PREVALENCE OF HYPERTENSION AND ITS ASSOCIATED FACTORS AMONG ADULTS RESIDING IN SUKUMBASI BASTI, DHARAN

by

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Prevalence of Hypertension and Its Associated Factors among Adults Residing in Sukumbasi Basti, Dharan

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Approval Letter

This ***dissertation*** entitled ***Prevalence of hypertension and its associated factors among adults residing in Sukumbasi Basti, Dharan*** presented by **Kajol Rai** has been accepted as the partial fulfilment of the requirements for the **B.Sc. degree in Nutrition and Dietetics.**

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(Kajol Rai)

Abstract

The purpose of this study was to determine the prevalence of hypertension and risk factors associated with it among adults residing in Sukumbasi Basti of Dharan. A total number of 188 aged above18 were assessed in this study. A simple random sampling method was applied. To determine the risk factors related to hypertension (i.e. BMI and WHR) height, weight, waist circumference, hip circumference and blood pressure were measured. SPSS version 27 and Microsoft Excel 2016 was used to analyze collected data. Descriptive analysis was used to find the prevalence of hypertension and chi-square test was used to test the significant association between factors of hypertension.

The overall prevalence of hypertension was found to be 36.7%. Males had higher prevalence of hypertension than females which was 46.3% and 29.6% respectively. Age ($p<0.01$), gender ($p= 0.019$), family history ($p=0.011$), diabetes ($p= 0.001$), WHR ($p= 0.002$), BMI ($p= 0.027$), physical activity ($p=0.044$), smoking ($p=0.019$), chewing tobacco ($p= 0.001$), alcohol ($p= 0.014$), green leafy vegetables ($p= 0.007$), fruits ($p= 0.011$), education ($p= 0.026$), marital status ($p<0.001$), stress ($p<0.01$), monthly income ($p=0.033$), occupation ($p=0.002$) and sleeping hours ($p= 0.002$) were found to be significantly associated with prevalence of hypertension. Dietary habits like Calorie intake ($P=0.029$), carbohydrate intake ($P=0.008$), protein intake ($P=0.041$), fat intake ($P=0.043$), wheat ($P=0.034$), pulses/legumes ($P=0.03$), milk and its products ($P=0.019$), red meat ($P=0.026$) and fast foods ($P=0.023$) were also significantly associated with hypertension. The result of the study showed that prevalence of hypertension in Sukumbasi basti was high.

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List of Abbreviations

Abbreviations	Full form
BP	Blood pressure
HTN	Hypertension
HBP	High blood pressure
LBP	Low blood pressure
NCD	Non-communicable diseases
LMIC	Low and middle income countries
WHO	World health organization
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
DALYS	Disability adjusted life years
NDHS	Nepal demographic and health survey
CNS	Central nervous system
RAAS	Renin-angiotensin aldosterone
OSA	Obstructive sleep apnea
ANS	Autonomic nervous system
DASH	Dietary approaches to stop hypertension
CVD	Cardiovascular disease
CHD	Coronary heart disease
CAD	Coronary artery disease
ACS	Acute coronary syndrome

AHA	American heart association
FH	Family history
LBW	Low birth weight
SNS	Sympathetic nervous system
LDL	Low density protein
HDL	High density protein
TG	Triglycerides
BMI	Body mass index
HC	Hip circumference
WC	Waist circumference
WHR	Waist-hip ratio
ASCVD	Atherosclerotic cardiovascular disease
SES	Socio-economic status
IPAQ	International physical activity questionnaire
CI	Confidence interval
GLV	Green leafy vegetables
RDA	Recommended daily allowances
SPSS	Statistical package for the social sciences

Part-I

Introduction

1.1 Background

There is an increasing prevalence of lifestyle diseases in developing countries. The rise in these diseases reflects a significant change in dietary habits, physical activity levels and socio-economic status among other lifestyle factors (Ndungi, 2012). The history of hypertension goes back a long way. In ancient Chinese and Indian Ayurvedic medicine, the quality of an individual's pulse, as felt by gentle palpation by the trained physician, was a window into the condition of the cardiovascular system. In the late nineteenth century, Frederick Akbar Mahomed (1849–1884), an Irish-Indian physician working at Guy's hospital in London, first described conditions that later came to be known as "essential hypertension," separating it from the similar vascular changes seen in chronic glomerulonephritis such as Bright's disease. By the middle of the twentieth century, checking blood pressure by sphygmomanometer became part of the routine physical examination in hospitals and clinics (Saklayen and Deshpande, 2016). Population surveys carried out since the 1970s in 15 developing countries including 23 population groups show that the prevalence of hypertension ranges from as low as 1% in some African countries to over 30% in Brazil (Nissinen *et al.*, 1988).

One-quarter of the world's adult population has hypertension, and this is likely to increase to 29% by 2025. Modeled projections indicate an increase to 1.15 billion hypertensive patients by 2025 in developing countries (Mittal and Singh, 2010). Hypertension increases with age, affecting approximately 66% of the elderly population (aged ≥65 years). By the year 2030, 1 of 5 Americans will be aged ≥65 years. A number of placebo-controlled clinical trials have demonstrated that blood pressure (BP) control reduces cardiovascular events in elderly patients, even in those aged >80 years. Despite advances in medical care, hypertension control rates remain low, especially in the elderly population(Nguyen *et al.*, 2012).

High blood pressure (HBP) is responsible for more than half of all strokes and coronary disease (Perkovic *et al.*, 2007) , and is now considered the biggest contributor to the global burden of non-communicable diseases (NCDs) and mortality. Hypertension is a major public

health problem right around the world. Globally, it affects around 22% of the population aged 18 years and over and is responsible for an estimated 9.4 million deaths per year (Vardell, 2020). Indeed, 45% of deaths due to heart disease and 51% of deaths due to stroke were attributable to hypertension(Lim et al., 2012). Approximately 75% of the world's hypertensive population live in low-income and middle-income countries (LMICs) (Mills *et al.*, 2016). Southeast Asia (25.1%) has the third-highest prevalence of hypertension after Africa (27.4%) and the Eastern Mediterranean (26.3%). Based on the World Health Organization (WHO) estimation for 2015, Nepal was ranked third in the prevalence of hypertension (29.4%) in South Asia, following Afghanistan (30.6%) and Pakistan (30.5%) (Vardell, 2020).

Studies show that a higher consumption of foods not only rich in simple carbohydrates, saturated and trans fats, and Na, as UPF but also a high consumption of alcohol, red and processed meat, and sugar-sweetened beverages have been associated with the occurrence of hypertension. Moreover, the consumption of UPF is associated with low intake of protein, fiber, vitamin and minerals, which may favor the development of hypertension as well. Sodium is one of the main ingredients added in the process of producing ready-to-eat food such as instant noodles, microwave popcorn, powdered soups, chips and processed meat, and it is well established that avoiding excessive sodium consumption is crucial to prevent hypertension and to reduce cardiovascular risk (Rezende-Alves et al., 2021). Fruits and vegetables are sources of micronutrients, such as K, P, Mg, Fe, folic acid, vitamin C, B-complex vitamins, folacin and riboflavin, associated with blood pressure reduction. Such foods also increase fiber intake in the diet and are rich in antioxidants and anti-inflammatory substances which have a protective role in chronic diseases (S. P. Whelton *et al.*, 2005)

1.2 Statement of the problem

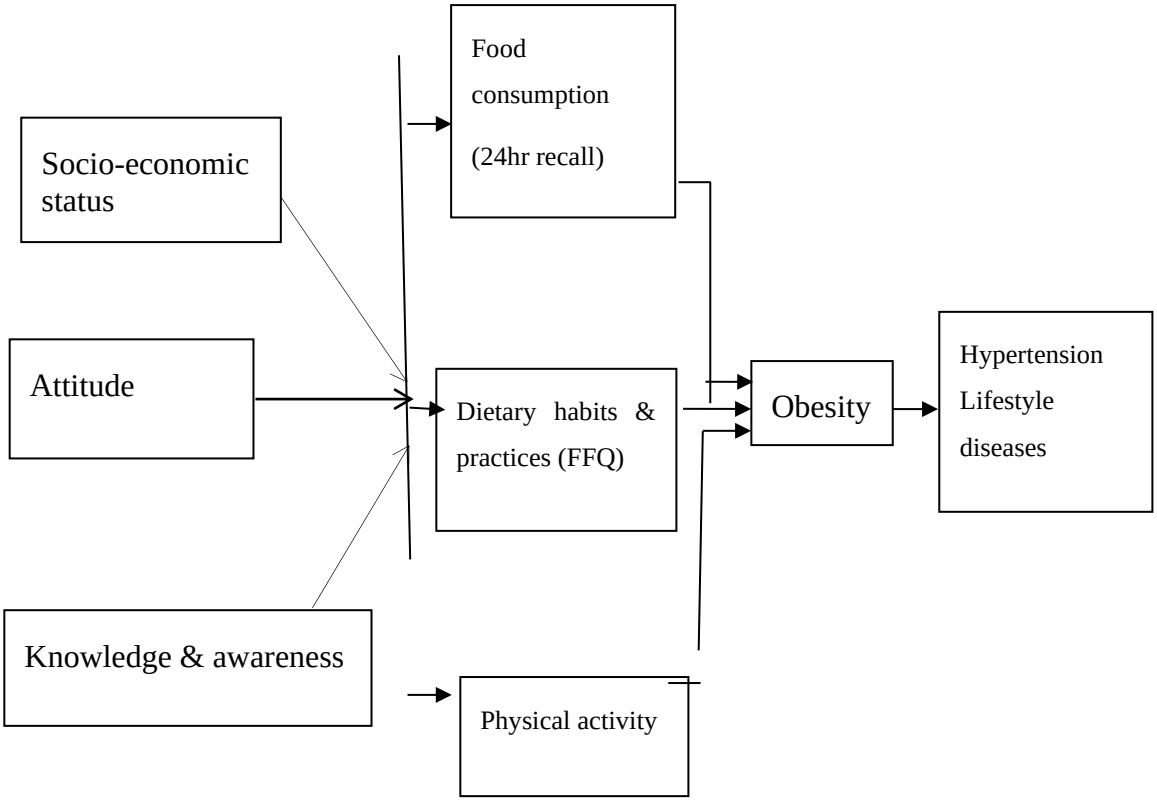
Increased blood pressure (BP) is the leading risk factor for death and disability globally according to the World Health Organization (WHO) Global Burden of Disease Study (Lim et al., 2012). Increased BP was the cause of an estimated 9.4 million deaths and 162 million years of life lost in 2010 and the cause of 50% of heart disease, stroke, and heart failure,18% of deaths overall and more than 40% of deaths in people with diabetes, hypertension is a leading risk for fetal and maternal death in pregnancy, dementia, and renal failure (Campbell

et al., 2014). Hypertension is a prevalent condition common among the least educated and poor people of low income families (Olsen *et al.*, 2016).

Sukumbasi denotes the people living without land ownership. They are usually migrants who move to the city to work as laborers, masons, factory workers, vendors, vegetable and fruit sellers, or traders and skilled laborers. Some residents migrated because of displacement due to political turmoil during the Maoist Insurgency and its after-effects (Karki, 2002) .Still more than half of population of Sukumbasi basti lives below poverty line and as a result they lack adequate financial resources to support themselves and households. They struggle to obtain food, clothing, shelter, education for children and medicine for health facilities. They also have little or no knowledge on balanced diet and importance of eating healthy foods (External communication). Since, not many research are conducted in Dharan for Sukumbasi people specifically on hypertension, no such data are available. This study, therefore, was done to see the prevalence of hypertension in adults of Sukumbasi Basti in the Dharan. This would assist to assess the health and socio-economic status of the adults. Furthermore, it would help in determination of mode of newly emerged lifestyle diseases with their clinical and epidemiological aspects. Moreover, the findings would aid the researchers in getting insight of the health status of Sukumbasi adults and help concerned body in crafting appropriate plans and policies on health.

1.3 Conceptual Framework of study

Figure 1.1 Conceptual framework of study



(Ndungi, 2012)

1.4 Objectives of the study

1.4.1 General objective

To estimate prevalence of hypertension and its associated factors among adults residing in Sukumbasi basti, Dharan.

1.4.2 Specific objectives

i. To determine the prevalence of hypertension in Sukumbasi basti along with their dietary pattern.
ii. To assess BMI and WHR of participants by using anthropometric measurements.
iii. To find out the risk factors associated with hypertension.

