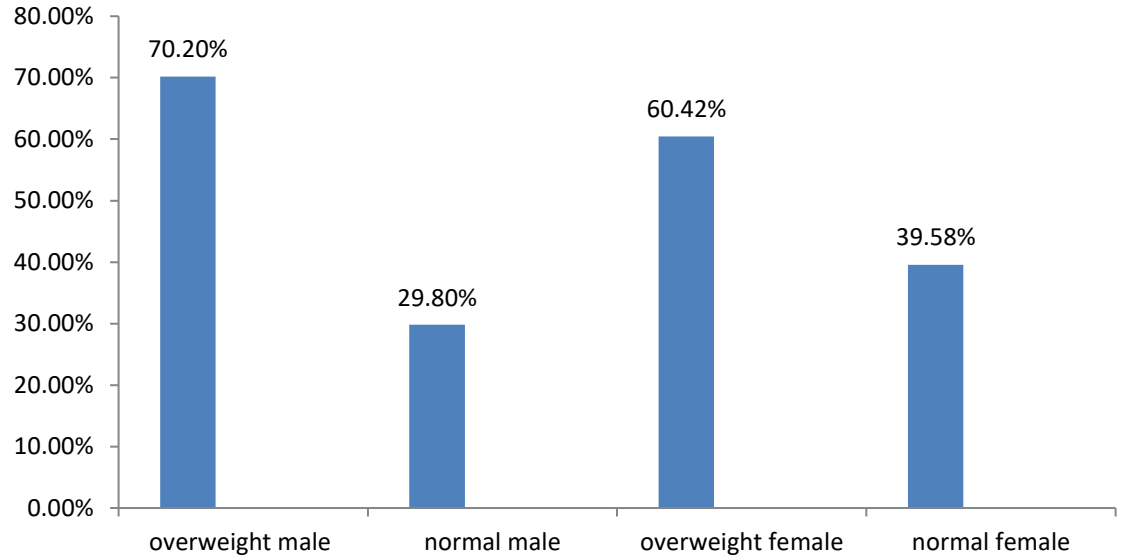

Fig: 4.3 Nutritional Status based on waist circumference of the study population

4.6.3 Nutritional status based on waist to hip ratio

The result of this study was analyzed according to International WHR categorization as given by WHO. Out of total population, 35% (70) were normal and 65% (130) were obese.

According to WHO WHR categorization of males, 50% (52) were normal and same percentage 52% (52) had abdominal obesity. In context of females, 18.75% (18) were normal and majority of females had abdominal obesity, 81.25% (78). The prevalence of overweight or obesity and abdominal obesity was 59.4% (women 73.8% and men 35.1%) in the Survey done in China which varied a little to our study (X *et al.*, 2012).

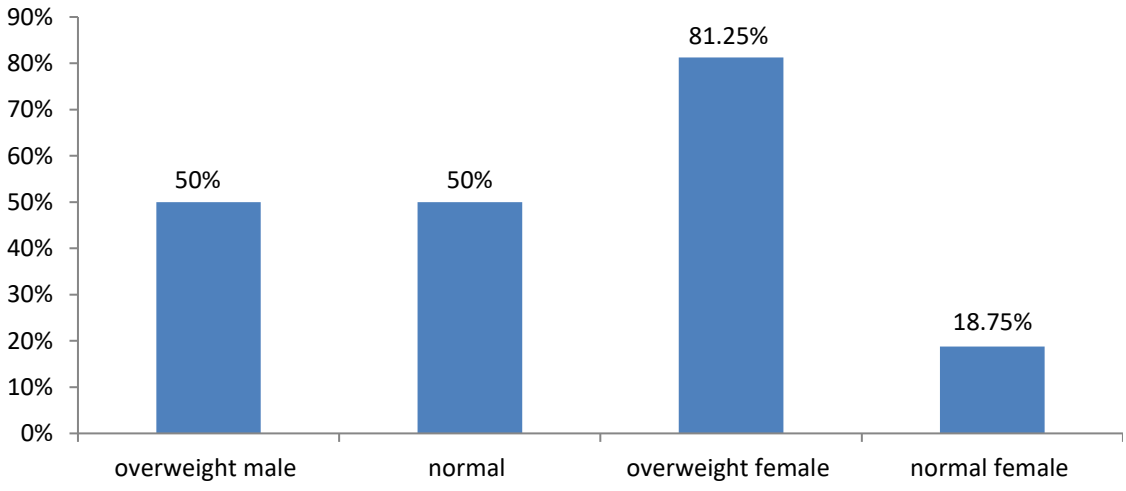

Fig: 4.4 Nutritional status based on Waist hip ratio of the study population

4.7 Factors associated with nutritional status based on BMI

The chi-square analysis showed that marital status (p=0.019), occupation (p=0.000), eating time (p=0.000), preferences (p=0.011), TV/mobile while eating (p=0.029), feast (p=0.025) and red parity (p=0.021) were significantly associated with BMI as shown in table.

The study revealed that marital status is associated with BMI. Most of the married populations were overweight and most of the singles were underweight. 31.75% married population, were overweight and on the other side, 46.15% of singles were underweight. Married people are healthier because they have a spouse who can monitor their health behaviors, who can care for them when they are ill and who will likely discourage them from engaging in risky behaviors (Averett *et al.*, 2010).

As per the occupation, most of the barbers were underweight i.e. 44% of barbers and whereas 58% waste workers were overweight. Studies in middle and low-income countries have yielded more-mixed results on socioeconomic differences in obesity, but these results may not be comparable to those from high-income countries because of the different role of under nutrition (Silventoinen *et al.*, 2013).

Eating time was also found to be associated with BMI. Most of the people having no fix time of eating were found to be underweight, 36.89% whereas 41.23% of people eating at same time were found to be overweight.

