NUTRITIONAL STATUS AND ITS ASSOSCIATED FACTORS AMONG ADULT POPULATION RESIDING IN DHARAN SUB-METROPOLITAN CITY

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A dissertation submitted to the Department of Nutrition and Dietetics, Central Campus of Technology, Tribhuvan University, in the 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 Its Associated Factors Among Adult Population Residing in Dharan Sub-metropolitan City* presented by Yosha Bhandari has been accepted as the partial fulfillment of the requirements for the degree of Bachelor of Science in Nutrition and Dietetics.

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ABSTRACT

The rapid social and economic transition of Nepal has resulted in the issue of double burden of malnutrition. Individual with lower weight are at risk various disease and disorder but the individuals with excess weight are also at the risk for a variety of disabling and life-threatening chronic conditions, including high blood pressure, menstrual abnormalities, psychosocial dysfunction etc. Thus, a cross-sectional descriptive study was done on 159 adults aged 18-59 years using a structured questionnaire and weight, height, waist circumference and hip circumference were measured to calculate BMI and analyzed using WHO classification. This study determined the pattern and prevalence of underweight, overweight and obesity along with central obesity among the people of Dharan. Microsoft excels and SPSS version 20 was used to analyze data. Chi square test was used to analyze the association between BMI and all the potential risk factors.

It was found that 5.4% were underweight, 44.7% were normal weight, 33.3% were overweight and 16.4% were obese. This study also found that blood pressure (p= 0.048), age (p=0.03), diabetes (p=0.05), type of diet (p=0.05) were significantly associated with the nutritional status of people residing in Dharan sub-metropolitan city. Type of diet (p=0.05), occupation(p=0.05) and blood pressure(p=0.04) were found to have a relation with abdominal obesity due to waist circumference while consumption of junk food(p=0.05) was found to be associated with abdominal obesity (WHR).To address both underweight and overweight, policymakers must simultaneously focus on encouraging positive behavior through education and addressing society-level risk factors that prevent people from achieving optimal health.

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LIST OF ABBREVIATIONS

Abbreviations	Full form
AHA	American Heart Association
BMI	Body Mass Index
CBS	Central Bureau for Statistics
CD	Communicable Disease
CDC	Centre for Disease Control
CED	Chronic Energy Deficiency
CVD	Cardiovascular Diseases
DALYs	Disability Adjusted Life year
GAIN	Global alliance for Improved Nutrition
GoN	Government of Nepal
GDP	Gross Domestic Product
IEG	Independent Evaluation Group
NAD+	Nicotinamide-Adenine Dinucleotide
NCDs	Non-Communicable Diseases
SEAR	South East Asian Region
SES	Socio-economic Status
STEPS	STEPwise approach to Surveillance
UK	United Kingdom
UNDP	United Nations Development Program
UNSCN	United Nations System Standing Committee on Nutrition
US	United States
WB	World Bank

WHO	World Health Organization
WC	Waist Circumference
WP	The Washington Post
WHR	Waist-Hip Ratio

PART I

INTRODUCTION

1.1 Background

Malnutrition in all its forms remains a global concern, particularly affecting highly vulnerable populations in several regions of the world including both underdeveloped and developed countries (IEG. 2016). Malnutrition manifests itself in many different ways: as poor child growth and development; as individuals who are skin and bone or prone to infection; as those who are carrying too much weight or whose blood contains too much sugar, salt, fat, or cholesterol; or those who are deficient in important vitamins or minerals (IEG. 2016). Malnutrition is a state of retarded physical development or specific clinical disorder caused by consistent lack of one or more nutrients. It is the diminishing health outcome due to deficiency, excess or imbalance of nutrients. Infants, pre-school children, adolescents, pregnant women and elderly people are the persons likely to be malnourished (Joshi 2016). The causes behind Nepal's stubbornly high malnutrition rates include poor health, poor sanitation, poor early childcare practices, poor agricultural practices and proper priority setting (Holt 2012). Urbanization has led to more change in lifestyle, accessibility to high fat, high sugar led food, more sedentary lifestyle promoting overweight and obesity (Subedi, Marais et al. 2017).

According to WHO, two billion people in the world suffer from various forms of malnutrition and approximately 1.9 billion adults, 18 years and older, are overweight or obese, while 462 million are underweight in 2014 (WHO 2018). Women, infants, children, adolescents and elderly are at particular risk of malnutrition. Malnutrition and diet are by far the biggest risk factors for the global burden of disease: every country is facing a serious public health challenge from malnutrition (IEG. 2016). In 2008, the prevalence of underweight was 46·5 % in India. From 2008 to 2012, 25·8 % of underweight persons transitioned to normal BMI, 12·9 % of normal-weight persons became underweight and 0·1 % of overweight/obese persons became underweight in India (Rai, Fawzi et al. 2018). The different common causes of underweight includes improper nutrition, intensive physical exercise, hereditary issues, chronic issue or serious health issues, side effects of medications and physiological illness (Kerkar 2018).

Obesity and overweight, rising in every region and nearly every country, are now becoming staggering global challenge (GAIN 2012). Many countries, most notably the US and UK, have experienced dramatically escalating obesity rates during the last two decades, rates that will continue to rise in the future (WP 2008). The worldwide obesity rate increased from 2.3% to 19.6% between 1990 and 2000 (BM and CM 1998). In the Pacific Islands, the Middle East, and China, obesity has increased at least threefold since 1980 (WHO 2004). The figure for obesity was greater in future burden of obesity and diabetes will affect developing countries like Nepal. In South East Asia there is double prevalence of female obesity in comparison to male obesity (WHO 2016). Recent study showed that the highest proportion of the world's obese people (13%) live in the United States. China and India together represent 15% of the world's obese population (Murray and Ng 2014).

Nepal, a federal democratic republic with approximately 30 million inhabitants, is a landlocked South Asian country located between China to the north and India to the east, south, and west. Its geography, culture, and religions are highly diverse and rich. Nepal comprises three distinct geographical areas: the Terai, the middle hills and valleys and the Himalayan Mountains. Much of Nepal's population resides in the fertile and humid south. In 2007, Nepal's adult literacy rate was 57% and life expectancy was 64 years (Vaidya, Shakya et al. 2010). Nepal falls in low human development category ranking 145 among 187 countries in the world, but still has progressed from 157th in 2013 which shows the increase in both income and educational level of Nepalese people (UNDP 2015) . The annual rate of urbanization was found to take place at 3.2% in 2014 (WB 2014) . Sunsari district too has urbanized from 17.5% in 1981 to 19.8% in 2001 and finally 34.3% in 2014. Dharan is the 8th largest urban city in terms of population size (CBS 2014).

1.2 Statement of problem and justification

The Double Burden of Malnutrition (DBM) is the coexistence of both under nutrition and over nutrition in the same population across the life course (Shrimpton and Rokx 2012). The DBM affects all countries, rich and poor. The DBM occurs in populations, households, and individuals**.** The prevalence of DBM at the household level is stunted children coexisting with overweight/obese women. At the individual level, the most common form of DBM seems to be energy over nutrition and iron deficiency (Mason and Shrimpton

2010). The causes of the DBM are related to a series of changes occurring in the world called the nutrition transition, the demographic transition, and the epidemiological transition of countries. The consequences of the DBM are enormous (Shrimpton and Rokx 2012) . This DBM phenomenon is an emergent public health problem. DBM profoundly complicates nutritional interventions because under- and over-nutrition have so far been treated as distinct nutritional problems when in fact they may share similar determinants (Wong, Zalilah et al. 2015).

Today, nearly one in three persons globally suffers from at least one form of malnutrition: wasting, stunting, vitamin and mineral deficiency, overweight or obesity and diet-related NCDs (WHO 2016). There is accumulating evidence that when economic conditions improve, obesity and diet related non-communicable diseases may escalate in countries with high levels of under nutrition. Nutrition transition is rapid in developing countries, but Nepalese transition is relatively unknown. It is speculated that the process of the nutrition transition in Nepal began in the 1980s following urbanization and the decision to open the economy to globalization and agricultural trade liberalization.

It is said that Nepal is in the fourth stage of nutrition transition; A country with a changing dietary pattern towards fat and sugar and decreasing intake of carbohydrate with increasing fast food intake. It is also said that Nepal is transiting from the stage three to four in the epidemiological transition; A country with increasing NCDs and decreasing communicable diseases with high prevalence of under nutrition as well as increasing overweight/ obesity (Subedi, Marais et al. 2017).

Table 1.1 Changes in the macronutrient distribution of total dietary energy in the Nepalese diet (1970-2010)

Sources of dietary energy (% of total energy kcal/capita/day)	**1970**	**1990**	**2010**
Energy from carbohydrate	74.2	72.9	70.2
Energy from protein	10.5	10.2	10.5
Energy from fat	12.4	14.5	17.3

The diet is shifting towards more energy dense foods, notably towards more meat, fat and sugar. Perhaps the increases in the western fast food franchises, local provender and supermarkets have had an influential role on dietary change. This shift has been particularly strong in urban centers, with meat and fat sectors underpinning growth (Subedi, Marais et al. 2017).

According to WHO, the mean prevalence of underweight/thinness in adult above 18 years age was found to be 17.1 among both genders while 16.5 for men while 17.6 for women. The mean prevalence of overweight among the adults aged 18 years and above was found to be 20.4 for both gender while 18.6 for males and 22.2 for females in 2015 (WHO 2015).

Both nutritional deficiency and over nutrition are evident to have an adverse impact on human health. People having nutritional deficiency are less immune and thus more prone to suffer from different infectious diseases (SM and Aynul 2010). On the contrary, overweight and obese persons are at higher risk to develop non-communicable diseases (NCDs) such as diabetes, hypertension, coronary heart disease and cancers (Burton, Foster et al. 1985). Effects of malnutrition are further devastating for women because it not only affects their own health but also the health of their offspring (Marchi, Berg et al. 2015) and it is imperative to ensure proper nutrition for every adult in order to nurture a healthy nation. Malnutrition also slows economic growth and perpetuates poverty. Mortality and morbidity associated with malnutrition represent a direct loss in human capital and productivity for the economy (Shekar, Heaver et al. 2006).

While warnings about health consequences of excess weight abound much less attention seems to be paid to the implications of being underweight. This may partly be explained by the fact that underweight is not as prevalent as being overweight among the adults (Letamo and Navaneetham 2014). For a country like Nepal, which is already troubled with an array of social, political as well as health issues, it is difficult to address double burden of malnutrition. Therefore, this study aimed to document the prevalence and risk factors of malnutrition encompassing both under nutrition and over nutrition prevailing among the adults residing in Dharan. This study will offer an insight to the stakeholders regarding the trend and magnitude of malnutrition existing among the adults residing in Dharan. This study also intended to offer some recommendations for policy and practice to address

DBM in Dharan, which will provide some evidence to the stakeholders for planning and implementing target specific and focused public health interventions to overcome this burden.

Identification of risk factors and their quantification is of great importance in order to calculate the avoidable burden of disease and framing of cost-effective strategies for prevention (Gyamfi 2010). Therefore, this study is designed to assess the nutritional status of the adults residing in Dharan sub-metropolitan city of hypertension and its risk factors among the people aged 18-59 years in Dharan Sub-metropolitan city which can be used as references for designing the effective programs for controlling both CDs and NCDs.