1.5 Research Questions

i. What is the prevalence of hypertension and its associated factors among adults residing in in Sukumbasi basti, Dharan?
ii. What are the risk factors associated with hypertension of the participants?
iii. Is there any association between hypertension and other factors like socio-demographic, economic, environmental, dietary habits, knowledge and anthropometric measurements among adults?

1.6 Significance of the study

i. This study provides information about prevalence of hypertension among adults of Sukumbasi basti, Dharan to address those who are hypertensive or at risk of being hypertensive.
ii. Increase awareness about hypertension along with its consequences in participants.
iii. Provides information which will be helpful for government and non-government organizations to initiate different programs on hypertension for the prevention and control of hypertension.

1.7 Limitations of the study

i. Visible salt intake through different package foods cannot be calculated.
ii. Other various complications besides diabetes were not assessed.

PART- II

Literature Review

2.1 Introduction

Hypertension, defined as systolic blood pressure (BP) ≥140 mm Hg, diastolic BP ≥90 mm Hg, increases with age, affecting more than 50% of patients aged ≥60 years, and approximately 66% of those aged ≥65 years (Nguyen *et al.*, 2012). Hypertension is a frequent, chronic, age-related disorder, which often entails debilitating cardiovascular and renal complications (Mittal and Singh, 2010). Hypertension is a global public health issue that accounted for an estimated 141 deaths and 2,869 disability-adjusted life years (DALYs) per 100,000 population in 2016. Similarly, an estimated 874 million adults had hypertension in 2015, with an increase expected within the next decade. Globally, in 2015, hypertension was the leading risk factor for deaths and health loss, largely from ischemic heart disease, hemorrhagic and ischemic stroke (Forouzanfar *et al.*, 2017). The ACC/AHA proposes categories for normal BP, elevated BP, and 2 stages of hypertension, with a cut point of systolic blood pressure (SBP) ≥130 mm Hg and/or diastolic blood pressure (DBP) ≥80 mm Hg for identification of hypertension.

Fig 2.1 Classification of blood pressure level

Blood pressure classification	**SBP (mm HG)**	**DBP (mm HG)**
Normal	<120	<80
Prehypertension	120-139	80-89
Stage 1	140-159	90-99
Stage 2	≥160	≥100

(P. K. Whelton *et al.*, 2022)

2.1.1 Types of hypertensions.

2.1.1.1 Essential hypertension

Essential hypertension can be defined as a rise in blood pressure of unknown cause that increases risk for cerebral, cardiac, and renal events. In industrialized countries, the risk of becoming hypertensive (blood pressure >140/90 mm Hg) during a lifetime exceeds 90%. Essential hypertension usually clusters with other cardiovascular risk factors such as ageing, being overweight, insulin resistance, diabetes, and hyperlipidemia.

2.1.1.2 Secondary hypertension

Secondary hypertension is elevated blood pressure that results from an underlying, identifiable, often correctable cause. Only about 5 to 10 percent of hypertension cases are thought to result from secondary causes (Onusko, 2003). Other underlying causes of secondary hypertension include hyperaldosteronism, pheochromocytoma, thyroid disease, coarctation of the aorta, and use of certain medications (Charles *et al.*, 2017).

2.1.1.3 Malignant hypertension

Malignant hypertension is a hypertensive urgency characterized by grade III/IV retinopathy and widespread endothelial damage. Control of BP is essential in the treatment of these disorders. In hypertensive emergencies, BP should be lowered within minutes with parenteral agents to prevent critical end-organ damage (Kitiyakara and Guzman, 1998).

2.1.1.4 Isolated systolic hypertension

Isolated systolic hypertension may occur in conditions associated with elevated cardiac output, such as anemia, hyperthyroidism, aortic insufficiency, arteriovenous fistula, and Paget's disease of bone (Chobanian *et al.*, 2003). However, most cases are caused by reduced elasticity and compliance of large arteries resulting from age and from the atherosclerosis-associated accumulation of arterial calcium and collagen and the degradation of arterial elastin (Yambe *et al.*, 2007).

2.1.1.5 Resistant hypertension

Hypertension that remains above 140/90 mmHg despite the use of three antihypertensive drugs in a rational combination at full doses and including a diuretic is known as ‘resistant’ (Kaplan, 2005).

2.2 Increasing hypertension in Nepal

In developed countries, the major burden of disease is due to chronic diseases, such as heart disease and stroke. In contrast, the major burden of disease among people in developing countries has been due largely to diseases caused by malnutrition, poor sanitation and infection. In recent years, with increasing economic and demographic development, there has been a shift in developing countries from diseases caused by poverty towards chronic, non-communicable, lifestyle-related diseases. The rapid emergence of these chronic diseases has not occurred with a similarly rapid decline in infectious diseases. Therefore, these developing countries are experiencing high rates of both infectious and chronic diseases.

Nepal has one of the highest prevalence of hypertension in South Asia. The 2016 Nepal Demographic and Health Survey (NDHS) revealed that the prevalence of hypertension varied among males (22.0%) and females (15.0%). Similarly, a nationwide survey on NCDs conducted in 2013 found that 26.0% of Nepalese population aged 15–69 years had hypertension (Aryal *et al.*, 2015).

2.3 Symptoms of hypertension

Most hypertensive people have no symptoms at all. There is a common misconception that people with hypertension always experience symptoms, but the reality is that most hypertensive people have no symptoms at all. Sometimes hypertension causes symptoms such as headache, shortness of breath, dizziness, chest pain, palpitations of the heart and nose bleeds. It can be dangerous to ignore such symptoms, but neither can they be relied upon to signify hypertension. The condition can be a silent killer and it is important for everybody to know(WHO, 2013).

2.4 Pathophysiology of hypertension

The pathophysiology of essential hypertension depends on the primary or secondary inability of the kidney to excrete sodium at a normal blood pressure. The central nervous system, endocrine factors, the large arteries, and the microcirculation also have roles in the disorder. Although monogenic forms of blood pressure dysregulation exist, hypertension mostly arises as a complex quantitative trait that is affected by varying combinations of genetic and environmental factors (Staessen *et al.*, 2003).

The various mechanisms affecting cardiac output/peripheral resistance involved in the development of essential hypertension are covered. These include genetics; sympathetic nervous system overactivity; renal mechanisms: excess sodium intake and pressure natriuresis; vascular mechanisms: endothelial cell dysfunction and the nitric oxide pathway; hormonal mechanisms: the renin-angiotensin-aldosterone system (RAAS); obesity, obstructive sleep apnea (OSA); insulin resistance and metabolic syndrome; uric acid; vitamin D; gender differences; racial, ethnic, and environmental factors; increased left ventricular ejection force and hypertension and its association with increased basal sympathetic activity – cortical connections. Maximum association of hypertension is found with sympathetic over activity which is directly or indirectly involved in different mechanisms of hypertension including RAAS, OSA, obesity, etc. It is not overt sympathetic activity but disturbed basal sympathetic tone. Basal sympathetic tone arises from hypothalamus; possibly affected by cortical influences. Therefore, hypertension is not merely a disease of circulatory system alone. Its pathogenesis involves alteration in ANS (autonomic nervous system) and likely in cortical-hypothalamic connections (Saxena *et al.*, 2018).

2.5 Treatment of hypertension

2.5.1 Lifestyle changes

Adopting healthy lifestyles, such as being active on ≥4 days per week, weight-loss in the presence of obesity, consuming a diet rich in fruits and vegetables, and sodium below the recommended threshold, avoiding high alcohol consumption and refraining from smoking have been effective lifestyle therapies to prevent or control stage 1 hypertension (HTN) (Ozemek *et al.*, 2020).

2.5.2 Smoke cessation

Smokers and users of smokeless tobacco generally have been found to have higher daytime ambulatory BP than nonsmokers; however, if clinic BP is measured when smokers are not smoking, they may have lower BP than nonsmokers. Repeated demands by physicians to their patients to stop smoking are helpful. Nicotine replacement therapies are effective and have minimal pressor effects, probably because they provide a lesser and slower rise in plasma nicotine (Kaplan, 2004).

2.5.3 Weight reduction

In virtually every study of weight reduction, systemic BP is reduced, even if the degree of weight loss is small. In general, the greater the weight loss, the greater the reduction in BP. With the marked weight loss accomplished by gastric surgery, the prevalence of hypertension is markedly reduced (Kaplan, 2004).

2.5.4 Physical activity

People who regularly perform physical activity have less CVD and the protection is as great with walking as with more vigorous exercise. The BP falls during aerobic exercise and remains lower for the remainder of the day. The overall antihypertensive effect is greater with a longer duration of exercise, but not with more intensive aerobic exercise. A similar reduction in BP has been seen with progressive resistance exercises (Kaplan, 2004).

2.5.5 Dietary sodium restriction

Although sodium sensitivity varies between individuals, a moderate reduction in dietary sodium intake will help prevent and treat hypertension. The degree of sodium reduction that was maintained in randomized controlled trials that go beyond 6 months' duration has been relatively small. In the 11 such trials that were reviewed, dietary sodium reduction averaged 33 mmoL /d with only a 1.1/0.6 mm Hg reduction in BP and no effect on mortality. It is likely that the minimal effects were directly related to the small degree of sodium reduction that was maintained(Kaplan, 2004).

2.5.6 Increase in potassium intake

In 33 randomized controlled trials of potassium supplementation, a significant antihypertensive effect has been seen, greater in blacks and in the presence of higher dietary sodium intake. Increased dietary consumption of potassium has been associated with a lower risk of stroke. The extra potassium in diets with more fresh fruits and vegetables may contribute to the reduction of BP as seen in the DASH and other controlled trials(He and Whelton, 1999).

2.5.7 Moderation of alcohol consumption

Acutely, large quantities of alcohol lower both BP and arterial stiffness, but chronic excessive drinking of more than three portions per day raises BP. In multiple populations, moderate consumption of any type of alcohol-containing beverage has been associated with lesser risks for heart attack, heart failure, ischemic stroke, diabetes, and dementia(Fuchs *et al.*, 2001). The greater protection reported with wine, red wine in particular, compared with other types of alcohol may reflect healthier lifestyle habits in those who drink wine (Thadhani *et al.*, 2002).

2.5.8 Stress reduction

Most studies of various cognitive-behavioral therapies have shown transient, but not sustained lowering of BP; however, more impressive effects were found in 45 hypertensive who received 10 hours of individualized stress management: after 6 months, ambulatory BP levels were reduced by 6.1/4.3 mm Hg(Linden *et al.*, 2001).

2.6 Complications of hypertension.

2.6.1 Stroke

Stroke is the primary cause of adult disability and presents a serious and growing threat to public health. Stroke survivors often suffer from long-term neurological disabilities significantly reducing their ability to integrate effectively in society with all the financial and social consequences that this implies (Flynn *et al.*, 2008). Stroke is a major cause of disability and death worldwide. Hypertension also leads to vascular stiffening, resulting in increase in pulse pressure, a good predictor of stroke (Yu *et al.*, 2011).

2.6.2 CVD

Cardiovascular disease (CVD) is a group of diseases that include both the heart and blood vessels (Mendis *et al.*, 2011), thereby including coronary heart disease (CHD) and coronary artery disease (CAD), and acute coronary syndrome (ACS) among several other conditions (Sanchis-Gomar *et al.*, 2016). Cardiovascular abnormalities are frequently the cause, as well as the effect, of elevated blood pressure (Reddy and Katan, 2004).

2.6.3 Pre-eclampsia

Preeclampsia, a pregnancy-specific condition, is characterized by hypertension and proteinuria after 20 weeks of gestation and remains one of the major causes of maternal deaths in the United States. In addition, preeclampsia may have an impact on women's health beyond their pregnancies, and has been associated with increased risks for future hypertension and cardiovascular disease, such as coronary heart disease and stroke (Garovic and August, 2013).

2.6.4 Kidney damage

Kidney damage represents a frequent event in the course of hypertension, ranging from a benign to a malignant form of nephropathy depending on several factors, that is, individual susceptibility, degree of hypertension, type of etiology and underlying kidney disease. Multiple mechanisms are involved in determination of kidney glomerular, tubular and interstitial injuries in hypertension. An adequate control of high blood pressure, obtained through an appropriate therapeutic intervention, still represents the key strategy to achieve a satisfactory control of renal damage in hypertension (Mennuni *et al.*, 2014).

2.6.5 Eye problems

Systemic hypertension has been linked to a wide range of major eye diseases. High arterial blood pressure (BP) decreases choroidal circulatory flow, increases intraocular pressure, and is associated with retinal microvascular abnormalities and prevalence of retinal vein occlusion (RVO) and retinopathy (Katsi *et al.*, 2012).