Preferences of homemade food or junk food were also found to be associated with BMI. 41.1% who prefer homemade food were found underweight whereas 34.64% people who preferred junk food were found overweight. Obesity is generally associated with high intake of junk foods rich in energy, fat, sugar and salt combined with a dysfunctional control of appetite and lack of exercise (Bayol *et al.*, 2007).

Using mobile phone or watching television while eating also has an association with BMI. 40% of people who watch TV/mobile sometimes while eating was found underweight and 37.37% of people who never watch TV/ mobile eating were found to be overweight.

Parity plays an important role in the BMI of parents. Similarly, in the study, 44.3% who do not have children were underweight and 36.6% who have more than 2 children were overweight. Weight gain and/or weight retention is because of hormonal changes during

pregnancy, increased dietary intake in females, adverse lifestyle risk factors associated with child-rearing and other postpartum behaviors in both male and females (Koch, 2008).

Table 4.11 Factors associated with nutritional status based on BMI (n=200)

Factors	Category	Under wt Frequency (%)	Normal Frequency (%)	Over wt Frequency (%)	Chi-square	p-value
Marital status	Married	39 (26.35)	62 (41.89)	47 (31.75)	7.932	0.019
	Single	24 (46.15)	19(36.53)	9(17.30)		
Occupation	Beauticians	15 (30)	27 (54)	8 (16)	35.078	0.000
	Waste worker	12 (24)	9 (18)	29 (58)		
	Barbers	22 (44)	20 (40)	8 (16)		
	Others	14 (28)	25 (50)	11 (22)		
Eating time	Same	25 (25.77)	32 (32.98)	40 (41.23)	16.371	0.000
	Different	38 (36.89)	49 (47.57)	16 (15.53)		
Preferences	Homemade	30 (41.1)	31 (42.5)	12 (16.4)	8.958	0.011
	Junk	33 (25.98)	50 (39.37)	44 (34.64)		
TV/Mobile	Always	17 (36.96)	18 (39.13)	11(23.91)	10.753	0.029
	Sometimes	22 (40)	25 (45.46)	8 (14.54)		
	Never	24 (24.24)	38 (38.39)	37 (37.37)		
Parity	0	27(44.3)	24 (39.3)	10 (16.4)	11.525	0.021
	1-2	13 (22.8)	28 (49.1)	16 (28.1)		
	More than 2	23(28.0)	29 (35.4)	30 (36.6)		

4.7.1 Association between intake and food consumption pattern

The intake and food consumption associated with BMI are calorie intake (p=0.004), protein intake (p=0.036), other vegetables intake (p=0.045), red meat (p=0.033) and salad intake (p=0.023).

The amount of calorie intake was associated with the BMI. 25% of populations consuming adequate calories were underweight and 41.3% consuming high calories in the

diet were found overweight. Obesity is often considered to be a result of either excessive high calorie food intake or insufficient physical activity (Hill *et al.*, 2012).

Similarly, protein intake was also associated with the BMI. 35.1% of people consuming low protein was underweight and 44.1% populations consuming high protein were found overweight. High protein intake in young children is associated with excess gains in weight and body fat, but the specific role of different protein sources has yet to be described (Pimpin L, 2018). A study conducted in obese people resulted that high protein diet actually helps in losing weight (Clifton, 2008).

Consumption of other vegetable besides green leafy vegetables was found to be associated with BMI. 33.3% who frequently consume vegetables were underweight and 46.0% who rarely consume vegetables were overweight. Dietary guidelines around the world recommend increased intakes of fruits and non-starchy vegetables for the prevention of chronic diseases and possibly obesity. A survey done in middle aged men and women supported the same results (Charlton K, 2017).

Salads are usually taken with the meals to get enough fiber for digestion and satiety. Consumption of salads was also associated with BMI. 49.4% who consumed salads rarely were underweight and 63.9% who consumed salads frequently were overweight. A diet high in fiber has been suggested to improve weight loss and decrease other anthropometrical indices (Hammadi, 2016).

The study found out that the red meat consumption of the study population was higher which shows the association with BMI. 30.1% of populations who rarely consumed red meat were underweight whereas 46.3% who consumed red meat everyday were overweight. A study done in 2014 revealed that red and processed meat intake is directly associated with risk of obesity, and higher BMI and WC (Azadbakht, 2014).

Table 4.12 Association of intake and food consumption with nutritional status based on BMI (n=200)

Factors	Category	Underweight Frequency (%)	Normal Frequency (%)	Overweight Frequency (%)	Chi-square	p-value
Calories	Adequate	19 (25)	42 (55.3)	15 (19.7)	18.916	0.004
	Low	28 (43.1)	21 (32.2)	16 (24.7)		
	High	16 (27.6)	18 (31.1)	24 (41.3)		
Protein	Adequate	29 (31.5)	34 (37.0)	29 (31.5)	10.284	0.036
	Low	26 (35.1)	36 (48.7)	12(16.2)		
	High	8 (23.5)	11 (32.4)	15 (44.1)		
Other vegetables	Frequently	38 (33.3)	52 (45.7)	24 (21.0)	9.760	0.045
	Sometimes	14 (28.6)	20 (40.8)	15 (30.6)		
	Rarely	11 (29.7)	9 (24.3)	17 (46)		
Salads	Frequently	6 (8.3)	20 (27.8)	46 (63.9)	11.294	0.023
	Sometimes	11 (15.3)	7 (9.7)	54 (75)		
	Rarely	46 (49.4)	14 (15.1)	33 (35.5)		
Red meat	Frequently	12 (29.3)	10 (24.4)	19 (46.3)	10.486	0.033
	Sometimes	26 (34.2)	31 (40.8)	19 (25)		
	Rarely	25 (30.1)	40 (48.2)	18 (21.7)		

4.8 Factors associated with nutritional status based on waist circumference

The chi square test showed that sleep (p=0.009), occupation (p=0.000), gender (p=0.000), water intake (p=0.002) are significantly associated with waist circumference.