1.3 Conceptual framework

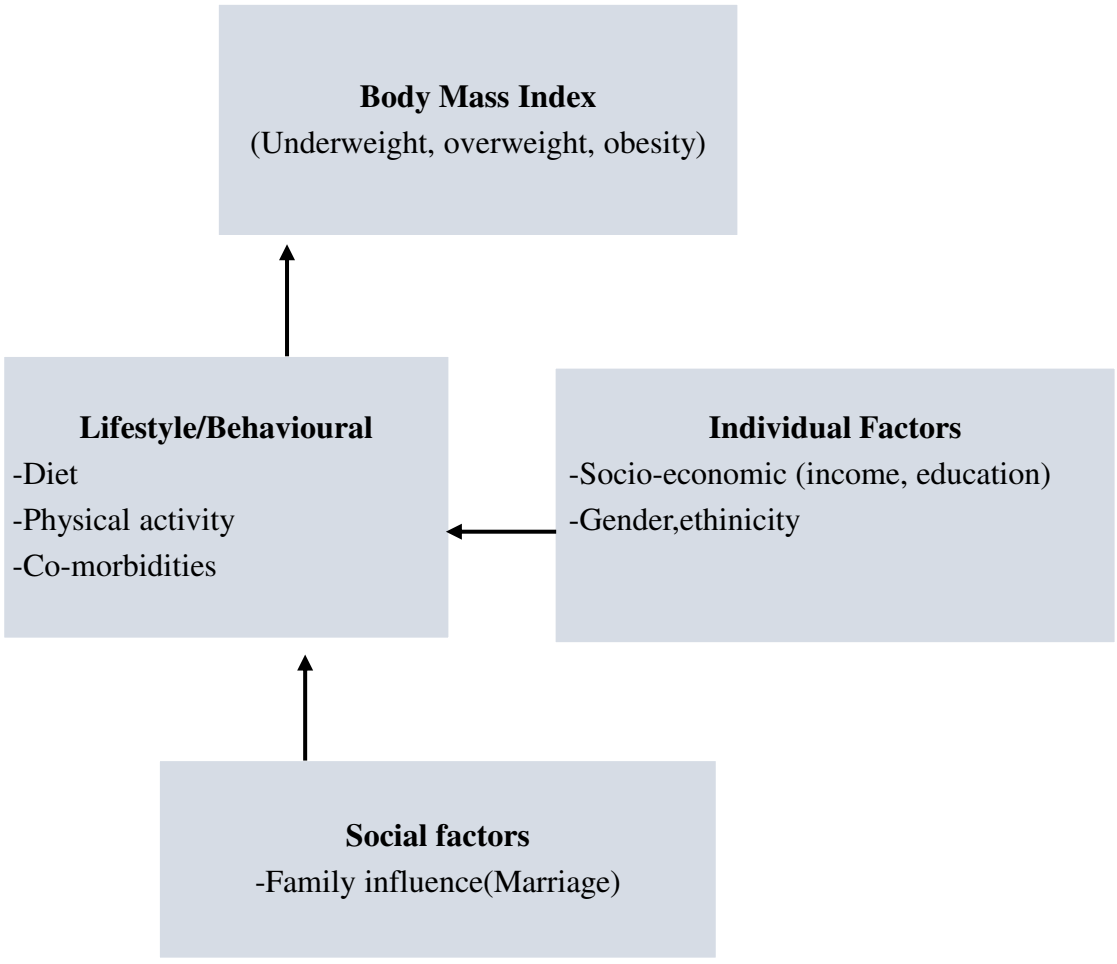

Fig1.1 Conceptual framework for underweight, overweight and obesity (Sartorius, Veerman et al. 2015)

1.4 Objectives of the study

1.4.1 General Objective

To assess the nutritional status among the adult people residing in Dharan sub-metropolitan city.

1.4.2 Specific Objectives

a) To carryout anthropometric measurements of 18- 59 years of people residing in Dharan to assess the nutritional status.

b) To conduct survey to find out socio-economic status, dietary intake, physical activity level, family history, behavioral factors and health factors with the help of questionnaire.

c) To identify some associated risk factors associated with nutritional status among the adult people residing in Dharan.

1.5 Research questions

The study investigated these general research questions:

a) What is the nutritional status of the adult people in Dharan?

b) What are the factors that are associated with nutritional status among population aged 18-59 years in Dharan?

1.6 Scope of the study

The study mainly focuses on the extent of prevalence, level of risks and the major risk factors associated with nutritional status among the residents in Dharan sub-metropolitan city. It also covers the individual age groups that are at most risk of different forms of malnutrition. Other determinants such as physical, environmental, socio-economic, biological, behavioral and nutritional factors that are known to correlate with malnutrition occurrence were also measured by the study among the residents. The study results may also be useful in highlighting the problem of hypertension and the main contributing factors. As health problems associated under and over-nutrition are increasing in number, these findings will be useful in formulating plans and policies according to the need as well as the end result could be used to form messages and counseling the people of this area.

1.7 Limitations

This study was carried out in Dharan sub-metropolitan city. The findings may not be generalized to others cities. Instrumental and personal errors may arise while measuring and recording anthropometric data and blood pressure. Number of people with higher age group was less so the relation with age was difficult to assess Respondents might not have given adequate information regarding economic status, age, education, dietary information due to hesitation or memory bias. Measurement of salt intake may not have been accurate.

PART II

LITERATURE REVIEW

2.1 Malnutrition

Malnutrition, in all its forms, includes under nutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and resulting diet-related non-communicable diseases. The developmental, economic, social, and medical impacts of the global burden of malnutrition are serious and lasting, for individuals and their families, for communities and for countries (WHO 2018). Although adult nutritional status can be evaluated in many ways, the BMI is most widely used because its use is inexpensive, noninvasive and suitable for large-scale surveys(Bose, Bisai et al. 2006). Therefore, BMI is the most established anthropometric indicator used for assessment of adult nutritional status (Datta Banik, Bose et al. 2007). BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially adult populations of developing countries (Banik 2012).

There are various forms of malnutrition that prevails among the adults which includes:

a). Under nutrition: Under-nutrition among adults is commonly assessed by using body mass index (BMI), defined as the weight in kilograms di vided by the square of the height in meters (kg/m^2). Under-nutrition or Chronic Energy Deficiency (CED) is usually defined when the BMI values is less than 18.5 kg/m^2 (Letamo and Navaneetham 2014).

b). Overweight and Obesity: A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more than 25 is considered overweight (Organization 2015).

The consequences of under-nutrition among adults and children are well known. There are certain health risks associated with under-nutrition such as vitamins deficiencies, osteoporosis, decreased immune function, increased risk for complications from surgery etc. (Nall 2018). Under-nutrition is a greater risk factor for low productivity, poor health and mortality. Moreover, under-nutrition among women leads to poor reproductive health outcomes (Mora and Nestel 2000). Under-nutrition and poor health from preventable causes disproportionately affect the well-being of millions of people in the developing

countries (Bitew and Telake 2010). Fear of being fat may induce unnecessary attempts to reduce body weight , producing thinness that in some cases is associated with nutritional deficiencies, irregular menstruation, and eating disorders (Patton, Selzer et al. 1999).

Previous studies suggest that underweight in women of childbearing age is a risk factor for adverse pregnancy outcomes, such as intrauterine growth retardation or low-birth weight infants. Low BMI can be a sign of CED and lack of adequate weight gain during pregnancy can lead to low birth weight babies leading to adverse health implications. Women with CED have increased morbidity while other studies have linked low BMI to decreased work capacity (Letamo and Navaneetham 2014).

Recent studies suggest that overweight and obese women were at greater risk to develop pregnancy-related complications like gestational diabetes, hypertension and prolonged labor and more likely to deliver through caesarian section (Hasan, Sutradhar et al. 2017). There is an overall consensus that obesity poses a significant risk for the development of cardiovascular disease, alterations in glucose metabolism and certain cancers, and reduces life expectancy (Gunaid 2012).

According to Global Nutrition Report, 2016 11 percent of gross domestic product (GDP) is lost every year in Africa and Asia due to malnutrition. Every year, global GDP losses from malnutrition are greater than what was lost each year during the 2008-2010 financial crisis.it also states that in the United States, when one person in a household is obese, the household spends on average an additional 8 percent of its annual income in healthcare costs. In China, a diagnosis of diabetes results in an annual 16.3 percent loss of income for those with the disease (Haddad, Achadi et al. 2015). Thus malnutrition, both under-nutrition and over-nutrition not only has health consequences but also economic consequences.

On the other, health professionals have warned about the adverse health outcomes of overweight and obesity [3]. Another explanation emanates from the fact that thinness is commonly regarded as an ultimate goal to the extent that it is hard to think of thinness as a health concern [7]. As such there is limited research on the health and well-being of underweight adults in the context of Sub-Saharan Africa, particularly in Botswana. Both underweight and obesity are forms of under-nutrition and have greater health consequences. However, with respect to human development perspective, underweight

demands as high degree of priority as it signifies the lack of food security than obesity which indicates over consumption of food.

2.1 Malnutrition around the world

Overweight and obesity prevalence is increasing worldwide both in developed and developing countries. In the United States, obesity increased for both sexes, as well as across ages, and ethnicities (Ogden, Carroll et al. 2006). In 2008, 33.9% of American adults was obese and 34.4% was overweight (Fryar, Carroll et al. 2012). In European countries, the prevalence of obesity was about 10% and the overweight prevalence was 36.6% and 25.6% among men and women. Individuals in the United Kingdom had the highest prevalence of obesity (12%), while Italians, French and Swedes had the lowest levels of obesity (about 7%) (Martinez, Kearney et al. 1999). In Asia, the prevalence of overweight and obesity were lower than the North of America. The prevalence rate of overweight and obesity among Chinese adults were 21.51% and 2.92% respectively, with higher prevalence seen in the north than in the south, more in females than in males, and more in older age than in younger (Wang, Wang et al. 2001). The prevalence of overweight and obesity among Thai adults was 31.5% and 7.8% (2003). In Malaysia, overweight and obesity prevalence were 41.1% and 14.4% (2003) (Nishida and Mucavele 2005).

Table 2.1 Prevalence of overweight among adults (18+ years) by WHO (WHO 2015)

	Prevalence of overweight among adults (18+ years), BMI <18 (crude estimates) (%)		
WHO region	**Both sexes**	**Male**	**Female**
African	30	21.8	37.6
Americas	61.4	63	59.9
South-East Asia	20.7	18.4	22.9
Europe	57.8	62.1	53.6
Eastern Mediterranean	47.5	44	51.5
Western Pacific	30.3	31.89	28.5
WHO Global	37.8	37.4	38.2

The prevalence of underweight is low in developed countries but it remains high in developing countries. The prevalence of underweight is the United States and Canada is 2.4% (Nishida and Mucavele 2005) and 2.0% [8] respectively. In Asian countries, the prevalence of underweight is very high: 19.2% in Thailand in 2003 (Nishida and Mucavele 2005); 9.6% in Malaysia in 2003 (Nishida and Mucavele 2005); and 20.9% in Vietnam in 2005 (Ha, Feskens et al. 2011). Underweight and overweight are coexisted in all countries around the world; many developing countries face the dual challenge of continuing underweight and increasing overweight (Kim, Hwang et al. 2010). Literature focusing on urbanization and health showed that the prevalence of overweight is significantly higher in urban than in rural areas.