2.6.6 Sexual dysfunction

Diabetes and hypertension have been associated with sexual dysfunction in both men and women. Neuropathy, vascular insufficiency and psychological problems have been implicated in impotence, impaired ejaculation and decreased libido in men and in decreased vaginal lubrication, orgasmic dysfunction and decreased libido in women (Zemel, 1988).

2.7 Risks factors associated with hypertension

2.7.1 Age

Aging is a universal process that began with the origination of life about 3.5 billion years ago. Accumulation of the diverse deleterious changes produced by aging throughout the cells and tissues progressively impairs function and can eventually cause death (Harman, 2001).In most older patients, elevation of systolic blood pressure occurs because of reduced elasticity of conduit arteries (Chobanian *et al.*, 2003).

2.7.2 Gender/Sexes

Life expectancy is longer in women compared to men, and cardiovascular events occur at a lower rate and at a later age in females than males. The impact of gender in hypertension and antihypertensive therapy remains poorly clarified (Doumas *et al.*, 2013). Hypertension awareness is greater in women than men, the prevalence of hypertension is higher in men than women until after menopause, and although the ACC /AHA guidelines recommend similar treatment for men and women, this is not currently the case in practice. New studies into mechanisms responsible for sex/gender differences in hypertension include the role of the kidneys, the renin–angiotensin system, relaxing, and developmental programming (Reckelhoff, 2018).

2.7.3 Family history

Numerous researchers have found that genetic factors play an important role in hypertension. Patients who had family history (FH) of hypertension would have a 2 to 4 fold higher risk of getting this disease (Winnicki *et al.*, 2006). Also, there were studies found that the prevalence of hypertension increased with the number of affected relatives(Goldstein *et al.*, 2008). Other studies showed that mothers with hypertension contributed more than fathers, and first-degree relatives with hypertension were linked to higher risk of getting hypertension, compared with second-degree relatives(M. Liu *et al.*, 2015).

2.7.4 Socio-economic status

The impact of socioeconomic status on hypertension is complicated and unclear. Several modifiable socioeconomic determinants, such as education and occupation, are associated

with hypertension. Additional socioeconomic status markers such as urban or rural dwelling and individual, local or national economic conditions are also associated with hypertension, although these associations are complicated and at times somewhat contradictory. Possible explanations for this impact include awareness of hypertension prevention and control and better accessibility and adherence to medical treatment among higher socioeconomic status groups, as well as low birth weight and higher job strain among lower socioeconomic status groups(Grotto *et al.,* 2008).

2.7.5 Obesity or being overweight

Hypertension is more common among the obese than among the non-obese and, conversely, a significant proportion of hypertensive persons in the population are overweight. Obese hypertensive subjects experience a greater risk of coronary heart disease than the non-obese, and mortality rates for obese hypertensive persons are higher than for those with obesity alone or hypertension alone. Weight reduction has been shown to lower blood pressure, and it may bring about a more favorable prognosis in obese hypertensive persons(Chiang *et al.*, 1969).

Table 2.2 Classification of BMI according to the proposed cut-offs for South Asian population

Classification	**BMI (kg/m2)**
Underweight	<18.5
Normal weight	18.5-23
Overweight	23-27.5
Obese	≥27.5

(Hossain *et al.,* 2019)

2.7.6 Physical activity

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. Physical fitness is a set of attributes that are either health- or

skill-related (Caspersen *et al.*, 1985). A sedentary lifestyle is a very serious worldwide problem, especially in North America and Europe. Unfortunately, physical inactivity, which has progressively increased over the past several decades, significantly increases the risk of numerous diseases/disorders, including several forms of cancer, diabetes, hypertension, coronary and cerebrovascular diseases, overweight/obesity, and all-cause mortality, among others. Unless there is a reversal of this sedentary lifestyle, the incidence of these diseases/disorders will increase, life expectancy will decrease, and medical costs will continue to rise(Knight, 2012).

The International Physical Activity Questionnaire (IPAQ) was developed to measure health-related physical activity (PA) in populations. The short version of the IPAQ has been tested extensively and is now used in many international studies (Hagströmer *et al.*, 2006). Total MET-minutes/week = Walk (METs ×min ×days) + Moderate (METs ×min ×days) + vigorous (METs ×min× days). MET factors for walk, moderate activity and vigorous activity are 3.3, 4 and 8 respectively(Craig *et al.*, 2003).

Table 2.3: Activity levels classification according to MET values

Activity	**MET value**
Light	<3
Moderate	3-5.9
Vigorous	>6

(Mendes *et al.*, 2018)

2.7.7 Smoking or Tobacco use

Impairment of endothelial function, arterial stiffness, inflammation, lipid modification as well as an alteration of antithrombotic and prothrombotic factors are smoking-related major determinants of initiation, and acceleration of the atherothrombotic process, leading to cardiovascular events. Cigarette smoking acutely exerts an hypertensive effect, mainly through the stimulation of the sympathetic nervous system (Virdis *et al.*, 2010).

Most commonly used smokeless tobacco products include - tobacco pan masala, tobacco with lime, tobacco with pan and betel quid(Gupta and Ray, 2003). According to estimates there are approximately 5 million deaths due to tobacco consumption annually which is expected to reach 10 million by 2025 (A. Pandey *et al.*, 2009).

2.7.8 Alcohol consumption

Acutely, large quantities of alcohol lower both BP and arterial stiffness, but chronic excessive drinking of more than three portions per day raises BP. Many observational studies have shown a relationship between three or more alcoholic drinks daily and hypertension. Reduction in alcohol intake is associated with lowering of blood pressure in randomized clinical trials: each drink per day reduction in intake lowers systolic and diastolic blood pressure by approximately 1 mm Hg. Although regular alcohol consumption seems to reduce the incidence of atherothrombotic cardiovascular events, excessive alcohol intake increases the risk of many medical and psychosocial problems. For persons with hypertension who drink excessively, average maximum alcohol intake of one drink per day in women and two drinks per day in men is a reasonable goal, if drinking is not otherwise contraindicated.

2.7.9 Salt consumption

The kidney plays a central role in our ability to maintain appropriate sodium balance, which is critical to determination of blood pressure. In evolutionary terms, our exposure to a high-salt intake (>6 g/d) is recent(O'Shaughnessy and Karet, 2004). Besides, high salt intake or preference for salty food is discussed to be positive associated with stomach cancer, and according to recent studies probably also obesity risk. On the other hand, a reduction of dietary salt intake leads to a considerable reduction in blood pressure, especially in hypertensive patients but to a lesser extent also in normotensives as several meta-analyses of interventional studies have shown. It is estimated that about 50–60 % of hypertensive are salt sensitive. In addition to genetic polymorphisms, salt sensitivity is increased in aging, in black people, and in persons with metabolic syndrome or obesity(Rust and Ekmekcioglu, 2016).

2.7.10 High sodium-Low potassium levels

The increased prevalence of hypertension and cardiovascular disease in industrialized societies undoubtedly is associated with the modern high-sodium/low-potassium diet. A high-sodium/low-potassium environment results in significant abnormalities in central hemodynamics, leading to potential target organ damage. Altered renal sodium handling, impaired endothelium-dependent vasodilatation, and increased oxidative stress are important mediators of this effect (Castro and Raij, 2013).

2.7.11 Stress

Activation of the sympathetic nervous system (SNS) has an important role in the pathogenesis of hypertension, and is determined by the brain. Previous many studies have demonstrated that oxidative stress, mainly produced by angiotensin II type 1 (AT1) receptor and nicotinamide adenine dinucleotide phosphate (NAD (P) H) oxidase, in the autonomic brain regions was involved in the activation of the SNS of hypertension (Kishi and Hirooka, 2012).

2.7.12 Dietary food habits

Diet affects significantly the incidence and severity of cardiovascular diseases and fatty acid intake, in its qualitative as well as quantitative aspects, and influences several risk factors including cholesterol (total, LDL and HDL), triglycerides, platelet aggregation and blood pressure, as evidenced in the 2001 WHO report. Saturated fat has a bad file and several experimental studies in the rat showed a progressive increase in blood pressure in response to a highly saturated diet. Polyunsaturated fatty acids have been shown to exert a positive action on hypertension (Grynberg, 2005).

A number of studies have shown that consumption of fruit, vegetables, wine and tea may protect against stroke, for which hypertension is the major risk factor. Flavonoid compounds, including flavonols, flavones and iso-flavones represent an important source of antioxidants in the diet. Increased consumption of flavonoid-rich foods may decrease rates of hypertension (Moline *et al.*, 2000).

2.7.13 Diabetes

Hypertension is common among patients with diabetes, with the prevalence depending on type and duration of diabetes, age, sex, race/ethnicity, BMI, history of glycemic control, and the presence of kidney disease, among other factors. Furthermore, hypertension is a strong risk factor for atherosclerotic cardiovascular disease (ASCVD), heart failure, and microvascular complications. ASCVD—defined as acute coronary syndrome, myocardial infarction (MI), angina, stroke, transient ischemic attack, or peripheral arterial disease presumed to be of atherosclerotic origin—is the leading cause of morbidity and mortality for individuals with diabetes and is the largest contributor to the direct and indirect costs of diabetes (De Boer *et al.*, 2017).

2.7.14 Pregnancy

Pregnancy-associated hypertensive disorders are leading causes of maternal and fetal mortality. These include: pre-pregnancy hypertension that persists throughout gestation (chronic/preexisting hypertension), de novo hypertension that is diagnosed after 20 weeks of gestation and resolves after birth (gestational hypertension), de novo hypertension that is diagnosed after 20 weeks of gestation with or without proteinuria and end-organ damage (preeclampsia and eclampsia), and chronic hypertension with superimposed preeclampsia during gestation (Cushen and Goulopoulou, 2017).

PART-III

Materials and methods

3.1 Research Materials

The equipments necessary for conducting this survey are listed below-

i. Stadiometer- A stadiometer which can measure minimum nearest 0.1cm up to maximum 6ft
i. Measuring tape- To measure hip and waist circumference non stretchable measuring tape was used.
ii. Weight scale- To measure weight of the participant a weight scale with minimum capacity 0.1kg to maximum 100 kg was used.
iii. Measuring utensils- For 24 hours dietary recall, standardized measuring utensils were used.
iv. Blood pressure measuring devices- To measure blood pressure, an analog sphygmomanometer named Doctor Morepen and stethoscope were used.
v. Questionnaire- Semi-structured questionnaire were used for collecting information to cover the demographics, health behaviors and dietary pattern of respondents etc.

3.2 Research design

This study was conducted among adults of Sukumbasi basti, Dharan to know the prevalence of hypertension and risk factors associated with it. Population data was taken from respective Dharan ward office. Questionnaire were asked, anthropometric measurements were taken and blood pressure was measured.

3.3 Study area

The study was conducted in Sukumbasi basti Northwest boundary of Sardu Khola, Dharan sub-metropolitan, Sunsari district, Koshi Province. Dharan is a sub-metropolitan city located in Sunsari district of the eastern Nepal. It is south to the hill station Bhedetar of Dhankuta district and north of Itahari. In Dharan, there are a number of well to do families however, there are also a number of poor families, mostly people who are from Sukumbasi Basti. People living in Sukumbasi basti of Dharan are known as slum-dwellers of Dharan. These

are the people who do not have their own house and reside near riverside called Sardu Khola which lies in North west side of Dharan. It included Naulo basti, Devi gaun and Gauri gaun which are located at Dharan-11, Dharan-13 and Dharan-16. The total population of Dharan ward number 11 was 17833, ward number 13 was 9733 and ward number 16 was 18033.