According to the table, 28% of beauticians were centrally obese, 38% waste workers were centrally obese, 28% of barbers were centrally obese and 44% of other populations were centrally obese. Adults spend about one third of their day at work and occupation may be a risk factor for obesity because of associated socioeconomic and behavioral factors such as physical activity and sedentary time (Allman-Farinelli *et al.*, 2010).

In context of gender, females were found to be more abdominally obese than males. The percentage of females who were obese was 39.6% and males were 29.8%. A survey done in

adults showed high prevalence of central obesity in women than men, 56.8% in women and only 12.6% in men (Fasanmade *et al.*, 2015). In females, the biological factor of menopause affects fat distribution that may increase risk or exacerbate negative effects of obesity on health (Caballero, 2012).

The amount of sleep per day was also found to be associated with high waist circumference. The people who slept more than 9 hours were found more centrally obese i.e. 47.91% than who sleep less. Several studies have demonstrated that insufficient sleep is associated with increased risk for poor physical health and mental health. In parallel with the decrease in sleep, the prevalence of obesity has increased (Sperry *et al.*, 2015).

Water intake was also found to be associated with waist circumference. People who drink more than 4 liters of water per day were found to be more obese i.e. 41.0%. Drinking water is often applied as a dietary means for weight loss and overweight/obesity prevention, but no evidence-based recommendation exists for this indication (Müller-Nordhorn, 2013).

Table 4.13 Factors associated with nutritional status based on waist circumference (n=200)

Factors	**Category**	**Normal Frequency (%)**	**Overweight Frequency (%)**	**Chi-square**	**p- value**
Occupation	Beauticians	36 (72.0)	14(28)	112.771	0.000
	Waste worker	31(62.0)	19 (38)		
	Barbers	36 (72.0)	14 (28)		
	Others	28 (56.0)	22 (44)		
Gender	Male	73(70.2)	31(29.8)	200.000	0.000
	Female	58 (60.41)	38(39.6)		
Sleep	>7 hrs	41 (54.66)	34 (45.34)	17.143	0.009
	7-9 hrs	62 (80.5)	15 (19.5)		
	< 9hrs	25 (52.09)	23 (47.91)		
Water intake	>2 ltrs	25 (67.6)	12 (32.4)	21.160	0.002
	2-4 ltrs	60 (70.6)	25(29.4)		
	< 4 ltrs	46 (59.0)	32 (41.0)		

4.8.1 Association with intake and food consumption

The chi square test showed that white meat consumption (p=0.000), fruit consumption (p=0.001), cold drinks consumption (p=0.031), fat intake (p=0.006) and carbohydrate intake (p=0.026) are significantly associated with waist circumference.

According to the table, 41% population consuming fruits frequently were found centrally obese. Fruit contains large amounts of simple sugars (glucose, fructose, sucrose, etc.), which are well known to induce obesity. Thus, considering the amount of simple sugars found in fruit, it is reasonable to expect that their consumption should contribute to obesity rather than weight reduction (Sharma *et al.*, 2016).

Population consuming white meat frequently, 37.5% were found to be centrally obese. In the contrary, studies show no relation of being centrally obese due to white meat consumption. The content of saturated fatty acid from red meat consumption may be a factor that contributed to this relationship, while white meat consumption was not associated with metabolic syndrome (Cocate *et al.*, 2013).

38.9% population consuming cold drinks frequently were found to be centrally obese. A study done in 2017 showed 51% had abdominal obesity who consumed sweetened cold drinks frequently. Sodas and other sweetened drinks are full of sugar such as high-fructose corn syrup. Many also contain caffeine, which is a diuretic that can cause dehydration (Zahran, 2016).

The population consuming adequate amount of carbohydrates rich were found to be obese, i.e. 37.5%. A survey done in Srilanka also showed that 45% of the populations were centrally obese who has high or adequate consumption of carbohydrates.

Population consuming high amount of fat than the required were seen abdominally obese, i.e. 38%. Various observational studies in developing and transitional countries suggested that shifting from a lower to a higher percentage of fat has been associated with higher total energy intake and to unhealthy weight gain, thus, potentially contributing to the increasing problem of overweight and obesity (Shrivastava *et al.*, 2014).

Table 4.14 Association with intake and food consumption with nutritional status based on waist circumference (n=200)

Factors	Category	Normal Frequency (%)	Overweight Frequency (%)	Chi-square	p-value
Fruits	Frequently	23(59.0)	16(41.0)	26.697	0.0001
	Sometimes	48(75.0)	48(25.0)		
	Rarely	60 (61.8)	37 (38.2)		
White meat	Frequently	10 (62.5)	6(37.50)	22.546	0.000
	Sometimes	44(66.67)	22(33.33)		
	Rarely	77(65.25)	41(34.75)		
Cold drinks	Frequently	22(61.11)	14(38.9)	13.851	0.031
	Sometimes	48(32.3)	29(37.7)		
	Rarely	61(70.1)	26(29.9)		
Carbohydrates	Adequate	45(62.5)	27(37.5)	14.387	0.026
	Low	42(71.2)	17(28.8)		
	High	44(63.8)	25(36.2)		
Fat	Adequate	57(66.3)	29(33.70)	18.200	0.006
	Low	17(77.3)	5(22.70)		
	High	57(62.0)	35(38.0)		

4.9 Factors associated with nutritional status based on waist hip ratio

The chi-square test showed that marital status (p= 0.013), occupation (p=0.000), gender (p=0.000), age (p= 0.026), watching TV/mobile (p=0.025), water intake (p= 0.015) are significantly associated with waist hip ratio.

The study revealed that marital status was associated with Waist Hip ratio. 70.94% of married individual had abdominal obesity which is supported by the study done in India (Sen *et al.*, 2013). Similarly, study done in Malaysia showed significant association between obesity and marital status. Marital status affects overweight and obesity because being married causes less conscious on their physical appearance (Sidik, 2009).