Table 2.2 Prevalence of underweight among adults (18+ years) by WHO (WHO 2015)

	Prevalence of underweight among adults (18+ years), BMI <18 (crude estimates) (%)		
WHO region	**Both sexes**	**Male**	**Female**
African	11.4	12.6	10.2
Americas	1.8	1.3	2.3
South-East Asia	21	20.6	21.5
Europe	1.4	0.7	2
Eastern Mediterranean	7.9	7.8	7.9
Western Pacific	6.3	5.2	7.5
WHO Global	9.3	8.8	9.6

2.3 Malnutrition in Nepal

Over the past few decades, the total population of Nepal has increased substantially with rapid urbanization, changing lifestyle and disease patterns. There is anecdotal evidence that NCDs and associated risk factors are becoming key public health challenges (Abarca-Gómez, Abdeen et al. 2017). The mean BMI Index of Nepal according to WHO 2016 is 22.5 kg/m² (WHO 2015). Nepal has been facing increasing burden of chronic NCDs over

the last 20 years (Aryal 2014). According to the WHO, approximately 60% of total deaths (aged between 30 and 70 years) are attributable to NCDs and NCD-related conditions in Nepal (WHO. 2014). Nepal has higher age-standardized death rates and disability-adjusted life years from NCDs than communicable diseases (Abarca-Gómez, Abdeen et al. 2017). The common modifiable risk factors for NCDs include tobacco use, harmful use of alcohol, inadequate intake of fruits and vegetables, high salt and trans-fat consumption, and physical inactivity (WHO. 2014). These risk factors are highly prevalent among the Nepalese adults (Bista, Mehata et al. 2015). According to the WHO STEP wise approach to surveillance (STEPS) survey 2013, 10.4 % of the Nepalese adults were found to be under weight, 17.7% were overweight, 4% obese, 12.3% currently consuming alcohol, 17.8% current tobacco users and only 1.1% having sufficient fruits and vegetables intake (Bista, Mehata et al. 2015). Further, the survey reported almost 41% of adults had at least one NCD risk factor, 30.9% had 2 risk factors, 18.7% had 3 risk factors and 9.0% had 4 or more NCD risk factors (Abarca-Gómez, Abdeen et al. 2017).

Table 2.3 Prevalence of underweight and obesity among adults (18+ years) in Nepal , BMI <18 (crude estimates) (WHO 2015)

Prevalence of underweight among adults (18+ years), BMI <18 (crude estimates) (%)			
Years	**Both sexes**	**Male**	**Female**
2013	17.8	17.1	18.4
2014	17.4	16.8	18
Prevalence of obesity among adults (18+ years), BMI <18 (crude estimates) (%)			
Years	**Both sexes**	**Male**	**Female**
2013	19.2	17.5	20.9
2014	19.8	18.1	21.5

2.4 Risks factors associated with malnutrition

Malnutrition is defined as not having enough energy or nutrients to live a physically active life that allows for optimal health. It encompasses both over-nutrition and under-nutrition and has direct negative consequences in terms of disease and disability, brain development,

educational attainment and income potential for individuals and communities. WHO considers that poor nutrition is the single most important threat to the world's health (WHO 2010). Underweight and obesity are both among the top ten leading risk factors for the global burden of disease(WHO 2002)

The immediate causes of malnutrition are due to inadequate food intake (in terms of quantity or quality) and diseases (WHO 2010). Malnourishment, heavy use of alcohol or drugs, smoking, low-income status, poor mental health, and poor self-care can contribute to a person being underweight, according to the different researches (Romero-Corral, Montori et al. 2006). Socio-demographic risk factors for overweight or obesity may include being middle aged, having higher education, higher economic status and residing in urban areas (Hong, Peltzer et al. 2018).

2.4.1 Socio-economic factors

In developing countries, trends in socioeconomic status and rates of obesity are the inverse of what is observed in developed countries (Sobal and Stunkard 1989). Various studies have shown that higher socio-economic status is positively associated with overweight and obesity in developing countries, particularly among women but negatively associated among the population of developed countries (Bhurosy and Jeewon 2014).Studies also have shown that in middle and low-income countries have shown that there is a strong and direct relationship between socioeconomic status and overweight/obesity, both among men and among women. This implies that the higher the socioeconomic status is, the more frequent obesity increases (Rodríguez-Martín, Novalbos Ruiz et al. 2009). It may be that in lower-income countries, higher SES leads to consuming high-calorie food and avoiding physically tough tasks. But in higher-income countries, individuals with higher SES may respond with healthy eating and regular exercise (Popkin, Adair et al. 2012). But a study done in Serbian adults(middle income country) aged 20 years and over, suggest that low socioeconomic status, as measured according to education, employment and wealth index, was associated with obesity (Rakić, Maksimović et al. 2018). A study done in India suggested that people with high socio-economic status have lower odds of being underweight (Rai, Fawzi et al. 2018).

2.4.2 Age

Age is unavoidable, it increases with the time. According to the Journal of Aging Science-aging is a natural process concerning physiological, cellular, psychological, social changes of an organism over a period of time. Pregnancy and menopause are significant factors in the development of obesity in women, suggesting that fluctuations in reproductive hormone concentrations uniquely predispose women to excess weight gain(Williams and Schlenker 2004) .A study done in Bangladesh (both males and females) showed that being older age significantly increased the risk of being underweight, while decreased the risk of being overweight (Mitra, Mistry et al. 2018) while a study done among the young adults in Myanmar suggested that being lower age (18-24 years) was found to be significantly associated with being underweight (Aung, Oo et al. 2015). A study done in females in Myanmar showed that among different age groups, underweight was the highest among 18–29 year-olds (20.2%), while overweight or obesity was the highest in the age group 30 to 49 years (around 50%) (Hong, Peltzer et al. 2018).

2.4.3 Gender

Malnutrition poses a variety of threats to both males and females. Malnutrition undermines adult's productivity, capacity to generate income, ability to care for their families, slow recovery from illnesses and increased susceptibility to infections (Ransom and Elder 2003). Malnutrition in women contributes significantly to growing rates of maternal deaths and is directly related to faltering nutritional status and growth retardation in children (Oniang'o and Mukudi 2002). Many factors have been associated with both forms of malnutrition of women which include the socioeconomic (e.g., occupation, educational background and the standard of living); cultural (e.g., religion and caste); the demographic (e.g., age and marital status) and dietary characteristics (Dewan 2008). Overweight and obesity has a far-ranging negative effect on health which includes: high blood pressure, diabetes, heart diseases, joint problems, sleep apnea and respiratory problems, cancer, metabolic syndrome and psychosocial effects (Must, Spadano et al. 1999). The reports from WHO show obese mothers are much more likely to have obese children, especially if they have gestational diabetes. Obesity-associated anovulation may lead to infertility and to a higher risk of miscarriage. Pregnancies in obese women have increased rates of pregnancy-associated hypertension, gestational diabetes, large babies, Cesarean section and perinatal mortality and morbidity(Group 2006) .

In a study done in India (Punjab) 20.2% males and 25.2% females were malnourished whereas 8.31% females and 5.04% males were found to be obese (Dewan 2008). The prevalence of underweight in Northern Uganda was 22.3% in men and 16.0% in women , while the prevalence of overweight (combined overweight and obesity) was 1.5% in men and 7.6% in women (Schramm, Kaducu et al. 2016).

2.4.4 Education

Education background is a predictor to judge socio-economic status as well as occupation. Higher education level is generally regarded as higher socio-economic status which leads to well-off living standard. The low-level educational attainment among male and female is the main problem of higher incidence of malnutrition, especially under-nutrition. Due to low education and poverty, most of the underweight male and female get marry before the legal age of marriage. It is not only affects their own health but the physical growth and development of future generations (Sanjay 2014). Individuals with higher educational status are recorded with higher prevalence of obesity than those with lower education (Pereko, Setorglo et al. 2013).

2.4.5 Income

Studies conducted in India show that income inequality had the same effect on the risk of being overweight as it did on the risk of being underweight, the odds of being underweight is increased by 19% and the odds of being obese is increased by 21% (Subramanian, Kawachi et al. 2007). While wealthier populations have the resources to purchase diverse foods that meet beyond their daily caloric requirements, poorer population cannot meet their recommended caloric intake. However, increasing numbers of poor people are becoming overweight in more nations, as these individuals consume affordable, yet highly caloric meals, such as fast food and processed foods (Burchi, Fanzo et al. 2011).

2.4.6 Marital status

Marital status can be defined as marital states at any given time point, which take several major forms such as married, never married, divorced, separated and windowed.

The results presented in an article indicate that both marital status and transitions between marital statuses affect body weight. Married people are heavier than either never-married or divorced people. Only one marital transition was found to affect body weight;

respondents who divorced experienced a decline in body weight. As expected, this effect is transitory, and fails to affect body weight in the long term. Men tend to be heavier but gain weight less rapidly than women. The findings also suggests that male and female do not react differently but rather in a similar fashion (Teachman 2016). It has been found that people after marriage perform less physical activity, change their dietary pattern, have least focus on being attractive, have more social support (Janghorbani, Amini et al. 2008).

2.4.7 Anthropometric Indices

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adult. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m²) (WHO 2018).

Table 2.4 Classification of obesity according to BMI

Class	**BMI Kg/m2**
Underweight	<18.4
Normal	18.5-24.9
Overweight	25-29.9
Obesity class I	30-34.9
Obesity class II	35-39.9
Obesity class III	>40

According to a data from nationwide survey done in 2016, it was found that 17.27% (both males and females) were underweight and 31.16% (both males and females) overweight/obese. The prevalence of both underweight (women 18.30% and men 15.83%) and overweight/obesity (women 32.87% and men 28.77%) was higher among women (Rawal, Kanda et al. 2018).A study done in eastern Nepal reported that nearly one thirds (32.9%) were overweight and 7.2% were obese (Vaidya A, Pokharel PK et al. 2007). Another community based survey done in same area in 2011 showed that the prevalence of overweight was around 28% while obesity was about 32% (Sharma, Ghimire et al. 2011).

2.4.8 Waist Circumference and Waist-hip ratio

Waist circumference (WC) is the simplest way to assess central obesity**.** WC is considered to be one of the most accurate anthropometrical indicators of abdominal fat**.** It is closely correlated to the waist to hip ratio (WHR), but regarded as more reliable measure of abdominal fat; WHR can mask the status of abdominal obesity with a disproportionately large hip circumference (Bourne, Flaxman et al. 2017). The recommended cutoffs for increased health risk are a waist circumference >102 cm (>40 inches) for men and >88 cm (>35 inches) for women. On average, premenopausal women have half the abdominal fat of men; this is largely due to body shape. While women generally have a higher total and percentage body fat, it is more often located on their hips and thighs due to their pear-shaped bodies. Men naturally have an apple shape, and carry excess weight in their abdominal region (Després and Lemieux 2006) .

People with larger waist sizes have increased risks of obesity-related disorders. 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).

The waist-to-hip ratio (WHR) is a quick measure of fat distribution that may help indicate a person's overall health. People who carry more weight around their middle than their hips may be at a higher risk of developing certain health conditions (Sayeed, Mahtab et al. 2003).

An abdominal girth in excess of 108 cm (40 inches) for men and 98 cm (35 inches) for women or a WHR > 1.0 and 0.85 in men and women, respectively, are the currently accepted indicators of excessive abdominal fat accumulation which correlate with a substantially increased risk of metabolic complications(Hajjar, Kotchen et al. 2006). Evidences say that the global epidemic of obesity has resulted mainly from societal factors that promote sedentary lifestyles and the consumption of high-fat, energy-dense diets. The increasing prevalence of obesity places a large burden on health care use and cost.

2.4.9 Dietary Habits

The vegan or total vegetarian diet includes only food from plants like fruits, vegetables, legumes (dried beans and peas), grains, seeds and nuts while non-veg diet include meat and meat products. There are different types of vegetarian such as:

a). Lacto-ovo-vegetarians: Eating both dairy products and eggs. This is the most common type of vegetarian diet.

b). Lacto-vegetarians: Eating dairy products but avoid eggs.

c). Ovo-vegetarian: Eating eggs but not dairy products.

Vegans do not eat dairy products, eggs, or any other products which are derived from animals. Most vegetarian diets are low or devoid of animal products. They are also lower in total fats, saturated fats cholesterol and high in fibers and other minerals, Phyto-chemicals (AHA, 2015). India is the only country in the world with highest number of vegetarian people i.e. 20%-40% of its total population (Perlot,2016). Though the actual population of vegetarian is not known in Nepal there are some ethnic groups, religions etc. that avoid non-vegetarian diets.