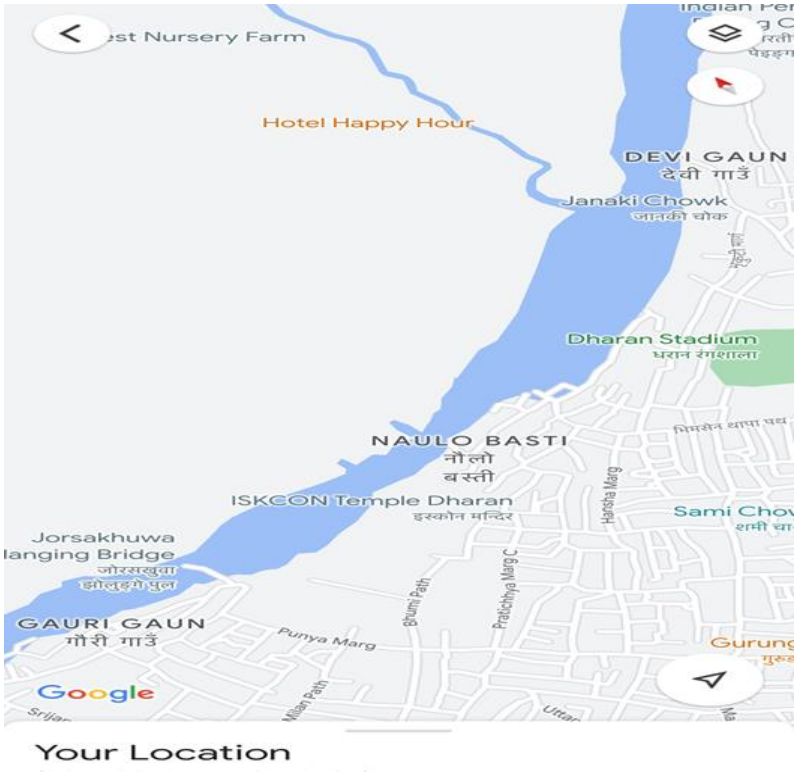


Fig 1.2: Map of study site

3.4 Research/Study variables

Research variables are of 2 types – Dependent variable and independent variables.

3.4.1 Dependent variable

The only dependent variable of this research is Blood pressure of the people.

3.4.2 Independent variables

The independent variables of this research are-

i. Anthropometric measurements- This includes measurements of waist, hip circumference and its ration along with BMI (body mass index).

ii. Socio-economic and demographic variables- It includes age, sex, education, religion, income, occupation, marital status, family size, smoking, physical activity and dietary consumption.

3.5 Target Population

The target populations of this study were the adults residing in Sukumbasi basti Northwest boundary of Sardu khola, Dharan.

3.6 Selection Criteria

3.6.1 Inclusion criteria

Adults aged above 18 from Sukumbasi basti of Dharan sub-metropolitan 11, 13 and 16.

3.6.2 Exclusion criteria

- ✓ People who are not from Sukumbasi basti of Dharan 11,13 and 16.
- ✓ Pregnant women and seriously ill people.
- ✓ People who do not want to participate in study.

3.7 Sample size method

Dharan city was selected by applying purposive sampling. The study was carried out in 3 wards which lies in the northwest part of Dharan sub-metropolitan city out of total 20 wards. These 3 wards were chosen for the survey by using simple random sampling method. From the 3 wards, the total population was 45599 out of which 188 people were selected for the survey from sample size calculation. From Dharan 11, 78 people were chosen and for Dharan 13, 56 people and lastly for Dharan 16, 54 people were selected by simple random sampling. Random households were chosen and from each household, one male and one female were selected in case of more than that lottery method was used for the survey.

3.8 Sample size calculation.

The sample size was determined by using a single proportional formula finding out the prevalence rate was 32% (Dhungana *et al.*), 95% confidence interval (CI) 7% margin of error (d) and 10% non-response rate was added to the total calculated sample size.

The calculation of infinite sample size was done by using the statistical formula,

(n) = Z2 ×p (1-p)/d2

Where n=required sample size

z=confidence interval at 95% (standard value of1.96)

p=estimated prevalence of hypertension in the project area

d =margin of error at 7% (standard value of 0.05)

i. calculation for the sample size.

The prevalence rate of hypertension is 32%

So, p= 0.32 and 1-p=0.68

The sample will be obtained as below,

(n) = Z2 ×p (1-p)/d2

= (1.96) ^2*0.32(0.68)/ (0.07) ^2

=170.52 or 171

Hence the desired sample size for conducting this survey 170.52

Now, New SS = n0 / [1+ {(n0-1) /POP}]

Where,

New SS = New sample size for finite population

n0 = Sample size in infinite population

POP = Total number of population

New SS = n0 / [1+ {(n0-1) / POP}]

= 171 / [1 {(171-1) / 45599}]

= 171 / 1.003 =170.48

Now the new sample size is further calculated below: -

Let us assume the non -response rate is 10%

Now the required sample size is =170.48+17.048

=187.52 or 188

3.9 Pre-testing

The set of questionnaire prepared was reviewed by supervisor. 10 people were chosen from the research site, where questionnaires were asked and tools were pre-tested for practicability of the tool. Pretesting is important to reduce measurement error and determine whether or not questions are suitable for the respondents to answer. After pre-testing some questions were modified, some were added and misleading questions were removed and again revised before using in actual survey.

3.10 Validity and Reliability

The instruments were validated by a group of professionals from Central Campus of Technology, Central department of Nutrition and Dietetics. In this study, the data collection tools was validated by comparing with standard known weights (for weighing balance). Similarly, the questionnaire was checked for consistency and clarity. The data collection tools was pretested using standardized instruments. All the questionnaires were also pre-tested and correction was done for reliability. Different foods were standardized in utensils for data collection of 24 hour recall method.

3.11 Data Collection Techniques

Participants were interviewed and data obtained from the respondents was collected on a structured form of a questionnaire. Stadiometer, weighing balance, and measuring tape was used for the measurement of height, weight, and body circumference respectively for the calculation of BMI.

3.11.1 Data collection for dependent variable

a) Blood pressure- Doctor Morepen sphygmomanometer was used to measure the blood pressure of the participants. The measurements was done in left arm two times separately and average BP reading was recorded. The average of the readings of SBP and DBP was taken as the blood pressure of the participant. The subject was made to sit in a chair at a resting position for at least 5 minutes before measuring blood pressure. There was at least 5-10 minutes of gap before taking second measurement.

3.11.2 Data collection for independent variables

a) Height -Stadiometer was used to measure height. Height was measured to the nearest 0.1 cm for the precision of the results. Participants were made to stand bare foot on height board and with feet parallel and joined together. The heels and buttock were touching the wall. The head was held erect and hands were hung closely at the sides.

b) Weight – Digital weighing machine was used to measure weight. Participants have to remove socks, shoes, gadgets or any heavy clothes before measuring weight.

c) Body mass index- It was calculated by using BMI formula.

d) Waist–hip circumference- Waist and hip were measured by using measuring tape and any extra or heavy clothes were asked to remove before taking measurements. Waist circumference was measured at the mid-point between the lower margin of the least palpable rib and the top of the iliac crest, while, hip circumference was taken at the maximum over the buttocks; using a non-stretchable tape that provided a constant 100 g tension and at a level parallel to the floor. The tape was snugged around the body, but not pulled so tight that it was constricting. Also, the subjects were made stand erect with arms at the sides, feet positioned close together, and weight distribution across the feet and relaxed with measurement taken at the end of normal respiration.

e) Physical activity- For classifying physical activity of participants, short IPAQ (International Physical Activity Questionnaire) was used. It was used to collect data on type, frequency, duration and intensity of physical activity during work, transportation and leisure time in a typical week.

f) Dietary intake- For the dietary assessment of the participants, food frequency questionnaire and 24 hour dietary recall was used. A food frequency questionnaire consists of a finite lists of foods and beverages with response categories to indicate usual frequency of consumption over the period of time queried. For 24 hour dietary recall, participants were asked to tell the foods and drinks that they have consumed previous day. It was written on the questionnaire.

3.12 Data Analysis

The collected questionnaire were arranged and checked at the final day of survey. Then, data was coded and entered in Microsoft Excel 2016 and then exported to SPSS version 27. Similarly, qualitative data will be transcribed and coded by assigning labels to various categories. Descriptive analysis was done to analyze the collected data. To calculate the frequency, percentage, mean and standard deviation, descriptive analysis was done. Chi square test were done to know whether there is any association between hypertension and its risk factors. ICMR (2020) food composition table was used to find out sodium and potassium level. ICMR was also used to find the RDA of calorie, carbohydrate, protein and fat for every participants.

3.13 Logistical and Ethical considerations

Clearance to conduct the research was obtained from the administration and department of nutrition and dietetics, Central campus of Technology.

The study participants were provided with oral consent prior to the study. Respondents was assured that the data collected will be treated with the uttermost confidentiality.

Part IV

Result and Discussion

The total people who participated in this study were 188. Research findings were done and the result obtained are provided and well explained in the following headings:

4.1 Demographic and socio- economic characteristics

In this heading, results are shown on the basis of participants' demographic and socio-economic characteristics like- age, gender, marital status economic factors, family type etc. which are given below.

4.1.1 Age distribution of the study population

The given below depicts that the age group which covered the major proportion was 31-40 years old, i.e. 27.1% (51) whereas the age group 60-70 covered the minor proportion with only 3.2% (6). The distribution of age groups is shown in Table 4.1

Table 4.1 Distribution of surveyed population by age (n=188)

Variables	**Frequency (n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Age group				
>18-20	7 (8.8%)	2 (1.9%)	9	4.8
21-30	19 (23.8%)	29 (26.9%)	48	25.5
31-40	16 (20%)	35 (32.4%)	51	27.1
41-50	20 (25%)	23 (21.3%)	43	22.9
51-60	13 (16.3%)	18 (16.7%)	31	16.5
>60	5 (6.3%)	1 (0.9%)	6	3.2

4.1.2 Gender wise distribution of the study population

The result showed that, out of total 188 respondents, 57.4% (108) were females and 42.6% (80) were males. The main reason female proportion being higher than male was mainly because most of the male members above 18 have gone to foreign country for employment. The distribution of gender is shown in table 4.2.

Table 4.2 Distribution of surveyed population by gender (n=188)

Variables	Frequency (n)	Percentage (%)
Gender		
Female	108	57.4
Male	80	42.6

4.1.3 Marital status of the study population

Among 188 participants, 86.7% (163) adults were married while, 13.3% (25) were unmarried/single. The distribution of marital status of participants is shown in Table 4.3

Table 4.3 Distribution of surveyed population by marital status (n=188)

Variables	Frequency (n)			Percentage (%)
	Male	Female	Total	
Marital status				
Single	19 (23.8%)	6 (5.6%)	25	13.3
Married	61 (76.3%)	102 (94.4%)	163	86.7

4.1.4 Religion and ethnicity of the study population

From the table given below, the maximum number of participants residing in this area were Hindus with 58.5% (110) which was six times greater than others which had the least number of participants, i.e. 8.5% (16). Christian and Buddhist had nearly same amount of proportion which was 17.6% (33) and 15.4% (29) respectively.

On the other hand, Janjati had the greatest proportion of participants, accounting for 76.1% (143) followed by Dalit with 13.8% (26), Brahmin 6.9% (13) and finally Chhetri with 3.2% (24).The distribution by religion and ethnicity is shown in Table 4.4.

Table 4.4 Distribution of surveyed population by religion and caste (n=188)

Variables	**Frequency (n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Religion				
Hindu	46 (57.5%)	64 (59.3%)	110	58.5
Christian	12 (20%)	17 (15.7%)	29	15.4
Buddhist	16 (15%)	17 (15.7%)	33	17.6
Others	6 (7.5%)	10 (9.3%)	16	8.5
Ethnicity				
Janjati	65 (81.3%)	78 (72.2%)	143	76.1
Brahmin	4 (5%)	9 (8.3%)	13	6.9
Chhetri	4 (5%)	2 (1.9%)	6	3.2
Dalit	7 (8.8%)	19 (17.6%)	26	13.8

4.1.5 Family type of the study population

According to the table, 81.9% (154) of adults lived in nuclear family whereas only 19.1% (34) of participants lived in joint family. Meanwhile, 58.5% (110) of participants lived in a house having less than 5 family members and 41.5% (78) of participants lived with more than 4 family members. The distribution by family type and family size are shown in the table 4.5.

Table 4.5 Distribution of surveyed population by size of family and family type (n=188)

Variable	**Frequency(n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Family type				
Nuclear	66 (82.5)	88 (81.5%)	154	81.9
Joint	14 (17.5%)	20 (18.5%)	34	19.1
Family size				
<5	50 (62.5%)	60 (55.6%)	110	58.5
≥5	30 (37.5%)	48 (44.4%)	78	41.5

4.1.6 Socioeconomic factors

Monthly income category was based on analysis of monthly expenses by (Sharma, 2016).It was visible from the result that the majority of respondents had monthly income more than 15 thousand i.e. 70.2% (132) followed by participants with monthly income ≤15 thousand 29.8% (56). More than half of the participants were involved in low physical demanding job like with business, tailor, service, shops and other semi-skilled jobs with 82.4% (151) especially female ones as they were mostly housewives. In second position was high physical demanding job like labor and farming occupation with 17.6% (33).