Besides, occupation played a role in abdominal obesity, 80% of beauticians, 64% waste workers, 60% barbers and 56% of other populations were obese.

As per the gender, females were found to have high prevalence of abdominal obesity than male. 50% of male study populations were found to be obese whereas 81.25% of females were found to be obese. The changes with age in the sex hormone levels of both men and women are associated with changes in body fat distribution (Sidik, 2009).

Age was also the associated factor for waist hip ratio. People of age group above 50 were all 100% abdominally obese. Similarly, a study conducted in South Asian population found that with age, waist circumference too increases (Amin F, 2015). It is because with age BMR decreases and utilization of fat decreases (Fetters, 2015).

People who rarely watch TV while eating were mostly found overweight, 75.75% but no theories was found to support this result. People consuming less than 2 liters of water daily were found abdominally obese, 70.27%. Drinking plenty of water is commonly recommended in weight loss regimens; however, very limited scientific evidence is available to justify this (Vij *et al.*, 2014).

Table 4.14 Factors associated with nutritional status based on waist hip ratio (n=200)

Factors	**Category**	**Overweight Frequency (%)**	**Normal Frequency (%)**	**Chi-square**	**p-value**
Marital status	Married	105 (70.94)	43 (29.05)	10.780	0.013
	Single	25 (48.07)	27 (51.92)		
Occupation	Beauticians	40 (80)	10 (20)	112.051	0.000
	Waste worker	32 (64)	18 (36)		
	Barbers	30 (60)	20 (40)		
	Others	28 (56)	22 (44)		
Gender	Male	52 (50)	52 (50)	200.00	0.000
	Female	78 (81.25)	18 (18.75)		
Age	19-29	36 (48.64)	38 (51.35)	18.874	0.026
	30-39	50 (71.42)	20 (28.57)		
	40-49	31 (72.09)	12 (27.90)		
	<50	13 (100)	0		
TV/mobile	Always	26 (56.52)	20 (43.47)	14.476	0.025
	Sometimes	29 (52.72)	26 (47.27)		
	Rarely	75 (75.75)	24 (24.24)		
Water	>2 ltrs	26 (70.27)	11 (29.72)	15.862	0.015
	2-4 ltrs	57 (67.05)	28 (32.94)		
	<4 ltrs	47 (60.25)	31 (39.75)		

4.9.1 Association between intake and food consumption pattern

The intake and food consumption associated with WHR are carbohydrates intake (p=0.016), fat intake (p=0.003), pulse intake (p=0.03), white meat (p=0.001), tea/ coffee consumption (p=0.029) and fruit intake (p=0.001).

This study showed that abdominal obesity was more prevalent in people consuming high carbohydrates, i.e. 72.5% in their diet than people consuming low or adequate calories as centrally obesity is associated with high or adequate consumption of carbohydrates.

The study also revealed that higher the intake of fat higher the rate of abdominal obesity of people were abdominally obese who consumes high fat in diet i.e. 63.7%. A survey done in India shows that prevalence of central obesity was 33.5% in those consuming high fat. This association can be linked to the high intake of energy due to generous use of oil for stir-frying the vegetables (Narasimhan *et al.*, 2016).

People consuming pulses frequently in their diet were found to be abdominally obese i.e. 69.6%. But no such results were found but dietary pulses (nonoil seeds of legumes such as beans, lentils, chickpeas, and dry peas) are well positioned to aid in weight control (Kim *et al.*, 2016).

White meat is also found to be associated with WH ratio. People consuming white meat regularly were found more abdominally obese, i.e. 74.25%. No significant relationship was found between white meat consumption, and general and abdominal obesity.

In the regular pattern of food intake, people who consumed tea/coffee frequently, 69.7% of them were abdominally obese. Drinking too much bubble tea can cause health problems that the huge amount of sugar in bubble tea might lead to obesity in young people.

People who consume fruits regularly were also found abdominally obese, i.e. 73.4%. Fruit contains large amounts of simple sugars (glucose, fructose, sucrose, etc.), which are well known to induce obesity (Sharma *et al.*, 2016).

Table 4.15 Association of intake and food consumption with nutritional status based on WHR (n=200)

Factors	**Category**	**Normal Frequency (%)**	**Overweight Frequency (%)**	**Chi-square**	**p-value**
Carbohydrates	Adequate	27(37.5)	45(62.5)	15.579	0.016
	Low	24(40.7)	35(59.3)		
	High	19(27.5)	50(72.5)		
Fat	Adequate	37(43.02)	49(56.98)	20.017	0.003
	Low	6(5)	6(5)		
	High	37(36.3)	65 (63.7)		
Pulses	Frequently	49(30.4)	112(69.6)	13.933	0.030
	Sometimes	9(56.3)	7(43.7)		
	Rare	12(52.2)	11(47.8)		
White meat	Frequently	8 (50)	8 (50)	22.441	0.001
	Sometimes	17(25.75)	49(74.25)		
	Rare	45(38.1)	73(61.9)		
Tea/ coffee	Frequently	44(30.3)	101(69.7)	14.030	0.029
	Sometimes	10(71.4)	4(28.6)		
	Rare	16(39.0)	25(61)		
Fruits	Frequently	13(33.33)	26(66.67)	22.626	0.001
	Sometimes	17(26.6)	47(73.4)		
	Rare	40(41.2)	57(58.8)		

PART V

Conclusion and recommendations

5.1 Conclusion

The study focus on the nutritional status and food consumption pattern and factors associated with the nutritional status of the study population of Dharan, Sunsari. Following conclusions can be drawn from the study.