Vegetarian diets are heterogeneous as are their effects on nutritional status, health, and longevity. Mortality rates are similar or lower for vegetarians than for non-vegetarians. There are increased risks of dietary deficiency disease on vegan but not on all vegetarian diets. There are strong data that concludes vegetarians are at lesser risk for obesity, atonic constipation, lung cancer, and alcoholism (Dwyer 1988). According to a survey done to find out the nutritional status between vegetarians and non-vegetarians among the Buddhists in Malaysia, it was found that more vegetarians were underweight than non-vegetarians (31.3% vs 15.6%), while prevalence of overweight and obesity was higher among the non-vegetarians (23.7% vs 9.9%). A higher proportion of non-vegetarians (34.1%) had an unhealthy range of body fat percentage and significantly higher risk of abdominal obesity (24.4%) than the vegetarians (19.1% body fat; 13.7% abdominal obesity) (Gan, Boo et al. 2018).

I) Fruits consumptions

Fruits and vegetables are important components of a healthy diet, contributing to a large proportion of an individual's daily intake of vitamins, minerals and dietary fiber. Globally,

majority of people consistently are consuming less than the daily recommended fruits and vegetables requirement. Low Fruits and vegetables intake is considered as the sixth main risk factor for mortality in the world (Sachdeva, Sachdev et al. 2013). Evidences have shown that increased consumption of fruits and vegetables may reduce the risks of mortality from all causes and the development of cardio-metabolic disease (Du, Li et al. 2016). Some systematic reviews have suggested that appropriately increased fruit and vegetable intake may help body weight management by preventing the development of obesity and reducing body weight over time because of dietary fiber and the high water content of fruits and vegetables which promotes satiety and reduces hunger(Alinia, Hels et al. 2009). However, one meta-analysis of interventional trials showed that increased fruit and vegetable intake had an effect on weight loss(Mytton, Nnoaham et al. 2014); another study did not find an effect in terms of body weight reduction (Kaiser, Brown et al. 2014).A Canadian study found that increased fruit intake was associated with reduced weight gain over a 6-year period among participants of the Quebec Family Study (Drapeau, Després et al. 2004). Additionally, some studies suggest that fruit consumption might have a more favorable impact on body weight control than vegetable consumption (Alinia, Hels et al. 2009).

II) Salt Intake

It has been recommended that adults should consume less than 5 gram of salt per day (WHO 2013). Recently, it has been found that high salt intake is associated with an increased risk of obesity. It is because high salt intake stimulates thirst and increases fluid intake and thereby increasing sugar-sweetened beverage consumption(He, Marrero et al. 2008). The association between salt and obesity may also be partially caused by excessive consumption of processed food that is high in both calorie and salt. However, increasing evidence suggests that there may be a direct link between salt intake and obesity independent of total energy intake (Ma, He et al. 2015).

2.4.10 Drinking and Tobacco consumption

Alcoholism in Nepal is overshadowed by other addiction like smoking, drug abuse etc. but, because of its cultural acceptability, alcoholism has become the single biggest medical and social problem in Nepali society (Rai 2002) . Alcohol consumption has been increasing worldwide. Almost 4% of all deaths worldwide are attributed to alcohol, greater than

deaths caused by HIV/AIDS, violence or tuberculosis. It is a leading risk factor for death for males aged 15-59 mainly due to injuries, violence and cardiovascular diseases. It is a leading risk factor for death for males aged 15-59 mainly due to injuries, violence and cardiovascular diseases.

Excessive alcohol consumption can satisfy caloric requirements, but easily leads to malnutrition and anemia. Although alcohol in small doses is an appetite stimulant, larger amounts suppress hunger, which doubly deprives the body of nutrients (Smith 2012). Studies have shown that high alcohol consumption leads to a suppression of lipid oxidation and thus the enhancement of a positive fat balance (Suter and Tremblay 2005). Alcohol also interferes with the absorption and storage of the B vitamins and vitamin A. Because alcohol is a diuretic that increases the output of urine, it can cause the loss of such water-soluble minerals such as zinc, magnesium and potassium. Zinc status appears to be particularly affected by alcohol and zinc deficiency interferes with the ability to taste and smell, further limiting dietary intake. Likewise, high alcohol consumption could lead to lose weight by depleting NAD+, thus preventing conversion of pyruvate acid to acetyl-CoA (McGuire and Beerman 2012).

About 60% of the adult population in Nepal has experienced alcohol. 38% of the total adult population is regular users. More men than women drink alcohol (CWIN, 2001).A study done in Nepal showed that increased alcohol consumption is significantly associated with obesity and overweight (Vaidya, Shakya et al. 2010) .

Tobacco use has been attributed to be one of the leading causes for the growing burden of non-communicable diseases. In 2015, consumption of tobacco products accounted for 11.5% of global deaths and 6% of global disability-adjusted life years (DALYs) (Reitsma, Fullman et al. 2017). A meta-analysis shows that smokers have unhealthy patterns of nutrient intake compared with nonsmokers. On average, smokers declared consuming more fat and more alcohol than nonsmokers, resulting in a greater energy intake (Dallongeville, Marecaux et al. 1998).

2.4.11 Stress

Stress is defined as the perception of environmental demands that are believed to exceed one's resources for adapting to the situation. It is suggested that stress may contribute to changes in dietary behaviors that lead to weight change, with various effects related to

baseline body mass index, or cortisol reactivity in response to stress. CRH (corticotrophin-releasing-hormone) suppresses appetite acutely after stress (Tsigos, Kyrou et al. 2016)probably by inhibiting food intake that is stimulated by neuropeptide Y (NPY) . However, once extra GCs (glucocorticoids) are produced, the intake of food is stimulated (Spencer and Tilbrook 2011) .Various studies have implicated the relation between stress and overweight and obesity in adults (Block *et al.*, 2008). Different hormones are known to be activated due to the stress which directly affects eating pattern and leads to weight gain (Scott *et al.*, 2012). According to a longitudinal study psychological stress was found to be positively associated with weight gain but not with weight loss (Harding, Backholer et al. 2014).

2.4.12 Physical activities

Almost everyone is engaged in physical activity in order to sustain life, however it is the time and amount we devote to that differentiate us. Physical activities can be performed in a wide range of intensities: walking or other moderate intensity activities or other vigorous activities such as jogging, running. According to AHA, physical activity not only helps to lower the blood pressure, it also helps to manage the weight, strengthen the heart and manage the stress level. According to research and recommendations from the CDC, it is suggested that people perform moderately intense exercise 30 minutes a day, most days of the week (Chobanian, Bakris et al. 2003). Lack of physical activity leads to fat gain in body as human body compensates the lack of exercise by maintaining energy and macronutrient balance (Chaput, Klingenberg et al. 2010). According to a study done in India revealed that obese subjects had lower level of physical fitness score (Kumar 2014).

2.4.13 Co-morbidity

Nepal is now passing through an epidemiological transition with non-communicable diseases. Hypertension, also known as raised or high blood pressure is a condition where the blood vessels have persistently raised pressure. Blood pressure is the force of the blood pushing against the walls of arteries as it flows through them. According to the study done by WHO, it is stated that among the South Asian countries, Nepal is reported to have the second highest proportion of hypertensive people (27.3%) after Afghanistan (29%) According to NDHS 2016 the 17% male and 23% female of age 15 and above are found to be hypertensive. About 2% of women and men have normal blood pressure and are taking

medicine to control their blood pressure. High blood pressure is about six times more common in people who are obese than in those who are lean. Positive association of BMI and blood pressure has also been reported among Asian populations (Dua, Bhuker et al. 2014).

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys, and nerves. The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin. In the past three decades the prevalence of type 2 diabetes has raised dramatically in countries of all income levels. According to the WHO, there is no exact data of patients with diabetes in Nepal. But, the 2016 Diabetes Profile has shown that 9.1 percent Nepali population are living with diabetes which includes 10.5 percent men and 7.9 percent women. In Nepal, obesity is found to be a cause of diabetes among 16.6 per cent female population and 13.6 per cent male as stated by WHO (2016).

PART III

METHODS AND MATERIALS

3.1 Research Design

A cross-sectional study design was conducted to assess the prevalence, levels of risk and the major risk factors for developing malnutrition among a representative sample in the Dharan sub-metropolitan city, Sunsari district, Nepal with the use of structured questionnaire on formal interview basis as well as direct physical measurements. Measurement of Blood Pressure, height, weight, waist circumference and hip circumference were taken.

3.2 Study Area

The study was conducted at Dharan Sub-metropolitan city, Sunsari district, Nepal. It has 27 wards with a total household of approximately 32,693 and total population of about 137,705. (Source: Dharan Sub-metropolitan Office)

3.3 Target population

The study of the population will be the population aged 18-59 years in the Dharan sub-metropolitan city.

a) Inclusion Criteria: People aged 18-59 years.

b) Exclusion Criteria:

Women who are pregnant and people having serious illness.

Participants who did not consent to participate in the study and are of age >18 years and <60 years.

People who were not from Dharan sub-metropolitan city.

3.4 Sampling Techniques

Random sampling method was used and 7 wards (i.e. 3, 9, 13, 15, 16, 18, and 24) were chosen among 27 wards. Samples aged 18-59 years were chosen from those wards to achieve the required sample size as determined by the statistical formula.

3.5 Sample Size

The sample size is determined by using a single proportional formula assuming the prevalence rate of obesity to be 24% in the survey area (according to survey done in Dharan in 2005), 95% confidence interval (CI), 7% margin of error (d) and 10% non-response rate is added to the total calculated sample size.

Calculation of sample size for infinite population: -

Sample size (n0) = Z2 ×p (1-p)/d2

Where z= confidence interval at 95% (standard value of 1.96)

P= estimated prevalence of obesity (24%)

d= margin of error (7%)

Now

$N0=1.96^2 \times 0.24 \times (1-0.24)/ (0.07)^2$

= 143.006

≈143

Thus, calculated sample size is adjusted for non-response. Considering non-response rate as 10%, the adjusted sample size is calculated to be 159.

3.6 Research Instruments

The equipment needed for performing the survey were:

a) Blood pressure measuring instruments: the type of the instrument used was digital blood pressure measuring instrument.

b) Weighing machine: Weighing machine having capacity of 180 kg (1 piece) was used.

c) Height measuring stand (stadiometre): Stadiometer having the maximum capacity of measuring 200 cm. (1 piece)

d) Measuring tape: To measure the waist and hip circumference.

e) Questionnaire: A well designed set of questionnaires was used for covering the information on these aspects:

Part I: Demographic factors

Part II: Diet

Part III: Behavioral factors

3.7 Pretesting

The prepared sets of questionnaire and anthropometric instruments were pre-tested among the people aged 18-59 years in order to maintain accuracy and clarity of questionnaire, to check the consistency in interpretation of questions by respondents and to identify ambiguous item. The questionnaire was developed in English and translated into Nepali language and reviewed by the supervisors in Central Campus of Technology. After pre-testing all the ambiguous, misleading and wrongly interpreted questions was omitted and questionnaire was revised in accordance with the findings of pre-testing

3.8 Validity and Reliability

Reliability refers to quality control measure of data collected. The study instruments were validated at Central Campus of Technology, Central department of Nutrition and Dietetics. Validity of stadiometer was ascertained by comparing the measurement from our stadiometer and UNICEF stadiometer. Measuring tape was calibrated against standard stadiometer. Validity of blood pressure measuring instrument was ascertained by comparing readings with the readings calculated from standard mercury sphygmomanometer. Questionnaire was validated by reviewing different literatures and was checked daily for completeness, consistency and clarity.