Most of the participants were literate which accounted for 51.6% (97) followed by secondary education with 21.3% (40). Similarly, the proportion of illiterate was 16% (30). However only minority of participants had received higher secondary and above, accounting for 11.2% (21). The distribution by socio-economic factors are shown in Table 4.6

Table 4.6: Distribution of surveyed population by socioeconomic factors (n=188)

Variables	**Frequency (n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Monthly income				
≤15 thousand	24 (30%)	32 (29.6%)	56	29.8
> 15 thousand	56 (70%)	76 (70.3%)	132	70.2
Occupation				
Low physical	54 (67.5%)	101 (93.6%)	151	82.4
High physical	26 (32.5%)	7 (6.5%)	33	17.6
Education				
Illiterate	8 (10%)	22 (20.4%)	30	16
Literate	39 (48.8%)	58 (53.7%)	97	51.6
Secondary school	20 (25%)	20 (18.5%)	40	21.3
Higher level and above	13 (16.2%)	8 (7.4%)	21	11.2

4.2 Behavioral characteristics

Most of the participants i.e. 71.3% (134) mentioned high stress, whereas only 28.7% (54) mentioned low stress. More than half of the respondents i.e. 56.4% (106) slept between 7-8 hours followed by more than 8 hours with 28.2% (53) and only 15.4% (29) slept less than 7

hours. The proportion of smokers were 21.3% (40) whereas the proportion of non- smokers were 78.7% (148). A major percent of participants did not chew tobacco which is 79.3% (149) and minor percent 20.7% (39) of participant chewed tobacco. The distribution according to behavioral characteristics are shown in Table 4.7

Table 4.7: Distribution of surveyed population by behavioral characteristics (n=188)

Variable	**Frequency (n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Stress				
High	21 (26.3%)	33 (30.6%)	54	28.7
Low	59 (73.8%)	75 (69.4%)	134	71.3
Sleeping hours				
<7	15 (18.8%)	14 (13%)	29	15.4
7-8	46 (57.5%)	60 (55.6%)	106	56.4
>8	19 (23.8%)	34 (31.5%)	53	28.2
Smoking				
Yes	27 (33.8%)	13 (12%)	40	21.3
No	53 (66.3%)	95 (88%)	148	78.7
Chew tobacco				
Yes	27 (33.8%)	12 (11.1%)	39	20.7
No	53 (66.3%)	96 (88.9%)	149	79.3

4.3 Physical activity

IPAQ questionnaire was used to assess the physical activity of the respondents in which subjects were categorized into three levels of physical activity. Low, moderate and high were the three levels of physical activity. According to which, only 12.2% (23) were engaged in low physical activity whereas a huge percent of participants i.e. 49.5% (92) did moderate physical activity and high physical activity was done by 38.3% (73). The distribution according to the physical activity is shown in the Table 4.8

Table 4.8: Distribution of surveyed population by physical activity (n=188)

Variable	**Frequency (n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Physical activity level				
Low	9 (11.3%)	14 (13%)	23	12.2
Moderate	37 (46.3%)	55 (50.9%)	92	49.5
High	34 (42.5%)	39 (36.1%)	73	38.3
Adequacy of physical activity				
Adequate	71 (88.8%)	94 (87%)	165	87.8
Inadequate	9 (11.3%)	14 (13%)	23	12.2

4.4 Family history and diabetes present

This study shows that a large percent of respondents i.e. 63.8% (120) didn't have a history of hypertension while 36.2% (68) of their family had a history of hypertension. Also, a majority of respondents did not have diabetes, accounting for 89.4% (168) whereas 10.6% (20) of them had diabetes. The distribution by family history and certain complications are shown in Table 4.9

Table 4.9: Distribution of surveyed population by family history and diabetes present (n=188)

Variable	Frequency (n)			Percentage (%)
	Male	Female	Total	
Family history				
Yes	23 (28.7%)	45 (41.7%)	68	36.2
No	57 (71.3%)	63 (58.3%)	120	63.8
Diabetes				
Yes	10 (12.5%)	10 (9.3%)	20	10.6
No	70 (87.5%)	98 (90.7%)	168	89.4

4.5 Anthropometric indices

According to the classification given by WHO for Asian BMI cut-off, the BMI and WHR of the participants were analyzed and it was found that more than half of participants were obese i.e. 53.2% (100) while, 13.3% (25) were overweight and 29.3% (55) were normal. Only 4.3% (8) of them were underweight. Similarly, there were more participants with abdominal obesity i.e. 57.4% (108) than normal, 42.6% (80). The distribution by anthropometric indices are shown in Table 4.10

Table 4.10: Distribution of surveyed population by anthropometric indices (n=188)

Variable	Frequency (n)			Percentage (%)
	Male	Female	Total	
BMI				
Underweight	7 (8.8%)	1 (0.9%)	8	4.3
Normal	32 (40%)	23 (21.3%)	55	29.3
Overweight	7 (8.8%)	18 (16.7%)	25	13.3
Obese	34 (42.5%)	66 (61.1%)	100	53.2
WHR				
Normal	50 (62.5%)	30 (27.8%)	80	42.6
Abdominal obesity	30 (37.5%)	78 (72.2%)	108	57.4

4.6 Dietary intake

4.6.1 Dietary characteristics

The table illustrated that almost all of the participants, 91.5% (172) had consumed salt more than 5gm. There could be various reason for high salt intake- i) Nepali people including Dharane people like food having more salt as salt makes food tastes better. ii) Most of the people still don't know the appropriate amount of salt. Only remaining 8.5% (16) consumed salt less than 5gm. These were those people suffering from hypertension.

It was surprising to know that most of the participants were non vegetarian i.e. 96.8% (182) and only 3.2% (6) were vegetarian. Chicken and pork meat were the most eaten meat while mutton, buff and fish were the least consumed one. Lastly, it was found that among 188 participants, 70.2% (132) did not drink alcohol while remaining 29.8% drank alcohol. The distribution according to dietary characteristics are shown in Table 4.11

Table 4.11: Distribution of surveyed population by dietary characteristics (n=188)

Variable	Frequency (n)			Percentage (%)
	Male	**Female**	**Total**	
Salt intake/day				
<5 gm	4 (5%)	12 (11.1%)	16	8.5
≥5gm	76 (95%)	96 (88.9%)	172	91.5
Vegetarianism				
Vegetarian	3 (3.8%)	3 (2.8%)	6	3.2
Non vegetarian	77 (96.3%)	105 (97.2%)	182	96.8
Drinking alcohol				
Yes	40 (50%)	16 (14.8%)	56	29.8
No	40 (50%)	92 (85.2%)	132	70.2

4.6.2 Dietary intake in 24 hour dietary recall

24 hour dietary recall was used to find out the dietary intake of each participants previous day. According to the result of the study, 92.6% (174) participants had consumed inadequate calories in their previous day. 5.9% (11) had adequate calorie and only 1.6% (3) had excess calorie. The mean calorie intake of the participants was found to be 1492.46±458.09 kilocalories which was lower than the minimum average adequate requirement of 2220 kilocalories set by ICMR 2020. It was seen that calorie intake were mostly inadequate because people are not aware of proper balanced diet and serving size. It was also found that most people skip their breakfast and directly had lunch and sometimes they would skip snacks also and directly ate dinner.

Nearly 90% (169) of participants consumed carbohydrates in excess amount than the recommended amount while, 5.9% (110) and 4.3% (8) consumed in adequate and low amount. The mean carbohydrate intake was found to be 243±184.05 grams. It was revealed that majority of participants i.e. 60.6% (114) had low protein intake, 10.6% (20) had adequate protein and 28.7% (54) had high protein intake. The mean protein intake was found to be 42.94±14.34 grams. It was found that a number of participants did not like to have dal which is a good source of protein. Noticeably, participants had high fat intake, accounting for 57.4% (108) whereas 31.4% (59) had low fat intake and only 11.2% (21) ate foods low in fats. The mean fat intake of participants were found to be 36.73±16 grams.

Almost all of the participants, 94.1% (177) had sodium intake ≥5gm and only 5.9% (11) had salt intake <5gm. The mean sodium intake was found to be 3220.78±587.82 which was higher than the recommended level set by ICMR 2020. Almost every participants ate foods rich in salt even in their regular food like dal and sabji. A majority of participants 92.6% (174) had potassium intake <3510mg while, remaining 7.4% (14) had potassium intake ≥3510 mg. Most people ate green leafy vegetables during winter season only which is why they have high potassium intake in winter and low potassium intake in summer. Also most of the participants had meat more than green leafy vegetables. The mean potassium intake was found to be 2081.36±762.40 which was much lower than the recommended level as they consumed less green leafy vegetables and more packaged foods.

Table 4.12: Distribution of surveyed population by dietary intake in a preceding day (n=188)

Variable	Frequency (n)			Percentage (%)
	Male	Female	Total	
Calorie				
Inadequate	78 (97.5%)	96 (88.9%)	174	92.6
Adequate	2 (2.5%)	9 (8.3%)	11	5.9
Excess	0	3 (2.8%)	3	1.6
Carbohydrates				
Low	3 (3.7%)	5 (4.6%)	8	4.3
Adequate	5 (6.3%)	6 (5.6%)	11	5.9
High	72 (90%)	97 (89.8%)	169	89.9
Protein				
Low	56 (70%)	58 (53.7%)	114	60.6
Adequate	6 (7.5%)	14 (13%)	20	10.6
High	18 (22.5%)	36 (33.33%)	54	28.7
Fat				
Low	3 (38.8%)	28 (25.9%)	59	31.4
Adequate	11 (13.8%)	10 (9.3%)	21	11.2
High	38 (47.5%)	70 (64.8%)	108	57.4
Sodium				
<2000 mg	4 (5%)	7 (6.5%)	11	5.9

≥2000 mg	76 (95%)	101 (93.5%)	177	94.1
Potassium				
<3510 mg	75 (93.8%)	99 (91.7%)	174	92.6
≥3510 mg	5 (6.3%)	9 (8.3%)	14	7.4

4.6.3 Food frequency questionnaire

In order to find out an individual's food consumption pattern food frequency questionnaire was used. It was categorized into four groups of consumption, first one was named "regular" in which food items were consumed more than once a day or every day. Similarly, second one was named "frequent" in which food items were eaten more than twice a week third one was "rare" in which food items were consumed at least once a week, once a fortnight or once a month. Lastly, "never" if food items were never eaten. It was revealed that rice was eaten daily by all participants. 25% (47) of participants consumed wheat regularly, 49% (93) consumed frequently and 25.5% (49) rarely. Similarly, maize/barley/millet were eaten by 6.9% (13) of participants regularly, 12.8% (24) frequently, 80.3% (151) rarely. A large percent of participant i.e. 84.6% (159) ate pulses and legumes regularly while 14.5% (27) of participants ate frequently. 1% (2) of participant rarely ate pulses/legumes.

Milk and milk products were consumed by 27.7% (52) of participants regularly then by 22.9% (43) frequently, 29.8% (56) rarely and 19.7% (37) never ate them. A majority of participants, 48.9% (92) consumed GLV regularly while 46.3% (38) consumed frequently. Participants of total 78.7% (148) ate other vegetables regularly on a daily basis, 20.2% (38) ate frequently while, 1.1% (2) rarely ate other vegetables. Eggs were eaten by 4.8% (9) of participants regularly, 28.42% (53) frequently, 53.7% (101) rarely and 13.3% (25) never ate egg. A majority of participants ate red meat rarely i.e. 54.3% (102) and then frequently 33% (62) while, white meat was eaten by 9.6% (18) regularly and 3.2% (6) never ate white meat. A large participants ate white meat occasionally which was 56.4% (106).