i. According to the BMI classification, 31.5% of total populations were underweight where as 28% of them were overweight.
ii. According to waist circumference, 19.64% of total males were abdominally obese and 39.58% of total females were abdominally obese.
iii. According to the WHR classification, 81.25% of total females were abdominally obese whereas 50% of total male were abdominally obese.
iv. The percentage of people consuming pulses regularly were 80.5%, GLVs consuming were 34.5%, dairy consuming were 25.5%, fruits were 19.5%, salads consuming were 17.5%, red meat consuming were 20.5%, tea consuming were 72.5%.
v. The factors associated with BMI are marital status (p=0.019), occupation (p=0.000), eating time (p=0.000), preferences (p=0.011), TV/mobile while eating (p=0.029) and no. of children (p=0.021), calorie intake (p=0.004), protein intake (p=0.036), other vegetables intake (p=0.045), red meat (p=0.033) and salad intake (p=0.023).
vi. The chi square test showed that sleep (p=0.009), occupation (p=0.000), gender (p=0.000), water intake (p=0.002), white meat consumption (p=0.001), fruit consumption (p=0.0000, cold drinks consumption (p=0.031), fat intake (p=0.026) and carbohydrate intake (p=0.026) are significantly associated with waist circumference.
vii. The factors associated with WHR are marital status (p= 0.013), occupation (p=0.000), gender (p=0.000), age (p= 0.026), watching TV/mobile (p=0.025), water intake (p= 0.015), carbohydrates intake (p=0.016), fat intake (p=0.003), pulse intake (p=0.03), white meat (p=0.001), tea/ coffee consumption (p=0.029) and fruit intake (p=0.001).
viii. Thus low consumption of green leafy vegetables, fruits, dairy, and salads in the people may also have micro nutrient deficiency in them.
ix. Thus, most of the working population in Dharan, were underweight as the BMI criteria and most of the females are abdominally obese according to waist hip ratio.

5.2 Recommendations

Based on the results of this study following recommendations could be made in order to lower the risk of overweight and obesity in reproductive aged females:

i. The high prevalence of poor nutritional status in the study area highlights a need for behavior change programs and strategy related to improve lifestyle through improved dietary practices and knowledge.
ii. The study could be replicated in other areas, and a comparison made with current study to establish if the problem of poor nutritional status is widespread. This would help in establishing the factors that contribute to BMI, WC and WHR in the study population.

PART VI

Summary

Nutrition is the intake of food, considered in relation to the body's dietary needs. Good nutrition means an adequate, well balanced diet combined with regular physical activity is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity. Similarly, an eating pattern represents the totality of all foods and beverages consumed. All foods consumed as part of a healthy eating pattern fit together like a puzzle to meet nutritional needs without exceeding limits.

A cross sectional study was conducted in working population of Dharan to know about the nutritional status and food consumption pattern. This study measured different anthropometric measurements and analyzed the data in microsoft excel and SPSS version 20.0 and WHO international classification on BMI, WC and WHR was used to determine generalized criteria of BMI, WC and WHR. The result concluded that 31.5% of populations were underweight and 28% were overweight using WHO 18.9-24.9 criteria whereas 29.81% of males were centrally obese using WHO WC >90 cm criteria and 39.58% females were centrally obese using WHO WC >80cm and 81.25% of females were abdominally obese using WHO WHR >0.84 criteria and 50% males were abdominally obese using WHO > 0.90 criteria.

There are many factors like age, gender, marital status, no. of children, preferences, calorie intake, fat intake, carbohydrate intake, protein intake and fruit consumption, egg consumption, other vegetables consumption, white meat, red meat, salads, tea/coffee, pulses, water intake, watching TV/mobile, which are directly associated with nutritional status based on BMI, waist hip ratio and waist circumference of study population.

The result showed that nutritional status and the consumption of food according to food groups were poor. The working population of the Dharan has poor nutritional status which may be due to lack of knowledge, income or ignorance. The high prevalence of poor nutritional status in the study area highlights a need for behavior change programs and strategy related to improve lifestyle through improved dietary practices and knowledge.

References

Ahuja, S. (2016). Importance of nutrition education. *Agro FOOD Industry Hi Tech, **27***(1).

Allman-Farinelli, Chey, T., Merom, D., & Bauman, A. E. (2010). Occupational risk of overweight and obesity: an analysis of the Australian Health Survey. *Journal of Occupational Medicine and Toxicology, **5***(14). doi:https://doi.org/10.1186/1745-6673-5-14

Amin F, F. S. S., Islam N, and Gilani A. H. (2015). Prevalence of obesity and overweight, its clinical markers and associated factors in a high risk South-Asian population. *BMC obesity, 2*(16).

Ashakiran, & R, D. (2012). Fast Foods and their Impact on Health. *Journal of Krishna Institute of Medical Sciences University, **1*** (2). doi:10.6.2012

Averett, S., Sikora, A., & Argys, L. M. (2010). For Better or Worse: Relationship Status and Body Mass Index. ***1***, 28.

Azadbakht, M. H. R. A. S. A. P. J. S. L. (2014). Is there a relationship between red or processed meat intake and obesity? A systematic review and meta-analysis of observational studies. ***15***(9), 740-748. doi: https://doi.org/10.1111/obr.12172

Bank, W. (2012). *Nutrition in Nepal: A National Development Priority [Report]*. . Retrieved from Washington DC,USA: http://documents.worldbank.org/curated/en/635951468124159285/Nutrition-in-Nepal-a-national-development-priority

Bayol, S., Farrington, S., & Stickland, N. (2007). A maternal 'junk food' diet in pregnancy and lactation promotes an exacerbated taste for 'junk food' and a greater propensity for obesity in rat offspring. ***98***(4), 843-851.

Betts, J., Chowdhury, E. A., Gonzalez, J. T., Richardson, J. D., Tsintzas, K., & Thompson, D. (2015). Is breakfast the most important meal of the day? *Proceedings of the Nutrition Society, **1***(4), 1-14. doi:10.1017/S0029665116000318

Blössner, M., & Onis, M. d. (2005). *Malnutrition Quantifying the health impact at national and local levels* (9241591870). Retrieved from http://www.who.int/iris/handle/10665/43120

Caballero, R. K. a. B. (2012). Global Gender Disparities in Obesity: A Review. *Advances in Nutrition, **3***(4), 491-498. doi:10.3945/an.112.002063

CDC. (2007). *NHANES, Anthropometric procedures manual*. Retrieved from https://www.cdc.gov/obesity/downloads/BMIforPactitioners.pdf

Charlton K, K. P., Soriano MM, Williams S, Banks E, Vo K, Byles J. (2017). Fruit and vegetable intake and body mass index in a large sample of middle-aged Australian men and women. *Nutrients, **6***(6). doi:10.3390/nu6062305.