3.9 Data Collection Technique

Data was collected through three stages; a structured questionnaire which was used for accessing the information about the participants followed by blood pressure measurement and anthropometric measurement. Interview was conducted directly with the participants. Blood pressure was measured with the subject in a seated position in left arm using a digital blood pressure measuring instrument. After 10 minutes blood pressure was measured again for minimizing variations and average of two readings was taken.

3.10 Study Variables

a) Dependent Variable:

i) Body mass index

Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. People with a BMI of 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 (Shiel 2018).

ii) Waist circumference

Women with waist circumference above 80 cm and men with 94 cm were identified as being abdominally obese(WHO 2008).

iii) Waist to Hip ratio

Women with waist to hip ratio greater than 0.85 and men with WHR > 1were considered as abdominally obese(WHO 2008) .

b) Independent Variables

i). Socio-demographic: Age, sex, marital status, level of education, family income.

ii). Lifestyle related factors: Salt intake, meat, fruit and vegetable consumption, alcohol consumption, tobacco (smoking and chewing), and physical activities.

iii). Co-morbidity: hypertension, diabetes.

iv). Physical activity: Physical activity was categorized as low, moderate and high according to the score of each individual calculated following the short IPAQ questionnaire. For this total MET-minutes/week was calculated and physical activity level was determined as shown below:

Total MET-minutes/week = Walk (METs×min×days) + Moderate (METs×min×days) + vigorous (METs×min×days).

Where, MET factors for walk, moderate activity and vigorous activity are 3.3, 4 and 8 respectively.

IPAQ categorical score is as follows:

Low: No physical activity is performed or physical activity with MET values less than 600 MET per week activity (IPAQ 2002).

Moderate: Physical activity with MET value 600 or greater than 600 per week or 3 or more day of vigorous activity of at least 20 minutes per day activity (IPAQ 2002).

Vigorous: Vigorous-intensity activity on at least 3 days and accumulating at least 1500 or 7 or more days more days of any combination of walking, moderate or vigorous intensity activities accumulating at least 3000 MET-minutes/week activity (IPAQ 2002).

Adequacy of physical activity for each individual was also determined according to WHO recommendation. WHO has recommended that adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity (WHO 2019).

3.10.1 Measurement of Variables

a) Blood pressure

After the interview, the study participant was allowed to rest (relax) for 15 minutes then two blood pressure measurements were taken three minutes apart in a sitting position. The blood pressure was measured on the left upper arm. The participant was positioned in such a way that the left upper arm was at the same level with the heart.

b) Weight, height, hip and waist circumference

Body weight was measured to the nearest 0.1 kg using a digital scale and height to the nearest 0.1 cm in the standing position with no shoes using a portable height board. Waist circumference was measured to the nearest 0.1 cm, using a measuring tape, directly over the skin or over light clothing, at the level of the midpoint between the inferior margin of the last rib and the iliac crest in the mid-axillary line. Hip circumference was measured, to the nearest 0.1cm, on the widest part of the hips over light clothing.

3.11 Data Analysis

First the data was checked for completeness and consistency. Then it was coded and entered in the computer using statistical software like Microsoft excels and SPSS version 20. Likewise, qualitative data was transcribed and coded by assigning labels to various

categories. Verified test parameters were used to establish the relationships between the variables and the prevalence of obesity.

3.12 Logistic and Ethical Consideration

Ethical clearance was obtained from Central Campus of Technology, Department of Nutrition and Dietetics and Dharan sub-metropolitan city office. Verbal consent from the study subjects will be obtained and the objective of the study was explained to them. Privacy and confidentiality of collected information was ensured at all level. All the participants were given health education on body weight management.

PART IV
RESULT AND DISCUSSION

The cross-sectional study to assess the prevalence of hypertension was conducted in 159 adults ranging from age 18 to 59 years of Dharan sub-metropolitan city and results obtained are explained in the following headings:

4.1 Demographic and Socio-economic characteristics

The information's on demographic and socio-economic characteristics are shown below:

4.1.1 Socio-economic factors

It was found that majority of the people residing in Dharan belonged to upper middle class (35.8%) followed by lower middle class (32.1%), upper lower class (30.8%) and minority of people belonged to lower class (1.3%) which is shown in the Table 4.1.

Table 4.1 Distribution of Socio-economic factors of the surveyed population

Socioeconomic status	**Male (n=77)**	**Female (n=82)**	**Total (n=159)**
Lower class	0 (nil.)	2 (2.4%)	2 (1.3%)
Upper Lower class	22 (28.6%)	27 (32.9%)	49 (30.8%)
Lower Middle class	20 (26%)	31 (37.8%)	51 (32.1%)
Upper Middle class	35 (45.5%)	22 (26.8%)	57 (35.8%)

4.1.2 Age distribution

Table 4.2 shows that the studied population consists of a greater number of females than males. Higher proportion of both males and females' participants belonged to age group 35-44 years.

Table 4.2 Distribution of age of surveyed population

Age category	Male (n=77)	Fem (n=82)	Total (n=159)
<25	17 (22.1%)	18 (22%)	35 (22%)
25-34	16 (20.8%)	24 (29.3%)	40 (25.2%)
35-44	19 (24.7%)	26 (31.7%)	45 (28.3%)
45-54	15 (19.5%)	9 (11%)	24 (15.1%)
55+	10 (13%)	5 (6.1%)	15 (9.4%)

4.1.3 Employment and income

Majority of the population were employed (50.3%). More males (72.7%) were employed compared to females (29.3%). The table below shows that majority of the females were unemployed (70.7%). The monthly income of most people (22.0%) residing in Dharan ranges from 22851-45750 whereas only one male had monthly income less than or equal to 2300. 22% of females had monthly income ranging from 11451-17150 and 20.8% males had income ranging from 17151-22850.

Table 4.3 Distribution of monthly income, and employment among the residents of Dharan

Variables	Males (n=77)	Females (n=82)	Total (n=156)
Monthly income			
less than or equal to2300	1(1.3%)	0 (nil.)	1 (0.6%)
2301-6850	5 (6.5%)	7 (8.5%)	12 (7.5%)
6851-11450	6 (7.8%)	10 (12.2%)	16 (10.1%)
11451-17150	14 (18.2%)	18 (22.0%)	32 (20.1%)
17151-22850	16 (20.8%)	15 (18.3%)	31 (19.5%)
22851-45750	19 (24.7%)	16 (19.5%)	35 (22.0%)
≥45751	16 (20.8%)	16 (19.5%)	32 (20.1%)
Occupation			
Employed	56 (72.7%)	24 (29.3%)	80 (50.3%)
Unemployed	21 (27.3%)	58 (70.7%)	79 (49.7%)

4.1.4 Education

Majority of the population were literate. Females (7.8%) were found to be more illiterate than males (20.7%). Most of the people (30.2%) had their primary level of education. During survey it was found that most female (34.1%) had their primary level of education while minority of the female (2.4%) had their graduate or post-graduate study. Most men (27.3%) had secondary level of education while minority of males (9.1%) had their lower secondary level of study. Distribution of monthly income, education and employment are shown in the Table 4.4.

Table 4.4 Distribution of education among the residents of Dharan

Variables	Males (n=77)	Females (n=82)	Total (n=156)
Education			
Illiterate	6 (7.8%)	17 (20.7%)	23 (14.5%)
Primary level	20 (26%)	28 (34.1%)	48 (30.2%)
Lower secondary level	7 (9.1%)	6 (7.3%)	13 (8.2%)
Secondary level	21 (27.3%)	20 (24.4%)	41(25.8%)
10+2	15 (19.5%)	9 (11%)	24 (15.1%)
Graduate or Post graduate level	8 (10.4%)	2 (2.4%)	10 (6.3%)

.4.1.5 Marital status

Majority of males (74.0%) and females (85.4%) were married while 23.4% of males were unmarried and 12.2% of females were unmarried. The percentage of respondents who were either divorced or separated was only 1.2% (1) for female and 2.6% (2) for males as shown in Table 4.4. None of the males were separated while 1.2% (1) female was separated. The distribution of marital status of the studied population is shown in the Table 4.5

Table 4.5 Distribution of marital status of surveyed population

Marital status	Male (n=77)	Female (n=82)	Total (n=159)
Unmarried	18 (23.4%)	10 (12.2%)	28 (17.6%)
Married	57 (74.0%)	70 (85.4%)	127 (79.9%)
Widow	2(2.6%)	1 (1.2%)	3 (1.9%)
Separated	0 (nil.)	1 (1.2%)	1 (0.6%)

4.1.6 Anthropometric measurements

Out of the total participants 9 (5.7%) were found to be underweight, 71 (44.7%) were found to have normal weight, 53 (33.3%) were found to be overweight, 19 (11.9%) had class I obesity, 5 (3.1%) were obese class II and 2(1.3%) were obese class III. The overall prevalence of obesity is 16.3%. Seventy-nine (49.6%) of the participants had their weight above the weight above the recommended for their height. Obesity was found to be more prevalent among female compared to males. The prevalence of abdominal obesity was found to be 56.6%. Abdominal obesity was found to be very highly prevalent among the females 80 (97.6%) than compared to males 10 (13%).

Table 4.6 Distribution of obesity of the surveyed population using BMI recommended by WHO

Variables	Male (n=77)	Female (n=82)	Total (n=159)
BMI			
Underweight	4 (5.2%)	5(6.1%)	9 (5.7%)
Normal weight	37 (48.1%)	34 (41.5%)	71 (44.7%)
Overweight	30 (39.0%)	23 (28.0%)	53 (33.3%)
Obesity class I	4 (5.2%)	15 (18.3%)	19 (11.9%)
Obesity class II	2 (2.6%)	3 (3.7%)	5 (3.1%)
Obesity class III	0 (nil.)	2 (2.4%)	2 (1.3%)
WHR			
Normal	67(87%)	2(2.4%)	69 (43.4%)
Abdominal Obesity	10 (13%)	80(97.6%)	90 (56.6%)

4.1.7 Dietary characteristics

Majority of the residents of Dharan were found to be rarely consuming fruits (52.2%) and vegetables (73.0%). The consumption of milk and milk products was also found to be rare (54.7%). The consumption of high salt food was found to be frequent (44.7%). There was high consumption of both white and red meat (62.3%) but red meat (6.9%) alone was found to be less consumed than white meat (25.2%).

Table 4.7 Distribution of Fruits Vegetables, Milk and milk products, and Meat among the residents of Dharan

Habitual dietary	Male (n=77)	Female (n=82)	Total (n=159)
Fruits			
Regular	15 (19.5%)	11 (13.4%)	26 (16.4%)
Frequent	24 (31.2%)	26 (31.7%)	50 (31.4%)
Rare	38 (49.4%)	45 (54.9%)	83 (52.2%)
Vegetables			
Regular	5 (6.5%)	5 (6.1%)	10 (6.3%)
Frequent	19 (24.7%)	14 (17.1%)	33 (20.8%)
Rare	53 (68.8%)	63 (76.8%)	116 (73.0%)
Milk and Milk Products			
Regular	22 (28.6%)	16 (19.5%)	38 (23.9%)
Frequent	16 (20.8%)	18 (22.0%)	34 (21.4%)
Rare	39 (50.6%)	48 (58.5%)	87 (54.7%)
Meat			
Red Meat	7 (9.1%)	4 (4.9%)	11 (6.9%)
White Meat	16 (20.8%)	24 (29.3%)	40 (25.2%)
Both meat	52 (67.5%)	47 (57.3%)	99 (62.3%)
None	2 (2.6%)	7 (8.5%)	9 (5.7%)

4.1.8 Salt consumptions and salty foods

It was found that majority of the people (59.1%) have more than or equal to five gram of habitual dietary salt intake. More males (63.6%) were found to be consuming high salt than females (54.9%). Almost equal number of male and female rarely consumed junk foods.