It was seen that tea and coffee were drank by 63.3% (119) on a daily basis while 6.4% (13), 10.6 % (19) and 19.7% (37) of participants drank frequently, rarely and never drank

tea or coffee. Fruits were eaten by 11.2% (21) on a regular basis whilst 25.5% (48), 63.3% (119) ate frequently and rarely. Salads were rarely eaten by participants, 41.5% (77) and only 20.7% (39) regularly ate salads. 11.7% (22), 35.1% (66), 39.9% (75) of participants ate fast foods regularly, frequently and rarely while 13.3% (25) never ate outside foods. 67.6% (127) of participants rarely drank cold drinks whereas 5.9% (11) and 7.4% (14) regularly and frequently drank processed drinks. However, 19.1% (36) never drank cold drinks. The distribution of food frequency questionnaire are shown in Table 4.13

Table 4.13: Distribution of surveyed population by food frequency questionnaire (n=188)

Variable	**Frequency (n)**			**Percentage (%)**
	Male	**Female**	**Total**	
Rice				
Regular	80 (100%)	108 (100%)	188	100
Wheat				
Regular	25 (31.3%)	22 (20.4%)	47	25
Frequent	31 (38.8%)	62 (57.4%)	93	49
Rare	24 (30%)	24 (22.2%)	48	25.5
Maize/Barley/Millet				
Regular	7 (8.8%)	6 (5.6%)	13	6.9
Frequent	10 (12.5%)	14 (13%)	24	12.8
Rare	63 (78.8%)	88 (81.5%)	151	80.3
Pulses/Legumes				
Regular	72 (90%)	87 (80.6%)	159	84.5
Frequent	8 (10%)	19 (17.6%)	27	14.5
Rare		2 (1.8%)	2	1

Milk and milk products				
Regular	23 (28.7%)	29 (26.9%)	52	27.7
Frequent	16 (20%)	27 (25%)	43	22.9
Rare	26 (32.5%)	30 (27.8%)	56	29.8
Never	15 (18.8%)	22 (20.4%)	37	19.7
Green leafy vegetables				
Regular	38 (47.5%)	54 (50%)	92	48.9
Frequent	38 (47.5%)	49 (45.4%)	87	46.3
Rare	4 (5%)	5 (4.6%)	9	4.8
Other vegetables				
Regular	63 (78.8%)	85 (78.7%)	148	78.7
Frequent	17 (21.3%)	21 (19.4%)	38	20.2
Rare	0	2 (1.9%)	2	1.1
Eggs				
Regular	2 (2.5%)	7 (6.5%)	9	4.8
Frequent	25 (31.3%)	28 (25.9%)	53	28.2
Rare	43 (53.8%)	58 (53.7%)	101	53.7
Never	10 (12.5%)	15 (13.9%)	25	13.3
Red meat				
Regular	9 (11.3%)	9 (8.3%)	18	9.6
Frequent	25 (31.3%)	37 (34.3%)	62	33
Rare	43 (53.8%)	59 (54.6%)	102	54.3
Never	3 (3.8%)	3 (2.8%)	6	3.2

White meat				
Regular	3 (3.8%)	2 (1.9%)	5	2.7
Frequent	32 (40%)	39 (36.1%)	71	37.8
Rare	42(52.5%)	64 (59.3%)	106	56.4
Never	3 (3.8%)	3 (2.8%)	6	3.2
Tea/Coffee				
Regular	50 (62.5%)	69 (69.3%)	119	63.3
Frequent	9 11.3%)	4 (3.7%)	13	6.4
Rare	6 (7.5%)	13 (12%)	19	10.6
Never	15(18.8%)	22 (20.4%)	37	19.7
Fruits				
Regular	13 (16.3%)	8 (7.4%)	21	11.2
Frequent	16 (20%)	32 (29.6%)	48	25.5
Rare	51 (63.8%)	68 (62.9%)	119	63.3
Salads				
Regular	14 (17.5%)	24 (23.1%)	39	20.7
Frequent	17 (21.3%)	9 (8.3%)	26	13.8
Rare	32 (40%)	45 (41.7%)	77	41.5
Never	17 (21.3%)	29 (26.9%)	46	24.5
Fast foods				
Regular	16 (20%)	6 (5.6%)	22	11.7
Frequent	28 (35%)	38 (35.2%)	66	35.1
Rare	21 (26.3%)	54 (50%)	75	39.9

Never	15 (18.8%)	10 (9.3%)	25	13.3
Cold drinks and juices				
Regular	7 (8.8%)	4 (3.7%)	11	5.9
Frequent	8 (10%)	6 (5.6%)	14	7.4
Rare	45 (56.3%)	82 (75.9%)	127	67.6
Never	20 (25%)	16 (14.8%)	36	19.1

4.7 Prevalence of hypertension

4.7.1 According to the guidelines given by AHA

Blood pressure measurements were done to all the participants to check hypertension. Also participants were asked if they were hypertensive or not and if yes are they still taking medicines to control hypertension. A total number of 188 adults participated in this survey.

The overall prevalence of hypertension was found to be 36.7%.The mean systolic and diastolic blood pressure results were 119.15±19.50 mmHg and 76.28±10.9 mmHg. Among them half of adults i.e. 51.1% (96) had normal blood pressure, 12.2% (23) had elevated blood pressure. It was also revealed that 19.7% (37) had stage 1 hypertension and remaining 17% (32) had stage 2 hypertension. However, only 17% of them are only taking anti-hypertensive drugs. According to the report of NDHS 2016, the prevalence rate of Nepal was found to be 19.9%. Our results can be compared to the study carried in a Community-Based Cross-Sectional Study in Kathmandu municipalities among adults where the prevalence of hypertension in the study population was 32.5% which was lower than our findings result (Dhungana *et al.*, 2016).The results of our study indicate that prevalence of hypertension in Sukumbasi basti of Dharan 11,13 and 16 were found to be higher than that of NHDS report and study done in Kathmandu municipalities .The prevalence of hypertension is shown by bar graph in fig 4.1

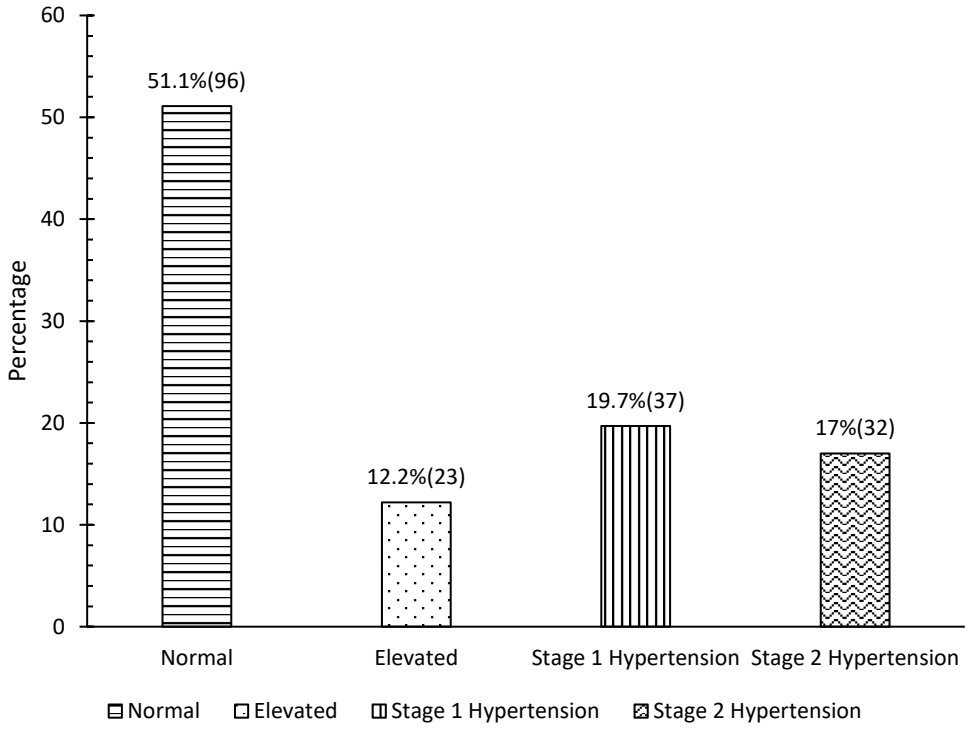


Figure 4.1 Prevalence of hypertension among surveyed adults (n=188)

4.7.2 Prevalence of hypertension gender wise according to AHA guidelines

Blood pressure were measured and the collected data were categorized into two group males and females which was later analyzed using SPSS. Out of 188 participants 80 were males and 108 were females.

According to this study it was found that the prevalence of hypertension was found to be 46.3% and 29.6% for males and females respectively. According to NHDS 2016, 24.3% of males and 16.9% of females had hypertension. Similarly, our results can be compared with the study result found in study done gender differences in factors associated with prehypertension and hypertension in Nepal in where pre-hypertension was present in 30.4% of males and 24.3% of females while hypertension was present in 20.4% of males and 14.8% of females (Agho *et al.*, 2018). Between the periods 2000–2005 and 2016–2020, the prevalence of hypertension increased from 25% to 38% in men and 21% to 28% in women (Dhungana *et al.*). This shows that hypertension is more prevalent in men than women.

Out of 108 females, 56.5% (61) were normal, 14.8% (16) had elevated hypertension, 15.7% (17) had stage 1 hypertension and remaining 13% (14) had stage 2 hypertension. For males, 42.5% (37) had normal hypertension while only 10% (9) had elevated hypertension. 26.3% (23) had stage 1 hypertension and 21.3% (19) had stage 2 hypertension. It shows that proportion of males are higher than females.

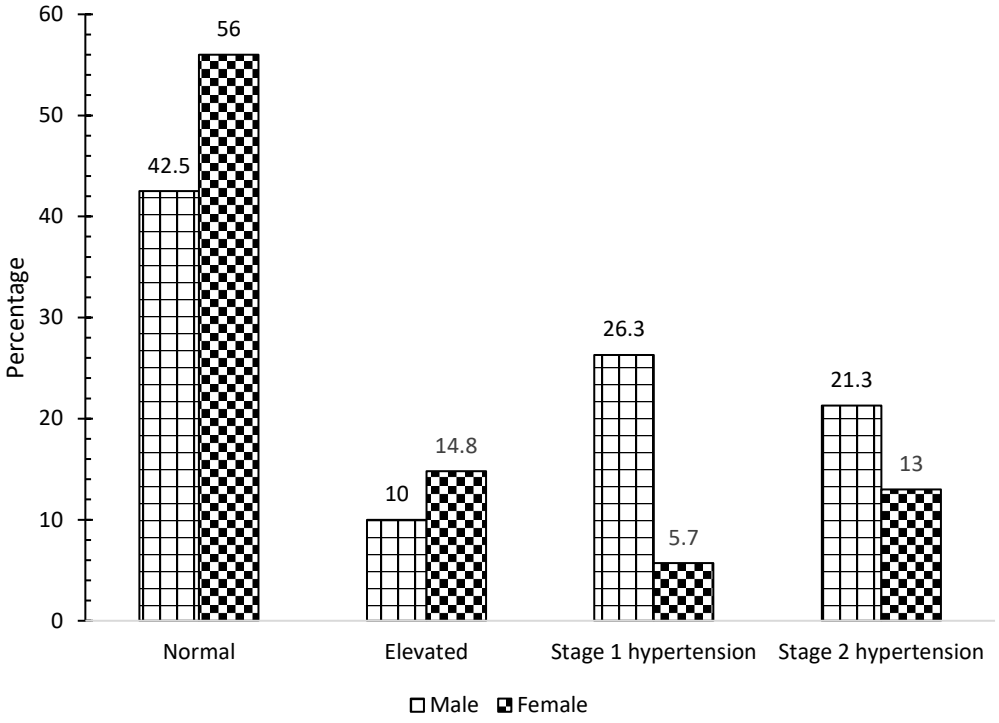


Figure 4.2 Prevalence of hypertension gender wise among adults living in Sukumbasi basti of Dharan according to AHA guidelines.

4.7.3 Factors associated with hypertension (WHO cut-off)

To identify the factors associated with hypertension chi-square analysis was used. The following analysis showed that age (P<0.01), gender (P=0.019), family history (P=0.011), diabetes (P=0.001), WHR (P=0.002), BMI (P=0.027), physical activity (P=0.044), smoking (P=0.019), tobacco (P=0.001), alcohol (P=0.014), GLV (P=0.003) and fruits (P=0.011) were significantly associated with hypertension. However, in this study salt intake have no association with hypertension.

The study shows that prevalence of hypertension increased as people age. A study done in US at 10 Veterans health administration found that the incidence of hypertension increases

with age and lesser the age better the blood pressure control (Borzecki *et al.*, 2006). Ageing exerts a marked effect on the cardiovascular system and, in particular, the large arteries causing arterial stiffness. Many studies have provided evidence that both peripheral (muscular) and central (elastic) arteries are stiffer in subjects with mixed (systolic/diastolic) hypertension compared with normotensive subjects (McEniery *et al.*, 2007). The study also found that gender is positively associated with hypertension. A research done in U.S revealed that gender is also associated with hypertension and that men have higher levels of hypertension and lower levels of hypertension awareness than women (Everett and Zajacova, 2015). There is significant evidence that androgens, such as testosterone, play an important role in gender-associated differences in blood pressure regulation (Ganten *et al.*, 1989).