Clifton, P. M., Bastiaans, K. and Keogh, J. B. (2008). High protein diets decrease total and abdominal fat and improve CVD risk profile in overweight and obese men and women with elevated triacylglycerol. Nutrition, Metabolism and Cardiovascular Diseases. . *Nutrition, Metabolism and Cardiovascular Diseases., **19***(8), 548-554.

Cocate, Antônio José Natali, & Oliveira, A. d. (2013). Red but not white meat consumption is associated with metabolic syndrome, insulin resistance and lipid peroxidation in Brazilian middle-aged adults

Devkota, S. C., De, A., & Sathian, B. (2015). Nutritional Deficiencies: Major Public Health Problem in Nepal. *American Journal of Public Health Research, **3***, 5. doi:10.12691/ajphr-3-4A-1

FAO. (1996). *Rome Declaration on World Food Security and World Food Summit*. Retrieved from Rome: http://www.fao.org/WFS/

FAO. (2004). *Uses of food consumption and anthropometric surveys in the Caribben*. Retrieved from Rome: http://www.fao.org/3/a-y5825e.pdf

FAO. (2008). *Food consumption* (978-92-5-106540-2). Retrieved from http://www.fao.org/3/i1515e/i1515e00.pdf

FAO. (2009). *Methods to Monitor the Human Right to Adequate Food*. Retrieved from Geneva: http://www.fao.org/3/a-i0351e.pdf

Farrell. (2013). *The Impact Of Nutrition Education On Food Security Status And Food-related Behaviors.* University of Massachusetts Amherst. Retrieved from https://scholarworks.umass.edu/theses/1036

Fasanmade, O., & Raimi, T. (2015). High prevalence of central obesity in rural South-Western Nigeria: Need for targeted prevention. *Journel of Diabetes and Endocrionology*, ***6***(3), 12-18. doi:10.5897/JDE2015.0084

Fetters. (2015). How your metabolism changes in your 20s, 30s and 40s. Womens Health. *Women's health*.

Gerbens-Leenesa, P. W., & M.S.Krola, S. N. (2010). *Food consumption patterns and economic growth*. Retrieved from https://doi.org/10.1016/j.appet.2010.09.013

Gillespie, S., & Haddad, L. (2001). Attacking the Double Burden of Malnutrition in Asia and the Pacific. *ADB Nutrition and Development Series, **4***.

Hammadi, E. A. (2016). Effects of Dietary Fiber Intake on Body Weight and Waist Circumference. *Arab Journal of Nutrition and Exercise (AJNE)*, ***1***(2), 77-84. doi:10.18502/ajne.v1i2.122

Hill, J. O., Wyatt, H. R., & Peters, J. C. (2012). *Energy Balance and Obesity* (Vol. **1**).

IFPRI. (2014). *Global Nutrition Report 2014: Actions and Accountability to Accelerate the World's Progress on Nutrition. [Report]*. Retrieved from Washington, DC: http://globalnutritionreport.org

IJABM. (2016). Gender differences in eating behaviour. *International Journal of Accounting & Business Management, 4*. doi:10

Institute, N. C. (2016). Dietary Assessment Primer. *A Resource for Diet Research, **115***(12), 1986-1995. doi:10.1016/j.jand.2015.08.016

Jelliffe, D. B. (1996). *The assessment of the nutritional status of the community [Report]*.

Johnson, O. C. (1963). A conference on Nutrition Teaching in medical school. *Nutrtion Reviews, **21***(2), 33-36.

Joshi. (2015). Nutrition and Dietetics- with Indian Case Studies (Vol. **4**). CHHENAI: McGraw Hill Education (India) Private Limited.

Joshi, P. (2012). Malnutrition in Children: A Serious Public Health Issue in Nepal. . *Health Prospect, **11***, 61-62.

Kankana, D. E. (2017). Study nutritional status by waist circumference and waist hip ratio. *Journal of Health & Medical Informatics, **8***(1).

Keller, W. (1982). Choice of indicator of Nutritional Status.

Kim, S., Russell de Souza, Vivian L Choo, & Adrian, V. H. (2016). Effects of dietary pulse consumption on body weight. *The American Journal of Clinical Nutrition, **130***(5), 1213-1223.

Koch, E., Bogado, M., Araya, F., Romero, T., Diaz, C., Manriquez, L., Paredes, M., Roman, C., Taylor, A. and Kirschbaum, A. (2008). Impact of parity on anthropometric

measures of obesity controlling by multiple confounders: A crosssectional study *Journal of Epidemiol Community Health.*, ***62***, 461-470.

Kong, T. G. o. H. (2017). Center for food safety.

Kris-Etherton, P. M., Akabas, S. R., & Bales, C. W. (2014). The need to advance nutrition education in the training of health care professionals and recommended research to evaluate implementation and effectiveness.

Lal B. Rawal, Kie Kanda, R. A. M., Deepak Joshi, Suresh Mehata, Nipun Shrestha, Prakash Poudel, . . . Renzaho, A. (2016). Prevalence of underweight, overweight and obesity and their associated risk factors in Nepalese adults: Data from a Nationwide Survey.

Madhvapaty, H., & Dasgupta, A. (2015). Study of Lifestyle Trends on Changing Food Habits of Indian Consumers *IOSR Journal of Environmental Science, Toxicology and Food T*, ***9***(I), 16-22.