Table 4.8 Distribution of Salt and Junk food among the residents of Dharan

Variables	Male (n=77)	Female (n=82)	Total (n=159)
Salt Intake			
Less than 5 gm	28 (36.4%)	37 (45.1%)	65 (40.9%)
More than 5 gm	49 (63.6%)	45 (54.9%)	94 (59.1%)
High salt foods			
Regular	17 (22.1%)	20 (24.4%)	37 (23.3%)
Frequent	31 (40.3%)	40 (48.8%)	71 (44.7%)
Rare	29 (37.7%)	22 (26.8%)	51 (32.1%)

4.1.9 Behavioral characteristics

According to this study majority of the people were non-smoker (84.3%), (81.1%) did not consume tobacco, (66%) non-drinker and had lower stress level (69.2%). Male smoker (18.2%) was in higher proportion than compared to female (13.4%). Females (11%) consuming tobacco was relatively lower compared to males (27.3%). This study also showed that females (31.7%) had higher stress level compared to males (29.9%).

Table 4.9 Distribution of Smoking, Tobacco, Stress of surveyed population

Factors	Male (n=77)	Female (n=82)	Total (n=159)
Smoking			
Yes	14 (18.2%)	11 (13.4%)	25 (15.7%)
No	63 (81.8%)	71 (86.6%)	134 (84.3%)
Tabaco Yes	21 (27.3%)	9 (11.0%)	30 (18.9%)
No	56 (72.7%)	73 (89.0%)	129 (81.1%)
Stress			
Yes	23 (29.9%)	26 (31.7%)	49 (30.8%)
No	54 (70.1%)	56 (68.3%)	110 (69.2%)

4.1.10 Diabetes

According to the study about 5% of the population was suffering from diabetes whereas about 95% of the population was free from diabetes. Among the population suffering from diabetes males had higher proportion 6 (7.8%) compared to female 2 (2.4%). The distribution of population affected by diabetes is shown in Table 4.10.

Table 4.10 Distribution of diabetes among the surveyed population.

Diabetes	Male	Female	Total
Yes	6 (7.8%)	2 (2.4%)	8 (5.0%)
No	71 (92.2%)	80 (97.6%)	151 (95.0%)

4.1.11 Hypertension

This study showed that majority of the population had normal blood pressure (120/80 mm/Hg). 42 (26.4%) had elevated blood pressure followed by 19 (11.9%) having hypertension class I and 9 (5.7%) having hypertension class II. Blood pressure was found to be higher in males compared to females.

Table 4.11.1 Distribution of prevalence of hypertension among the residents of Dharan

Blood Pressure (mm/Hg)	**male**	**female**	**Total**
Normal (120/80)	36 (46.8%)	53 (64.6%)	89 (56%)
Pre-hypertensive (121-139/80-89)	23 (29.9%)	19 (23.2%)	42 (26.4%)
Hypertension I (140-159/90-99)	10 (13%)	9 (11%)	19 (11.9%)
Hypertension II (more than or equal to160/100)	8 (10.4%)	1 (1.2%)	9 (5.7%)

Treatment and control of hypertension

The study showed that higher number of people 127 (78.6%) were undiagnosed about their hypertension. More females 65 (79.3%) were not aware about their blood pressure level compared to males 60 (77.9%). Equal number of both genders was aware about their hypertensive state.

Table 4.11.2 Distribution of previously diagnosed hypertension among the residents of Dharan

Previously diagnosed	Male	female	Total
Yes	17 (22.1%)	17 (20.7%)	34(21.4%)
No	60 (77.9%)	65 (79.3%)	125(78.6%)

Among the hypertensive patients a greater number of males (8) was taking medicine compared to females (5) and among the patients consuming medicines 5 number of males had their blood pressure controlled whereas 3 females had their blood pressure controlled.

Table 4.11.3 Distribution of on-treatment and well-controlled hypertension among the residents of Dharan

Variable	Male (n=18)	Female (n=10)	Overall (28)
On-treatment	8/18	5/10	13/28
BP well controlled	5/13	3/13	8/13

The prevalence of underweight, normal weight, overweight, obesity I and obesity II among the residents of Dharan was found to be 5.7%, 44.7%, 33.3%, 11.9%, 3.1%, 1.3% respectively from this study which is slightly higher in case of underweight (17.27%) whereas lower in the case of overweight and obese (31.16%) according to the nationwide study conducted in 2016 (Rawal, Kanda et al. 2018). The prevalence of both underweight and overweight signifies the existence of double burden of malnutrition which can cause severe problem in the coming future. These findings are inconsistent with data from South Asian neighboring countries. For example, a Bangladeshi study reported that 30.4% were underweight, 18.9% were overweight and 4.6% were obese (Biswas, Garnett et al. 2017) whereas in Pakistan underweight 30%, pre-overweight 15%, overweight 25% and obesity 14% (Janjua, Mahmood et al. 2015) also reported the similar patterns of underweight and overweight/ obesity among the adults. Dharan, being an urban setting is expected to have generally high prevalence compared to general population surveys which includes rural settings. A number of factors like easily accessible to health facilities may also have been implicated to the development of bodyweight.

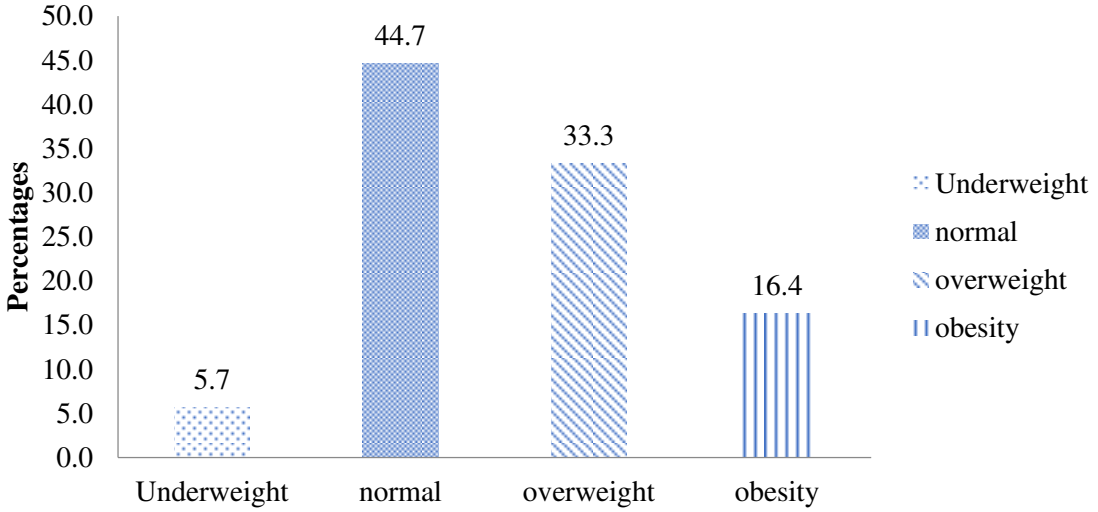

Fig 4.1 Percentages of nutritional status in Dharan

Underweight was found almost equally in both genders whereas normal weight was found to be slightly higher in male as compared to female. The case of overweight and obesity opposite as compared to the case of normal weight as it was higher in female by almost 6%. Research done in 2016 in Nepal showed 18.30% of Nepalese women and 15.83% of males were underweight whereas 32.87% women and 28.77% men were overweight/obese (Rawal, Kanda et al. 2018). Similar cases has been identified in Indonesia where women has higher case of overweight and obesity (Rachmi, Li et al. 2017). Similar case of normal BMI higher in males was also shown in Nigerian adults (Ogunlade and Asafa 2015).

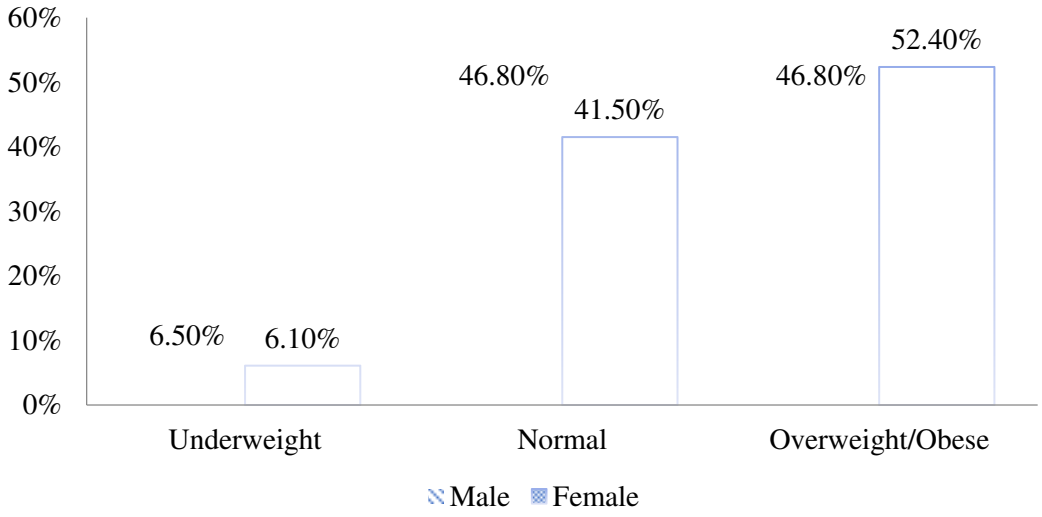

Fig 4.2 Percentages of Nutritional Status according to gender in Dharan

Underweight was more prevalent in age group between 35-44 years (68.9%) and above 55 years age (66.7%). The other remaining age groups had underweight prevalence less than 43%. Normal weight was more prevalent in <25 years of age group (60%) followed by age group 25-34 (50%). Obesity is mostly prevalent in age group above 55 years i.e. 33.3% followed by age group 45-54 years of age (12.5%). Other age groups have overweight and obesity less than 10%. A study done in Nepal in 2016 showed underweight was more prevalent in older age group and normal weight was highly prevalent in the younger age group while overweight and obesity was more prevalent in the age group above 30(Rawal, Kanda et al. 2018). Obesity is also higher in age group above 55 years in a study done in Bangladesh (Biswas, Garnett et al. 2017). A study done in Nigeria also showed higher prevalence of obesity and overweight in above 54 years of age (Ogunlade and Asafa 2015).