The study proved that family history and hypertension are connected. To show association between hypertension and family history, a cross-sectional survey among 5,000 Sri Lankan adults, evaluating FH at the levels of parents, grandparents, siblings and children and the results showed that the prevalence of hypertension was significantly higher in those with a family history of hypertension (Ranasinghe *et al.*, 2015).From the study it is proved that diabetes and hypertension are directly associated. A study done in south eastern city of Turkey reported that diabetes is associated with hypertension (Ucan and Ovayolu, 2010). High blood pressure is reported in over two-thirds of patients with type 2 diabetes, and its development coincides with the development of hyperglycemia (Ferrannini and Cushman, 2012).

The study showed association between BMI and hypertension. According to a study conducted in middle-aged and elderly population in rural China to examine the effects of BMI (Body Mass Index) and WHR (Waist Hip Ratio) on average blood pressure showed positive association with hypertension. The average blood pressure levels and the prevalence of hypertension in males and females increased significantly with the increase of BMI or WHR ($P < 0.01$), as well as with the increase of both of them ($P < 0.01$). The average blood pressure and the prevalence of hypertension stopped increasing when WHR was greater or equal to 0.76, suggesting that WHR greater or equal 0.80 (Zhao *et al.*, 2000). Likewise, physical activity was found to be significantly associated with hypertension.

Table 4.14: Factors associated with hypertension based on BMI cut–off (n=188)

Variables	Category	Normal/Elevated	Hypertensive	Chi-square	P-value
Age	18-20	9 (100%)	0		
	21-30	46 (95.83%)	2 (4.16%)	56.748	<0.01*
	31-40	35 (68.62%)	16 (31.37%)		
	41-50	16 (37.20%)	27 (62.80%)		
	51-60	13 (41.94%)	18 (58.06%)		
	60-70	0	6 (100)%		
Gender	Male	43 (53.75%)	37 (46.25%)	5.465	0.019*
	Female	76 (70.37%)	32 (29.62%)		
Family history	Yes	35 (51.47%)	33 (48.52%)	6.415	0.011*
	No	84 (70%)	36 (30%)		
Diabetes	Yes	6 (30%)	14 (70%)	10.681	0.001*
	No	113 (67.26%)	55 (32.73%)		
WHR	Normal	61 (76.25%)	19 (23.75%)	10.056	0.002*
	Abdominal obesity	58 (53.7%)	50(46.29%)		
BMI	Underweight	7 (87.5%)	1 (12.5%)	9.140	0.027*
	Normal	42 (76.36%)	13 (23.63%)		
	Overweight	15 (60%)	10 (40%)		
	Obesity	55 (55%)	45 (45%)		

Physical activity	High	52 (71.23%)	21 (28.76%)	6.266	0.044*
	Moderate	50 (54.34%)	42 (45.65%)		
	Low	17 (73.91%)	6 (26.08%)		
Smoking	Yes	19 (47.5%)	21 (52.5%)	5.458	0.019*
	No	100 (67.57%)	48 (32.43%)		
Tobacco	Yes	15 (38.46%)	24 (61.53%)	13.066	0.001*
	No	104 (69.79%)	45 (30.2%)		
Alcohol	Yes	28 (50%)	28 (50%)	6.071	0.014*
	No	91 (68.94%)	41 (31.06%)		
Salt intake	< 5 gm	9 (56.25%)	7 (43.75%)	0.374	0.541
	≥5 gm	110 (63.96%)	62 (36.04%)		
Stress	High	22 (40.74%)	32 (59.25%)	16.593	<0.01*
	Low	97 (72.38%)	37 (27.62%)		
GLV	Regular	68 (73.91%)	24 (26.09%)	11.337	0.003*
	Frequent	44 (50.57%)	43 (49.43%)		
	Rare	7 (85.71%)	2 (14.28%)		
Fruits	Frequent	9 (42.85%)	12 (57.14%)	7.899	0.019*
	Regular	37 (77.08%)	11 (22.92%)		
	Rare	73 (61.34%)	46 (38.65%)		

*statistically significant ($p<0.05$)

A study done in Cameroon between urban and rural dwellers found that physical activity was directly associated with hypertension. Hypertension prevalence was higher in urban than

in rural due to better transport facilities and less physical activity (Sobngwi *et al.*, 2002). Smoking was positively associated in the study conducted in Chinese men in urban and rural areas of Kunshan, which showed that smoking had a significant association with hypertension and long-term and heavy cigarette smoking is associated with hypertension in men (Hu *et al.*, 2014).Tobacco smoking and hypertension are the two most important risk factors for coronary heart disease and stroke. Both of these risk factors have very high prevalence in India, Nepal and other countries of this region.(M. Pandey, 1999). Likewise, alcohol has both acute and chronic effects on blood pressure. The Kaiser-Permanente study of about 87,000 persons reported that alcohol use has a positive relation to hypertension (Friedman *et al.*, 1982). The study found that stress was directly related to hypertension. A study done in China also found stress associated with the prevalence and hypertension. It showed that showed that psychosocial stress was associated with an increased risk of hypertension and hypertensive patients had a higher incidence of psychosocial stress compared to normotensive patients (M.-Y. Liu *et al.*, 2017). Factors affecting blood pressure through stress include white coat hypertension, job strain, race, social environment, and emotional distress (Kulkarni *et al.*, 1998).

Lastly, GLV and fruits showed significant association with the prevalence of hypertension. Specifically, dietary nitrate, which is rich in some vegetables and fruits, has been shown to have a range of beneficial vascular effects, including lowering blood pressure (BP), inhibiting platelet aggregation, protecting against or improving endothelial dysfunction, and enhancing exercise ability in healthy individuals and patients with peripheral arterial disease (J. K. Jackson *et al.*, 2018). This findings were supported by a study done in U.S female professionals which showed a high association of GLV and fruits with hypertension. Higher intake of fruits and vegetables, as part of a healthy dietary pattern, may only contribute a modest beneficial effect to hypertension prevention, possibly through improvement in body weight regulation (Wang *et al.*, 2012).

4.7.4 Factors associated with socio-economic factors

The result revealed that education (P= 0.026), monthly income (P=0.033), occupation (P=0.002), marital status (P<0.001) and sleeping hours (P=0.002) was significantly associated with hypertension whereas family type showed no association with hypertension.

A study done in Brazil in 2016 proved that participants with low income levels are associated with arterial hypertension (Lyra *et al.*, 2012). Occupational stress, or job strain, resulting from a lack of balance between job demands and job control, is considered one of the frequent factors in the etiology of hypertension in modern society (Rosenthal and Alter, 2012).

A study done in Austria over the age of 15 years showed that education had a significant association with the prevalence of hypertension that is hypertension increases with decrease in educational level (Kautzky-Willer *et al.*, 2012). As recently reported in the Prospective Urban Rural Epidemiologic study, low-income individuals with low educational levels have a lower prevalence of HTN than those with higher education attainment (Rosengren *et al.*, 2019). Inconsistent with this finding, in the same study, high-income individuals with high levels of education are more likely to be health-conscious and therefore have a markedly reduced prevalence of HTN. Differences in the relationship between educational groups and HTN prevalence can be explained by markedly poorer healthcare according to the level of education and income. Additionally, individuals in low-income countries and with lower levels of education have received poorer secondary prevention and poorer therapy for HTN than other groups (Nesbitt and Palomarez, 2016). While, marital status ($P \leq 0.001$) have shown association with hypertension, family type ($P=0.851$) did not show any association with hypertension.

The study revealed that hypertension is associated to marital status. The result of a survey conducted in Iran shows that the relationship between marital status and health outcomes varied by gender. Being never married was an important risk factor for hypertension and tended to be a significant risk factor for mortality in men. However, among women, being widowed was associated with a lower risk of T2D and never married women had a lower risk of hypertension (Ramezankhani *et al.*, 2019). One preliminary study has found that blood pressure is lowered by a behavioral intervention that includes extending sleep duration (Haack *et al.*, 2013). The study found that sleeping hours are associated with hypertension. According to the sleep heart health study, it was found that usual sleep duration above or below the median of 7 to less than 8 hours per night is associated with an increased prevalence of hypertension, particularly at the extreme of less than 6 hours per night (Gottlieb *et al.*, 2006). The association is shown in Table 4.15

Table 4.15 Factors associated with hypertension based on socio-economic factors (n=188)

Variables	Category	Normal/Elevated	Hypertensive	Chi-square	P-value
Monthly income	≤15K	29 (51.79%)	27 (48.21%)	4.550	0.033
	>15K	90 (68.18%)	42 (31.81%)		
Occupation	High physical	106 (68.38%)	49 (31.61%)	9.845	0.002*
	Low physical	13 (39.39%)	20 (60.6%)		
Education	Illiterate	14 (46.67%)	16 (53.33%)	9.260	0.026*
	Literate	58 (59.8%)	39 (40.20%)		
	Secondary school	30 (75%)	10 (25%)		
	Higher level and above	17 (80.95%)	4 (19.04%)		
Marital status	Single	24 (96%)	1 (4%)	13.273	<0.001*
	Married	95 (58.28%)	68 (41.71%)		
Sleeping hours	<7	11 (37.93%)	18 (62.06%)	12.543	0.002*
	7-8	67 (63.20%)	39 (36.80%)		
	>8	41 (77.35%)	12 (22.64%)		
Family type	Nuclear	97 (62.98%)	57 (37.01%)	0.035	0.851
	Joint	22 (64.70%)	12 (35.29%)		

*statistically significant ($p<0.05$)

4.7.5 Dietary habits associated with hypertension

In this research, calorie intake (P=0.029), carbohydrate (P=0.008), protein (P=0.041), fat (P=0.043) and food products including wheat (P=0.034), pulses (P=0.03), milk and its products (P=0.019), red meat (P= 0.026) and fast foods (P=0.023) have shown association with hypertension however, vegetarianisms (p=0.301), eggs (P=0.567), white meat (P=0.636) and tea/coffee (P=0.730) did not show any association with hypertension.

From the study, it was revealed that calorie/energy intake is positively associated with hypertension. A study done in Norway among 24000 women found that high energy intake, inactivity, hypertension and diabetes are linked to obesity and an unfavorable hormonal profile (Furberg and Thune, 2003). The study found that protein intake is associated with hypertension. A cross-sectional epidemiological study of 4680 persons, aged 40 to 59 years, from 4 countries showed that vegetable protein intake was inversely related to blood pressure and a diet high in vegetable products be part of healthy lifestyle for prevention of high blood pressure and related diseases but in case of animal protein intake, high protein intake may be detrimental to blood pressure (Elliott *et al.*).. Similarly, fat intake was also significantly associated with hypertension. A study done in China provides evidence that high dietary fat intake increases the risk of hypertension (Yuan *et al.*, 2020). Wheat consumption was also significantly associated with hypertension. This is supported by a study done in US by American Dietetic Association which found that whole wheat and whole grains can reduce blood pressure and may help to control weight (Behall *et al.*, 2006). Legumes contain various components linked to lower blood pressure, including dietary fibre, bioactive peptides, and flavonoid polyphenols. A study done in UK found a significant association between higher dietary legume intake and hypertension where consuming more legumes may have clinical value for lowering hypertension risk (Hartley et al., 2022). A study done in Puerto Rico found an inverse relationship between milk consumption and definite hypertension in urban Puerto Rican men where men had 2 times increase in hypertension who had drank no milk compared to those who consumed over 1 quart of milk a day (Garcia-Palmieri *et al.*, 1984).

Red meat is an important dietary source of protein and other essential nutrients. Its high intake has been associated with an increased risk of cardiovascular morbidity and mortality, including hypertension and hyperlipidemia (Diarz *et al.*, 2020) .A study done in US among women found that red meat intake was positively associated with hypertension whereas poultry intake was unassociated with the risk of hypertension (Wang *et al.*, 2008). Fast food

items contain a high level of calories and salt that is detrimental to health (Kazi *et al.*, 2020). A study done in Iran among Iranian children and adolescent found a significant association was found between fast food consumption, BP levels, and anthropometric indices (P. Jackson *et al.*, 2004).