Madiba, J. S. (2006). *Factors influencing food consumption patterns in selected communities in Limpopo Province, South Africa* (Magister Institutionis Agrariae), University of Pretoria, Pretoria.

Mann, J., Cummings, J., Englyst, H., Key, T., & Liu, S. (2007). FAO/WHO scientific update on carbohydrates in human nutrition : conclusions., ***6***(1).

Meerman, J., & Aphane, J. (2012). *IMPACT OF HIGH FOOD PRICES ON NUTRITION*. http://www.fao.org/fileadmin/user_upload/agn/pdf/Meerman_Aphane_ICN2_FINAL.pdf

MoHP. (2016). *Nepal Health and Demography Survey*. https://www.dhsprogram.com/pubs/pdf/fr336/fr336.pdf

Müller-Nordhorn, R. M. G. S. A. G. J. (2013). Association between water consumption and body weight outcomes: a systematic review. *The American Journal of Clinical Nutrition*, ***98***(2), 282-299.

Musaiger, A. O., Al-Khalifa, F., & Al-Mannai, M. (2016). Obesity, unhealthy dietary habits and sedentary behaviors among university students in Sudan. *Environmental health and preventive medicine, **4***, 224-230. doi:10.1007/s12199-016-0515-5

Narasimhan, Lakshmipriya Nagarajan, Ruchi Vaidya, Geetha Gunasekaran, Gayathri Rajagopal, Vijayalakshmi Parthasarathy, . . . Vasudevan Sudha. (2016). Dietary fat intake and its association with risk of selected components of the metabolic syndrome among rural South Indians. *Indian Journal of Endocrinology and Metabolism, **20***(1), 47-54. doi:10.4103/2230-8210.172248

NHMRC. (2004). *Clinical practice guidelines for the management of overweight and obesity in adults*. Retrieved from https://www.nhmrc.gov.au/guidelines-publications/n57

NHS. (2015). *Malnutrition*. Retrieved from England: ohttp://www.nhs.com/malnutrition/

Otuneye, A. T. A., P. A. Abdulkarim, A. A. Aluko, O. O. Shatima, D. R. (2017). Relationship between dietary habits and nutritional status among adolescents in Abuja municipal area council of Nigeria. *Nigerian Journal of Paediatrics, 44*(3), 128. doi:10.4314/njp.v44i3.1

Paula, C., Priscila, A. T., Elizabeth, F., Rosane, P., & Debora, M. (2012). *Eating behaviors and the social status of families of malnourished children* (Vol. **46**).

Pimpin L, J. S., Johnson L, Llewellyn C, Ambrosini GL. (2018). Sources and pattern of protein intake and risk of overweight or obesity in young UK twins. ***120***(7), 820-829. doi:10.1017/S0007114518002052

Population, M. o. H. a. (2016). *Nepal Health and Demography Survey*. Retrieved from Ministry of Health Ramshah Path, Kathmandu Nepal

Reddy, S., & Anitha, M. (2015). Culture and its Influence on Nutrition and Oral Health. *Biomedical and Pharmacology Journal*, ***12***(1). doi:http://dx.doi.org/10.13005/bpj/757

Reinhardt, K., & Franzo, J. (2014). Addressing chronic malnutrition through multisectorial sustainable approaches. *A review of the causes and consiquences, **1***, 13.

Sen, N., M., & Dutta, S. (2013). Factors affecting overweight and obesity among urban adults: a cross-sectional study. *Epidemiology Biostatistics and Public Health, **10***(1).

Sharma, Hea Chung, Hyeon J. Kim, & Hong, S. T. (2016). Paradoxical Effects of Fruit on Obesity. ***8***(10), 633. doi: 10.3390/nu8100633

Shridhar, & Rajendra N, M. H., Shridevi P, Prasad M, Mujeeb MA, Arun S, Neeraj D, Vikas S, Suneel D, Vijay K. (2015). Modern Diet and its Impact on Human Health. *Journal of Nutrition & Food Sciences, **5***(430). doi:10.4172/2155-9600.1000430

Shrivastava, S. R., & Shrivastava, P. S. (2014). Assessment of nutritional status in the community and clinical settings. *Journal of Medical Sciences, **34***(5), 211-213. doi:10.4103/1011-4564.143648

Sidik, S. M. a. R., L. (2009). The prevalence and factors associated with obesity among adult women in Selangor, Malaysia. *Asia Pacific Family Medicine, **8***(2).

Silventoinen, K., Tatsuse, T., Martikainen, P., & Ossi Rahkonen, E. L., Michikazu Sekine, and Tea Lallukka. (2013). Occupational Class Differences in Body Mass Index and Weight Gain in Japan and Finland. ***6***, 443-450. doi:10.2188/jea.JE20130023

Sperry, S., Scully, S. D., Gramzo, R. H., & Jorgensen, R. S. (2015). Sleep Duration and Waist Circumference in Adults: A Meta-Analysis. ***38***(8), 1269-1276. doi:10.5665/sleep.4906

UNDP. (2018). Annual report. Retrieved from http://www.np.undp.org/content/nepal/en/home/

UNICEF. (2015). *Conceptual Framework for Causes of Malnutrition*. Retrieved from Geneva: https://www.unicef.org/sowc98/fig5.htm

USAID. (2010). *Food utilization practices, beliefs and taboos in Nepal* (10-01-367). Retrieved from www.ghtechproject.com/resources

USAID. (2018). *Nepal: Nutrition Profile* Retrieved from https://www.usaid.gov/sites/default/files/documents/1864/Nepal-Nutrition-Profile-Mar2018-508.pdf

Vabø, M. (2014). *The Relationship between Food Preferences and Food Choice*. Retrieved from Norway: www.ijbssnet.com

Veghari, G. (2013). The relationship of ethnicity, socio-economic factors and malnutrition in primary school children in north of iran. *a cross-sectional study*, ***13***(1).