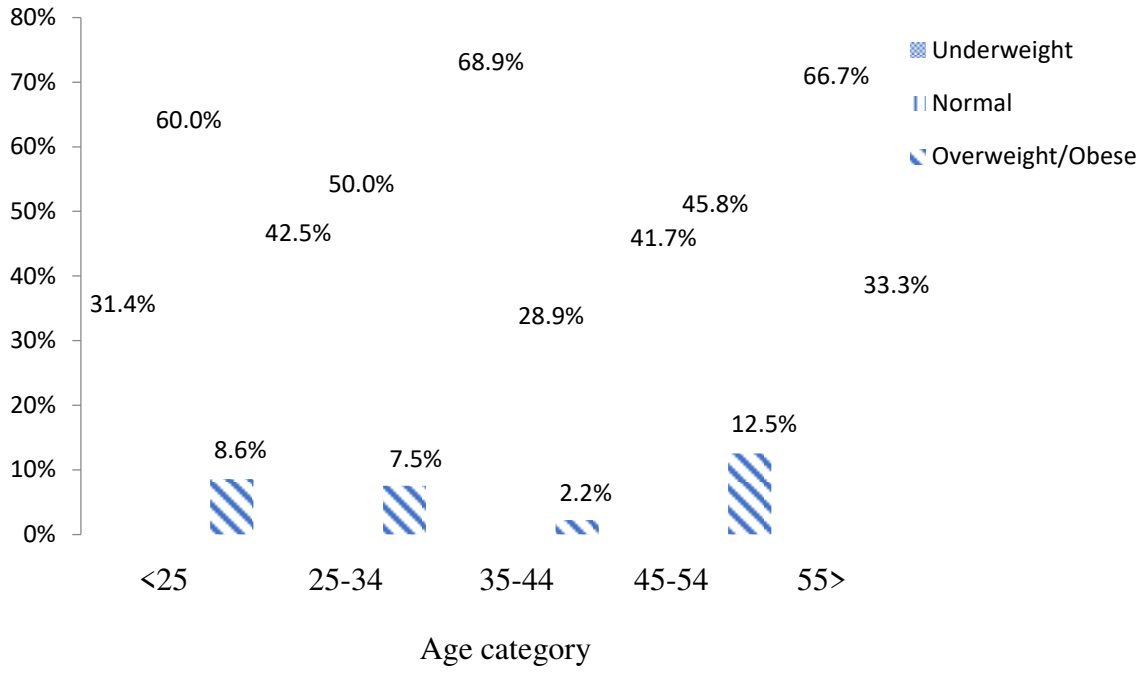

Fig 4.3 Percentages of Nutritional Status according to age category in Dharan

This data analysis showed that 46.75% of males and 60.98% of females were suffering from abdominal obesity. Similar kind of result was obtained from a research done in Malaysian adults where lower number of males (23.8% male and 66.4% female) were suffering from abdominal obesity (Ahmad, Adam et al. 2016) whereas in Ikorodu (Lagos)

1.92% of males and 21.5% of female were abdominally obese (Ademolu, Ademolu et al. 2016).

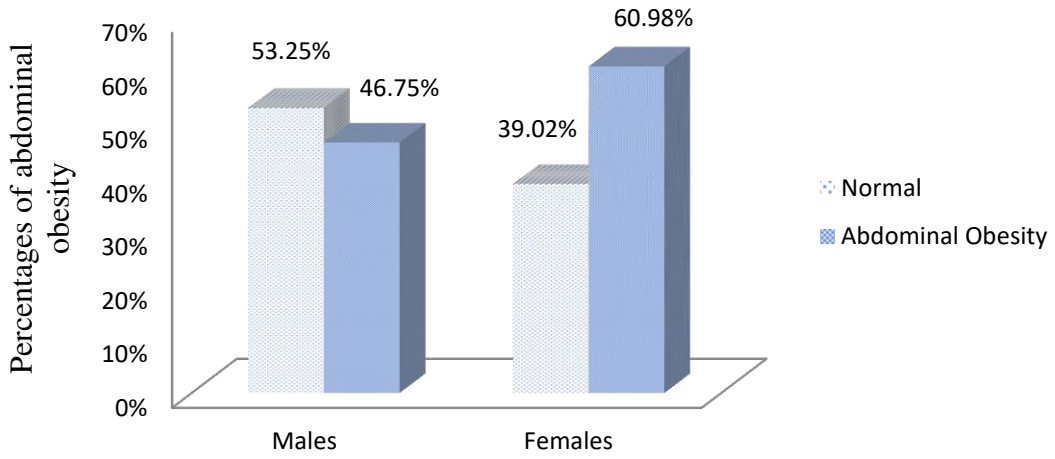

Fig 4.4 Abdominal obesity according to WC

Only 12.99% of males had central obesity whilst almost all (97.56%) of females had central obesity which was found using waist hip ratio. This may be because the urban people are more likely to consume western food, low physical activity and genetic predisposition of the women (Janghorbani, Amini et al. 2007). The prevalence of central obesity in male and female was found to be 28.85% and 40.39% respectively in Ikorodu (Lagos) (Ademolu, Ademolu et al. 2016). Moreover similar reports were found in USA where 6.2% of men and 54.2% of women had central obesity according to WHR (Kim, Hou et al. 2019).

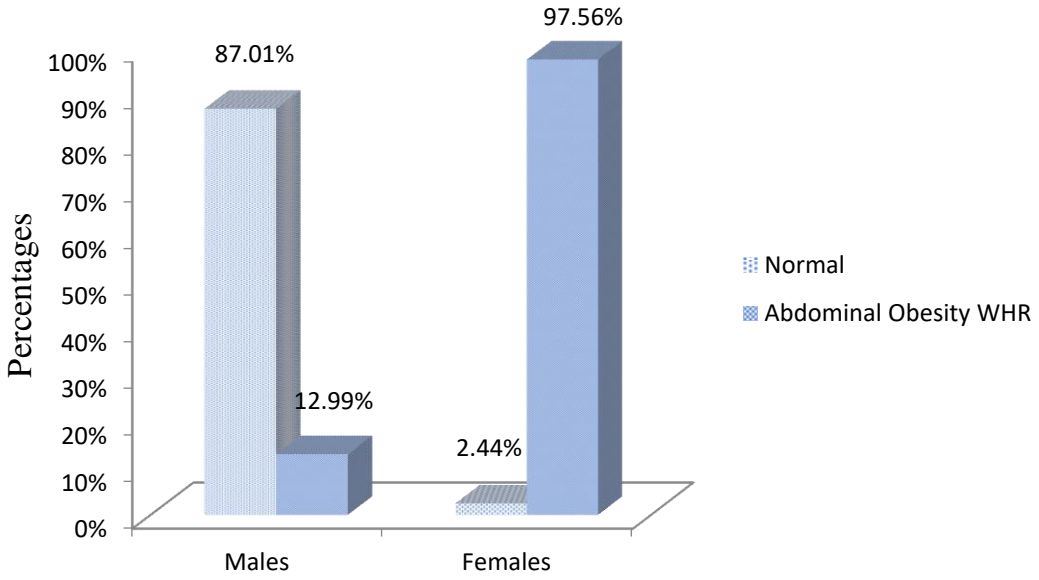

Fig 4.5 Abdominal obesity according to WHR

4.1.12 Factors affecting the BMI

Blood pressure was found to have a relation with BMI among the residents of Dharan sub-metropolitan city. It was found that most of the population had normal blood pressure while 42 (26.4%) had elevated blood pressure followed by 19 (11.9%) having hypertension class I and 9 (5.7%) having hypertension class II. Males were more hypertensive than females according to this survey. A study done among the Indians showed that the prevalence of prehypertension and hypertension increased more than 2 and 3.74 times, respectively, in overweight/obese subjects as compared with the nonobese counterparts(Dua, Bhuker et al. 2014). Relationship between hypertension and overweight and obesity as observed inn this has also been observed in other studies(Rohrer, Anderson et al. 2007). Some studies also sheds light on renin-angiotensin system - the hormone system that regulates blood pressure which may also promote excess weight gain (Whiteman 2016). Significant associations between BMI and BP have also been documented in lean Chinese populations (Tesfaye, Nawi et al. 2007). Obesity along with hypertension is found to be associated with increased risk of morbidity and mortality, particularly cardiovascular diseases (Tyagi 2007).

According to this study age is also associated with BMI od the residents of Dharan sub-metropolitan city. In this study underweight was more prevalent among the middle age

group whereas normal weight was found to be in more younger adults. Overweight and obesity increased along the age. Similar kind of report was presented in Iran where increased age is associated with the risk of obesity and overweight (Janghorbani, Amini et al. 2007). This may be due to the hormonal change along with less active lifestyle with the increase in age (Mayoclinic 2017). In a survey done in Thailand among the Open University students the prevalence of overweight and obesity was greater among older compare, especially for participants less than 45 to younger people (Wichai Aekplakorn, Bruce Neal et al. 2004).

Though only 5% of the population was suffering from diabetes where higher proportion of males were diabetic as compared to females, diabetes is also found to a risk factor for the nutritional status of the people residing in Dharan. Obesity is one of the most important modifiable risk factors for the prevention of type 2 diabetes. Despite attending diabetic care, high proportion of type 2 diabetic individuals have been reported to be overweight or obese in different settings in various studies (Damian, Kimaro et al. 2017). It is also said that insulin injection can lead to weight gain as it deposits fat cells in our body (Sejdini 2017). Similar type of report was found in a study done in USA among the adults (Nguyen, Nguyen et al. 2011).A study done by (Kramer, Cao et al. 2010) obesity is prevailing rapidly in adults with or without type II diabetes. A study done on the Saudi diabetic population, showed that only 20% of Type 2 diabetic patients had normal BMI. It has been documented that for most patients weight loss seems to be a desirable goal for the improvement of glycemic control, hyperlipidemia, and hypertension (Mugharbel and Al-Mansouri 2003). A significant associations of low and high BMI with risks of diabetes among older adults (aged 40-70 years) in a study done in Japan (Sairenchi, Iso et al. 2008).

Type of diet is found to have association with the nutritional status of people residing in Dharan sub-metropolitan city. Most of the people in Dharan was found to be non-vegetarian. Findings from an accumulating number of studies have also shown evidence that most vegetarian diets may not be nutritionally adequate but also associated with lower risk of certain chronic diseases, including obesity. Vegetarians have lower BMI as compared to the non-vegetarians in a study done in India (Agrawal, Millett et al. 2014). Incidence of overweight or obesity was not related to physical activity, but the types of diet of the subjects in a study done in Arab (Sachithananthan and Al Rashedi 2014).

Table 4.12 Risk Factor strongly associated with BMI among the residents of Dharan

Factors	Underweight	Normal	overweight	Chi-square	P-value
Blood pressure					
Hypertensive	2(7.1%)	12(42.9%)	14(50.0%)	5.03	0.048*
Non-hypertensive	7(5.3%)	59(45%)	65(49.6%)		
Age Category					
<25	3(8.6%)	21(60.0%)	11(31.4%)	15.33	0.0.3*
25-34	3(7.5%)	20(50.0%)	17(42.5%)		
35-44	1(2.2%)	13(28.9%)	31(68.9%)		
45-54	2(8.3%)	12(50.0%)	10(41.7%)		
55+	0(0.0%)	5(33.3%)	10(66.7%)		
Diabetes					
Yes	0(00%)	1(12.5%)	7(87.5%)	5.12	0.05*
No	9(6.0%)	70(46.36%)	72(47.68%)		
Type of Diet					
Vegetarian	1(20%)	3(60%)	1(20%)	3.192	0.03*
Non-vegetarian	8(5.19%)	68(44.15%)	78(50.64%)		

4.1.13 Factors affecting WC

Type of diet, occupation and blood pressure were found to have a relation with abdominal obesity due to waist circumference. Larsson and colleagues stated that the adipocytes around the abdomen are unique in such a way that they deposit their free fatty acids directly into the portal vein which increases the amount of fatty acids in the liver. The elevated free fatty acid concentration results in an increase in the contents of the portal blood vessels leading to high blood pressure (Kabwama, Kirunda et al. 2018). The employment was also found to be associated with abdominal obesity as it raises the lifestyle (Maher, Waswa et al. 2010).In a study done in India stated that consumption of red and other processed meat has been associated with central obesity (Singh, Arthur et al. 2014).

Table 4.13 Risk Factor strongly associated with abdominal obesity (WC) among the residents of Dharan

Factors	Normal	WC	Chi-square	P-value
Type of Diet				
Vegetarian	3(60%)	2(40%)	5.21	0.05*
Non-Vegetarian	70(45.5%)	84(54.5%)		
Blood Pressure				
Hypertensive	13(46.4%)	15(53.6%)	9.52	0.05*
Non-hypertensive	60(45.8%)	71(54.2%)		
Occupation				
Employed	35(43.8%)	45(56.2%)	5.82	0.04*
Not employed	38(48.1%)	41(51.9%)		

4.1.14 Factors affecting WHR

Consumption of junk food was found to be associated with abdominal obesity as shown in the table 4.12. this result is similar with the a survey done in Iran (Payab, Kelishadi et al. 2015). .Some studies indicate that visceral adiposity ,together with lipid dysregulation and decreased insulin sensitivity is related to the excessive consumption of fructose (Ademolu, Ademolu et al. 2016). Religion was found to be nearly associated with abdominal obesity.