Table 4.16 Factors associated with hypertension based on dietary habits (n=188)

Variables	Category	Normal/Elevated	Hypertensive	Chi-square	P-value
Vegetarianisms	Vegetarian	5 (83.33%)	1 (16.66%)	1.071	0.301
	Non-vegetarian	114 (62.63%)	68 (37.36%)		
Calorie intake	Inadequate	114 (65.51%)	60 (34.49%)	7.050	0.029*
	Adequate	5 (45.45%)	6 (54.55%)		
	Excess	0	3 (100%)		
Carbohydrates	Low	1 (12.5%)	7 (87.5%)	9.540	0.008*
	Adequate	8 (72.72%)	3 (27.28%)		
	High	110 (65.09%)	59 (34.91%)		
Protein	Low	64 (56.14%)	50 (43.85%)	6.392	0.041*
	Adequate	15 (75%)	5 (25%)		
	High	40 (70.07%)	14 (25.92%)		
Fat	Low	30 (50.84%)	29 (43.15%)	6.280	0.043*
	Adequate	13 (61.90%)	8 (38.09%)		
	High	76 (70.37%)	32 (29.62%)		
Wheat	Regular	31 (65.95%)	16 (34.04%)	6.772	0.034*

	Frequent	65 (69.89%)	28 (30.10%)		
	Rare	23 (47.92%)	25 (52.08%)		
Pulses/Legumes	Regular	107 (67.29%)	52 (32.70%)	8.674	0.013*
	Frequent	12 (44.44%)	15 (55.56%)		
	Rare	0	2 (100%)		
Milk and products	Regular	41 (78.84%)	11 (21.16%)	9.970	0.019*
	Frequent	28 (65.11%)	15 (34.88%)		
	Rare	8 (50%)	28 (50%)		
	Never	22 (59.45%)	15 (40.54%)		
Eggs	Regular	5 (55.55%)	4 (44.45%)	2.024	0.567
	Frequent	34 (64.15%)	19 (35.84%)		
	Rare	67 (66.33%)	34 (33.66%)		
	Never	13 (52%)	12 (48%)		
Red meat	Regular	7 (38.89%)	11 (61.11%)	9.273	0.026
	Frequent	35 (56.45%)	27 (43.54%)		
	Rare	72 (70.58%)	30 (29.41%)		
	Never	5 (83.33%)	1 (16.67%)		
White meat	Regular	3 (60%)	2 (40%)	1.706	0.636
	Frequent	47 (66.19%)	24 (33.81%)		
	Rare	64 (60.37%)	42 (39.62%)		
	Never	5 (83.33%)	1 (16.67%)		
Fast foods	Regular	9 (40.9%)	13 (59.01%)	9.539	0.023

	Frequent	49 (74.24%)	17 (25.75%)		
	Rare	48 (64%)	27 (36%)		
	Never	13 (52%)	12 (48%)		
Tea/coffee	Regular	73 (61.34%)	46 (38.65%)	1.295	0.730
	Frequent	9 (69.23%)	4 (30.76%)		
	Rare	14 (73.68%)	5 (26.32%)		
	Never	23 (62.16%)	14 (37.83%)		
Cold drinks	Regular	4 (36.36%)	7 (63.63%)	7.342	0.062
	Frequent	8 (57.14%)	6 (42.85%)		
	Rare	88 (69.29%)	39 (30.7%)		
	Never	19 (52.77%)	17 (47.22%)		

*statistically significant ($p<0.05$)

Part-V

Conclusion and recommendations

5.1 Conclusion

The research had assessed prevalence of hypertension and risk factors associated with it among adults and data were collected. From here, following conclusions were drawn based on the objectives of the research which is given below:

1) Prevalence of hypertension among adults in Sukumbasi basti, Dharan was found to be 36.7%.
2) BMI and WHR were measured and assessed according to which 53.23% of participants were obese and 57.41% had abdominal obesity.
3) Based on WHO cut-off, aging, gender, family history, diabetes, WHR, BMI, physical activity, smoking, tobacco, alcohol, GLV and fruits all were associated with hypertension.
4) Socio-economic factors like occupation, monthly income, education, marital status, stress and sleeping hours were significantly associated with hypertension.
5) Dietary factors like calorie intake, carbohydrate intake, protein intake, fat intake, wheat, pulses, milk and its products, red meat and fast foods were significantly associated with hypertension while, cold drinks showed close association with hypertension.
6) Family type, being vegeterian and consuming cold drinks were not significantly associated with hypertension.

5.2 Recommendations

From the study done and result obtained, following recommendations are suggested–

a) Even though the areas were zone labor still, hypertension prevalence rate is high. Thus, immediate intervention programme should be conducted.
b) Longitudinal survey can be done for more detailed study since, this study was cross-sectional survey was done for the study.
c) Along with dietary habits, dietary history can also be observed and study.

Part VI

Summary

Hypertension is a long-term medical condition which is a primary risk factor for cardiovascular disease, including stroke, heart attack and heart failure. Total 188 adults were selected out of which 76 participants were from Dharan-11, and 55 participants were from Dharan 16 and 13 to assess prevalence of hypertension and risk factors associated with it among adults in Sukumbasi basti. In this study, anthropometric indicators BMI/WHR and blood pressure measurements were taken and associated risk factors were assessed. Structured questionnaire were used to know the socio-demographic, behavioral factors, physical activity and dietary aspects. The collected data were analyzed using Excel 2016 and SPSS version 27. Chi-square test were used to analyze the factors associated with hypertension.

The prevalence of hypertension was 36.7%. Similarly, the prevalence of hypertension in males were 46.3% and 29.6% in females. Adults of age group (41-50) years were most affected (62.8%) with hypertension than other age groups. Majority of participants (86.7%) were married. 81.9% of families were from nuclear family. Maximum family members (70.2%) had monthly income above 15 thousand. More than half of the participants (51.6%) were literate and only 11.2% had received higher education. 82.4% of participants were engaged in low physically demanding occupation while remaining 17.6% were engaged in high physically demanding occupation. 49.5% of participants performed moderate physical activities and 63.8% of participants did not have family history of hypertension. Only 10% of participants had diabetes. Majority of participants (53.2%) were obese. A huge percent of participants did not drink alcohol which was 70.2%.

Family type, vegetarian and fast foods were not associated with hypertension It was found that hypertension were associated with age, gender, family history, diabetes, WHR, BMI, physical activity, smoking, tobacco, alcohol, GLV and fruits according to WHO cut off. Occupation, annual income, marital status, stress and sleeping hours are also factors of hypertension. Calorie intake, carbohydrate intake, protein intake, fat intake, wheat, pulses, milk and its products, red meat and fast foods were associated with hypertension. Therefore, it is time to be serious on this topic and conduct various programmes regarding hypertension.

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Appendixes

Appendix-A

Central Campus of Technology

Informed consent form for study participants

My name is Kajol rai, a student of Nutrition and Dietetics at Central Campus of Technology, Dharan is going to conduct dissertation work in for the award of bachelor's degree in Nutrition and Dietetics. I am going to give you information about this research and invite you to participate in this research.

The topic for the study is "Prevalence of hypertension and risk factors associated with it among adults residing in Sukumbasi basti, Dharan".

Under this study, hypertension and its risk factors will be assessed. The study will provide information about hypertension and risk factors associated with it among adults. During the study height, weight, pressure and hip waist circumference of the participants will be measured. Hypertension and risk factors associated with it will be assessed using questionnaire. The information obtained from the participants will be kept confidential. 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. Please sign below if you want to participate in the study.

Signature of participant: ……

Appendix-B

Questionnaire

A) Basic information

1) Form no-
2) Name of the participant-
3) Address-

B) Socio-economic and demographic variables

1) Gender- Male/Female
2) Age-
3) Caste- i) Janjati ii) Brahmin iii) Chhetri iv) Dalit
4) What is your ethnicity?
   i)Hindu ii) Buddhist iii) Christianity iv) Islam v) Others
5) Marital status- Single/Married
6) Number of family members-

i) Female members- ii) Male members-

7) Type of family- Joint/Nuclear
8) What is your educational level?

i) Illiterate ii) Literate iii) Primary level education iv) Secondary level education v) Higher secondary education vi) Bachelor vii) Masters viii) PhD

9) Occupation-

i) Business ii) Labor iii) Farming iv) Abroad v) Unemployed vi) Housewife vii) Other

10) Income of family (Rs.)

i) Less than 2500 ii) 2500-10000 iii) 10000-25000 iv) 25000-50000 v) 50000 and above

C) History and complications

1) Do you have hypertension? Yes/No

2) If yes, then how many years it has been diagnosed?

a) 1 year b) 2-5 years c) 5-10 d) more than 10 years

3) Does your any of your family member have hypertension? Yes/No

If yes, then what is your relation with him/her (specify):

4) Does your family have a history of hypertension? Yes/No

If yes, then your relation with him/her:

5) Do you use medication to control hypertension? Yes/No

If yes, then are you still taking medicines for hypertension: Yes/No

6) Did you ever take drugs for hypertension? Yes/No

A) Behavioral factors questionnaire

i) Do you smoke cigarette?

a) Yes b) No

If yes, then how many cigarettes per day?

a) 1-3 b) 3-9 c) 9 and above

ii) Do you chew tobacco?

a) Yes b) No c) Sometimes

iii) Do you drink alcohol?

a) Yes b) No c) Sometimes

If yes or sometimes, then

I) How frequently do you drink alcohol?

a) Everyday b) once a week c) twice a week d) more than twice a week e) Once a month f) Twice a month

iv) How much do you drink alcohol at a time?

a) Half glass b) 1 glass c) 2 glass d) more than 2

v) Do you drink cold drinks or any type of processed juices?

a) Yes b) No

If yes, then how often you drink these drinks?

a) Everyday b) Once a week c) Twice a week d) More twice than a week

vi) Do you have any kind of stress? Yes/No

vii) Do you drink alcohol for relieving stress?

a) Yes b) No

ix) How many hours per day do you sleep on an average? _____ Hours.

D) <u>Physical activity questionnaire (IPAQ)</u>

1) 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)?

1. _____Days per week
2. Don't Know/Not Sure
3. Refused

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

1. __ __ Hours per day __ __ __ Minutes per day
2. Don't Know/Not Sure
3. Refused

OR

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

1. __ __ Hours per week __ __ __ __Minutes per week

2. Don't Know/Not Sure

3. Refused

3) 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)?

1. ____Days per week

2. Don't Know/Not Sure

3. Refused

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

1. __ __Hours per day __ __ __ Minutes per day

2. Don't Know/Not Sure

3. Refused

OR

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

1. __ __ __ Hours per week __ __ __ __Minutes per week

2. Don't Know/Not Sure

3. Refused

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

1. ____Days per week

2. Don't Know/Not Sure

3. Refused

6) How much time did you usually spend walking on one of those days?

1. __ __ Hours per day __ __ __ Minutes per day

2. Don't Know/Not Sure

3. Refused

OR

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

1. __ __ __ Hours per week __ __ __ __Minutes per week

2. Don't Know/Not Sure

3. Refused

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

1. __ __ Hours per weekday __ __ __ Minutes per weekday

2. Don't Know/Not Sure

3. Refused

OR

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

1. __ __ Hours on Wednesday __ __ __ Minutes on Wednesday

2. Don't Know/Not Sure

3. Refused

E) <u>Dietary/Food Habit Questionnaire</u>

1) Are you: Vegetarian/ Non-vegetarian/Vegan

If Non- vegetarian, then

i. Which meat do you eat the most?

a) Chicken b) Pork c) Mutton d) Buff e) Fish

ii. On an average, how many times per week you eat meat?

a) Everyday b) Once a week c) Twice a week d) More than twice a week e) Once a month f) Twice a month

2) Do you drink milk? Yes/No

i) If yes then do you remove milk cream? Yes/No

3) Do you eat eggs? Yes/No

4) Do you eat fruits? Yes/No

5) How much oil do use daily for cooking? _____ Spoon

And monthly- _____ liters

6) For cooking which oil do you use?

a) Animal fat b) Vegetable oil c) Combination

If vegetable oil then specify: _____ oil

7) How much salt do you use per food for cooking? _____ Spoon and monthly: gm _____

8) Do you consume dairy products? Yes/No

If yes, then specify:

F) <u>Food frequency questionnaire</u>

Types of food	Regular (at least once a day)	Frequent (3/4 times a week)	Rare (once in a week or less)	Never
Rice				

Wheat

Maize/Barley/Millet

Pulses/Legumes

Milk and milk products

Red meat

White meat

Egg

GLV

Other vegetables

Tea/Coffee

Fruits

Salad

Fast foods

24 Hours Dietary recall

Time	Food items eaten	Serving	Amount
Breakfast			
Lunch			
Snacks			
Dinner			

Bedtime

A) Anthropometric measurements

Measurement	Reading
Height(cm)	
Weight(kg)	
Waist circumference(cm)	
Hip circumference(cm)	

A) Blood pressure measurements

Blood pressure	Reading 1	Reading 2	Mean
Systolic blood pressure (mmHg)			
Diastolic blood pressure (mmHg)			

APPENDIX -C

Color plates

Fig- Measuring height

Fig-Measuring blood pressure

Fig- Measuring waist and hip