Vij, & S, J. A. (2014). Effect of excessive water intake on body weight, body mass index, body fat, and appetite of overweight female participants. ***5***(4), 340. doi:10.4103/0976-9668.136180

Wathome, D. M. (1990). *The relationship between income and food consumption patterns in urban nakuru.* University of Nairobi.

WFP. (2007). WFP Annual Report 2007.

WHO. (2008). World health stastics.

WHO. (2012). World health statics.

WHO. (2015). A Healthy Diet.

WHO. (2016). *Nutrition for Health and Development* Retrieved from https://www.who.int/nutrition/nhd/en/

WHO. (2017). Obesity and overweight

WHO, & UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children* (978 92 4 159816 3). Retrieved from https://www.who.int

WHO (2012). Prevalence of obesity, abdominal obesity and associated factors in hypertensive adults aged 45-75 years., ***3***(32), 361. doi:10.1016/j.clnu.2012.08.005

Zahran, S. M. (2016). Association of Beverage Consumption with Obesity in Healthy Adults. ***1***(1), 37-51. doi:10.18502/ajne.v1i1.1222

Zimmerman, M. B. S. (2012). *An Introduction to Nutrition* (Vol. **1**).

Appendices

Appendix A

INFORMED CONSENT

Date ……

Namaste!

I Ms. Jenisha Dahal, graduate student in Department of Nutrition and Dietetics conducting a dissertation work for award of bachelor's degree in Nutrition and Dietetics

The topic for the study '**NUTRITIONAL STATUS AND FOOD CONSUMPTION OF WORKING POPULATION OF DHARAN, NEPAL'**

For this study, you have been chosen as one of the participants. I would like to take some of your measurements and I will be asking few questions about you eating pattern. This will be very helpful for me to conduct this survey. This will take very few minutes. Confidentiality will be maintained and only be shared for academic purposes. Any question that you don't want to answer is okay.

Therefore I take your consent to participate in the above study. You can withdraw this consent at any later date, if you wish to. This consent form being signed voluntarily indicates your participation in the study.

Signature ……..

The study procedures will be explained in the detail and I hope all questions will fully and clearly be answered.

Investigator's sign ……

Appendix B

Questionnaire

General characteristics

1. Name:
2. Sex: Male Female
3. DOB:
4. Age in years:
5. Measurements:

Height (cm)	Weight (kg)	BMI	Waist/hip ratio

6. Address:
7. Family size:
8. Family type: Nuclear Family Joint family
9. Income of family: less than1 lakh 1-3 lakhs more than 3 lakhs
10. Type of house: Own Rented
11. Education level:

24 HOUR DIETAEY RECALL

Meals	Description	Amount
Breakfast		
Lunch		
Snacks		
Dinner		
Before bed		

FOOD CONSUMPTION PATTERN

12. How many meals do you have in a day?

    One Two Three

13. How often do you have feasts?

    Once a week Twice a week Sometimes

14. Do you have breakfast?

    Yes: No: Sometimes:

15. Do you have snacks?

Yes: No: Sometimes:

If yes; At home: Outside:

16. Do you skip your meal?

Yes: No: Sometimes:

17. How often do you stay fasting?

Once a week Sometimes Never

18. Do you eat together with your family?

Before: Together: After:

19. Do you eat leftovers?

Yes No Sometimes

20. Do you replace your food with other items?

Yes No Sometimes

21. Do you have same eating time every day?

Yes No

22. Who makes food at your home?

23. Which kind of oil do you use for cooking?

Vegetable oil: Animal oil: Others:

24. What kind of salt do you use?

25. Amount of oil used per month?.....ltr

26. Amount of salt used per month?.....kg

27. Do you take medications? Yes No

28. Do you smoke? Yes: No

29. Do you drink? Yes: no:

	Everyday	*4-5times a week*	*2-3times a week*	*Once a week*	Every 15 days	Every month	Never
Pulses *Whole* *Polished*							
GLVs							
Other vegs							
Salads							
Milk and milk products							
Fruits							
Meat/fish/eggs/chicken							
Tea/coffee							
Cold drinks							
Refined flour pdts *pasta/noodles/other*							
packaged food							
junk food *chatpatey/panipuri* *chowmin/thukkpa* *pizza/burger* *momos*							

Hygiene and sanitation

30. What is the source of drinking water?

31. Any purification method used?

32. Do you use any protective materials during work?

Appendix C

Survey site

Appendix D

NHRC Approval letter

Government of Nepal

Nepal Health Research Council (NHRC)

Estd. 1991

Ref. No.: 747

4 October 2018

Ms. Jenisha Dahal
Principal Investigator
Institute of Science and Technology

Ref: **Approval of thesis proposal** entitled **Nutritional status and food consumption pattern of different population groups (municipal waste workers, barbers, beauticians and normal)of Dharan, Nepal**

Dear Ms. Dahal,

It is my pleasure to inform you that the above-mentioned proposal submitted on **11 May 2018 (Reg. no. 269/2018)** has been approved by Nepal Health Research Council (NHRC) National Ethical Guidelines for Health Research in Nepal, Standard Operating Procedures Section 'C' point no. 6.3 through Expedited Review Procedures.

As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol. Expiration date of this proposal is **November 2018.**

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission. The researchers will not be allowed to ship any raw/crude human biomaterial outside the country; only extracted and amplified samples can be taken to labs outside of Nepal for further study, as per the protocol submitted and approved by the NHRC. The remaining samples of the lab should be destroyed as per standard operating procedure, the process documented, and the NHRC informed.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of their research proposal and **submit progress report in between and full or summary report upon completion.**

As per your thesis proposal, the total research budget is **NRs 11,000** and accordingly the processing fee amounts to **NRs 1,000.** It is acknowledged that the above-mentioned processing fee has been received at NHRC.

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

Thanking you,

Nirbhay Kumar Sharma
Acting Administrative Chief

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Website: http://www.nhrc.org.np, E-mail: nhrc@nhrc.org.np

Appendix E