Table 4.14 Risk Factor strongly associated with abdominal obesity (WHR) among the residents of Dharan

Factors	**Normal**	**WHR**	**Chi-square**	**P-value**
Religion				
Hindu	66(44%)	84(56%)	8.21	0.06
Christian	2(33.3%)	4(66.7%)		
Buddhist	1(33.33%)	2(66.7%)		
Junk Food				
Regular	16(43.2%)	21(56.8%)	7.92	0.05*
Frequent	28(40.8%)	42(59.2%)		
Rare	24(47.1%)	27(52.9%)		

Part V

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

A cross-sectional study design will be conducted to assess the nutritional status of adult population among a representative sample in the Dharan sub-metropolitan city, Sunsari district, Nepal.

a) This study revealed that 5.4% were underweight, 44.7% were normal weight, 33.3% were overweight and 16.4% were obese according to WHO classification.

b) While the underweight was almost equal among the males and females. The case of overweight/obesity was found to be higher in females which is opposite in case of normal weight.

c) Normal weight was more prevalent among the age group lower than 25 years while overweight/obesity was mostly prevalent among the older people. People aged between 34-44 were found to be mostly underweight.

d) Abdominal obesity was found to be higher among the females (60.98%) as compared to males (46.75%) according to WC. Central obesity in accordance to WHR is highest in females (97.56%) as compared to males (12.99%).

e) This study also found that blood pressure (p= 0.048), age (p=0.03), diabetes (p=0.05), type of diet (p=0.05) were significantly associated with the nutritional status of people residing in Dharan sub-metropolitan city.

f) Type of diet (p=0.05), occupation(p=0.05) and blood pressure(p=0.04) were found to have a relation with abdominal obesity due to waist circumference while consumption of junk food(p=0.05) was found to be associated with abdominal obesity (WHR).

5.2 Recommendation

a) As Dharan continues to develop, modernize and urbanize there needs to be strong education program to ensure that population are aware about dangers of double burden of malnutrition and related diseases.

b) Population-wide approach, based on healthy lifestyle promotion campaigns and especially body weight management and promoting tobacco, alcohol and smoking control should be integrated with existing health care system. This helps in addressing both CD and NCDs.

SUMMARY

Overweight, obesity compounded with underweight expose the double burden in the health care system and are becoming serious public concern in the urban setting of Nepal. Data from different surveys and report has revealed that nutritional status of Nepalese are declining progressively.

The cross-sectional study was conducted among the adult population residing in Dharan to check out their nutritional status and its associated risk factors. This study measured different anthropometric measurements, blood pressure and analyzed the data in micro soft excel and SPSS version 20. The classification for blood pressure and BMI used in the study is recommended by WHO.

There are various factors namely socio demographic and economic factors, dietary factors, behavioral factors, physical activity, health related factors that affect nutritional status were assessed. It was found that 5.4% were underweight, 44.7% were normal weight, 33.3% were overweight and 16.4% were obese. This study also found that blood pressure ($p= 0.048$), age ($p=0.03$), diabetes ($p=0.05$), type of diet ($p=0.05$) were significantly associated with the nutritional status of people residing in Dharan sub-metropolitan city. Type of diet ($p=0.05$), occupation($p=0.05$) and blood pressure($p=0.04$) and consumption of junk food ($p=0.05$) was found to be associated with abdominal obesity.

Obesity and Overweight are projected to continue to rise in Nepal while there is still the issue of undernutrition. Urgent attention should be paid to increasing efforts to prevent this rising burden. Surveillance, monitoring and evaluation are critical aspects of the double burden of malnutrition management programs. Studies of these activities will bring experience and lessons from practice, which could help to make timely adjustments in the policy making that could achieve optimal in low resource settings.

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APPENDICES

Appendix-A

Questionnaire

Nutritional assessment form

Department of nutrition and dietetics

Central campus of technology

Tribhuvan University

Dharan, Nepal

Participant's code _____ Date of interview (B.S) _____

GENERAL INFORMATION

1. Name: _____

2. Date of birth (B.S) _____

3. Age (years) _____

4. Religion:

. a) Hindu d) Muslim

b) Christian e) Others

c) Buddhist

5. Caste/Ethnicity

a). Brahmin b). Janjati

b). Chhettri d). Madhesi

e). Dalit f) Others

6. Marital Status

a). Unmarried b). Married

c). Divorce d). Separated

e). Widow

7. Address – Dharan___ Ward no:_____

ANTHROPOMETRIC INFORMATION

	Reading a	Reading b	Mean reading
Weight (kg)			
Height (cm)			
Waist circumference (cm)			
Hip circumference (cm)			

BLOOD PRESSURE

Blood pressure	Reading A	Reading B	Mean reading
Systolic blood pressure (mmHg)			
Diastolic blood pressure (mmHg)			

FAMILY INFORMATION

8 Number of family_____

9. Number of female members _____

10. Number of male members

11. Type of family

i. Single ii. Joint

12. Socio-economic Status (Kuppuswamy Scale

1. Educational level

a). Primary b). Secondary

c). Lower secondary d) Graduate or postgraduate

e). Profession or honours f). Others

2.Family monthly income level (Rs): (it has to be as follows)

a). ≤2300 b).2301-6850

c). 6851-11450 d).11451-17150

e). 17151-22850 f).22851-45750

g).≥45751

3. Occupation

a). unemployed d). Clerical, shop owner, farmer

b). Unskilled worker e). semi-Professional

c). Semiskilled worker f). e). Professional

d). Skilled worker

PHYSICAL ACTIVITY QUESTIONNAIRE (Short IPAQ)

13. During the last 7 days, on how many days did you do vigorous physical activities (heavy lifting, digging, aerobics, or fast bicycling for more than 10 minutes)?

_____Days per week

Don't Know/Not Sure

Refused

14. How much time did you usually spend doing vigorous physical activities on one of those days?

_____Hours per day_Minutes per day

Don't Know/Not Sure

Refused

OR

How much time in total would you spend over the last 7 days doing vigorous physical activities?"

_____ Hours per week_____Minutes per week

Don't Know/Not Sure

Refused

15. During the last 7 days, on how many days did you do moderate physical activities (carrying light loads, bicycling at a regular pace, or double tennis. NO walking)?

_____Days per week

Don't Know/Not Sure

Refused

16. How much time did you usually spend doing moderate physical activities on one of those days?

_____Hours per day_Minutes per day

Don't Know/Not Sure

Refused

OR

What is the total amount of time you spent over the last 7 days doing moderate physical activities?"

_____ Hours per week_____Minutes per week

Don't Know/Not Sure

Refused

17. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____Days per week

Don't Know/Not Sure

Refused

18. How much time did you usually spend walking on one of those days?

_____Hours per day_Minutes per day

Don't Know/Not Sure

Refused

OR

What is the total amount of time you spent walking over the last 7 days?

_____ Hours per week____Minutes per week

Don't Know/Not Sure

Refused

19. During the last 7 days, how much time did you usually spend sitting on a week day?

_____Hours per weekday__Minutes per weekday

Don't Know/Not Sure

Refused

OR

What is the total amount of time you spent sitting last Wednesday?

_____Hours per weekday__Minutes

Don't Know/Not Sure

Refused

BEHAVIORAL FACTORS

20. Do you smoke/ chew tobacco or not?

a). Currently (30days) b). Past user

c). No

21. Do you drink?

a).Yes b). No

22. How frequently do you consume?

a). Daily b) Weekly

c). Twice a week c). Once a month

e). Twice a month f). Others

23. How much do you drink at a time?

a). Half glass (Tea cup) b). One glass

c). Two or more

24. How often do you have stress?

a). Daily I b). 2-3 times a week

c). Never

25. Do you use food as a stress relieving method?

a). Yes b). No

26. If yes which type of food do you prefer?

a). Junk food b). Fruits and vegetables

c). Cereals

27. On average, how many hours in night do you sleep?___hours

28. How often do you have disturbed sleep?

a) Never b) Daily c) weekly d) others specify

CO_MORBIDITIES

Hypertension

29. Have you ever been diagnosed of hypertension?

a). Yes b). No

30. Have you ever taken drug for high blood pressure?

a). Yes b). No

Diabetes

31. Have you ever been diagnosed with diabetes? (Check medical records if available)

a). Yes b). No

DIETARY QUESTIONNAIRE

32.What are you?

a). Vegan c). Lacto ovo vegetarian

b). Lacto-vegetarian d). Non-vegetarian

33. How much oil do you use monthly while cooking?_____Liters

34. Which cooking oil do you use for cooking?

i. Animal fat ii. Vegetable oil

iii. Ghee iv. Combination_____

35.How many packets of salt do you use monthly? _

36. How often do you consume milk and milk products? ___

FOOD FREQUENCY QUESTIONNAIRE

Fruits	**More than once a day Daily**	**Twice a week**	**Thrice a week**	**Once a week**	**Once a fortnight**	**Once a month**	**Never**	**Remarks**
Apricot								
Apple								
Banana								
Raisins								
Kiwi								
Mango								
Orange								
Peaches								
Papaya								
Dates								
Figs								
Coconut								
Avocado								

Vegetables	**More than once a day**	**Daily**	**Twice a week**	**Thrice a week**	**Once a week**	**Once a fortnight**	**Once a month**	**Never**	**Remarks**
Green leafy vegetables									
Roots and Tubers									
Others vegetables									

Meat	**More than once a day**	**Daily**	**Twice a week**	**Thrice a week**	**Once a week**	**Once a fortnight**	**Once a month**	**Never**	**Remarks**
White meat) Chicken/Fish									
Red meat) Pork/Beef/Mutton									

Junk Foods	**More than once a day**	**Daily**	**Twice a week**	**Thrice a week**	**Once a week**	**Once a fortnight**	**Once a month**	**Never**	**Remarks**
Dried salted fish									
Canned food/meat									
Pickles									
Bacon/ham									
Cheese/Chips/Cheese balls									
Soysauce /chowmin									
Dalmoth									
Smoked meat and fish									
Noodles									
Biscuits									
Papad									

Appendix-B

Consent form

Namaste!

I, Miss Yosha Bhandari, a undergraduate student of Nutrition and Dietetics in Central Campus of Technology, Dharan; am going to conduct dissertation work in Dharan sub-metropolitan city for the award of bachelor degree in Nutrition and Dietetics.

The topic for the study is **"NUTRITIONAL STATUS AND ITS ASSOSCIATED FACTORS AMONG ADULT POPULATION RESIDING IN DHARAN SUB-METROPOLITAN CITY"**. Under this study, nutritional status and risk factors associated with it will be surveyed among the adult population residing in Dharan sub metropolitan city.

This study will provide information about the nutritional status and risk factors associated with it among 18-59 years age people residing in Dharan sub-metropolitan city. During the study height and weight, waist circumference, waist-hip ratio and blood pressure of the participants will be measured and socio demographic and economic factors, behavioral factors, physical activity, dietary factors and health related factors will be assessed.

You have been selected for the study, you will be asked some questions and some physical measurements will be taken. This study will make you known about your nutritional status. Some questions may be personal, all information you provide will be important and the privacy of information will be maintained and they will not be misused. Your participation in this study will be voluntary. You may not answer some or all questions if you feel them personal or sensitive. But I hope you will be participated in this study.

Do you want to get participated in this study?

Yes, I want to be participated in the study and permit to take all measurements and ask the questions required for the study.

Signature of participant:	Signature of surveyor
Date:	Date:
Place:	Place:

Appendix-C

Photo Gallery

Map of the study site

Measurement of Height

Measurement of Waist

Measurement of Blood Pressure