PREVALENCE OF CARDIOVASCULAR DISEASE FACTORS AMONG ADULTS IN A KATHMANDU, NEPAL

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DECLARATION

I hereby humbly declare that the Thesis entitled '**Prevalence of cardiovascular disease factors among adults in a selected community of Kathmandu, Nepal**' a requirement for the degree of Master of Philosophy (MPhil) in Epidemiology and Biostatistics under the Faculty of Biological Sciences, Dhaka University (DU), was carried out by me under the guidance of Professor (Dr) Liaquat Ali, Director, Bangladesh Institute of Health Sciences for the session 2011-2012.

No part of this work has been submitted elsewhere for any other academic purpose.

……..

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CERTIFICATION

This is to certify that Mr. Raja Ram Dhungana has completed his Thesis entitled '**Prevalence of cardiovascular disease factors among adults in a selected community of Kathmandu, Nepal**' as a requirement for the partial fulfillment for Degree of Master of Philosophy in Epidemiology and Biostatisticsunder faculty of Biological Sciences, University of Dhaka under my guidance and supervision. I hereby recommend it for approval.

Supervisor

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This thesis entitled '**Prevalence of cardiovascular disease factors among adults in a selected community of Kathmandu, Nepal**' is submitted by Raja Ram Dhungana in partial fulfillment of the requirements for the degree of Master of Philosophy (Epidemiology and Biostatistics) under the Faculty of Biological Sciences, Dhaka University, for the Session 2011-2012. Acceptance of the thesis has been approved by:

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Abbreviations

ACSM	American College of Sports Medicine
BMI	Body Mass Index
BP	Blood Pressure
CDC	Centers for Disease Control
CHD	Coronary Heart Disease
CHOD	Cholesteroloxidase
COPD	Chronic Obstructive Pulmonary Disease
CVD	Cardiovascular Disease
DALY	Disability Adjusted Life Year
DBP	Diastolic Blood Pressure
GDP	Gross Domestic Product
GLV	Green Leafy Vegetables
GOD	Glucose Oxidase
GPO	Glycerol-3-phosphate Oxidase
HDL	High Density Lipoprotein
HDL-C	High Density Lipoprotein-Cholesterol
ICMR	Indian Council of Medical Research
LDL	Low Density Lipoprotein
LDL-C	Low Density Lipoprotein-Cholesterol
LMCs	Low and Middle-income Countries
MET	Metabolic Equivalent
NCD	Non-communicable disease
NHFH& R	National Heart Foundation Hospital and Research Institute
PAL	Physical Activity Level
SBP	Systolic Blood Pressure
TG	Triglycerides
VDC	Village Development Committee
WHO	World Health Organization
WHR	Waist Hip Ratio

Abstracts

Background: Cardiovascular disease (CVD) is emerging as a prominent health problems among low and middle income countries. It has particularly affected the poorest. However, comparatively fewer CVD risk factors studies are conducted among rural communities of Kathmandu, Nepal, where most people are in-migrating and living under epidemiological and nutritional transition. This study aimed to identify the prevalence of cardiovascular risk factors in one of the rural communities of Kathmandu, Nepal.

Method: We conducted ananalytical cross-sectional study inSitapaila Village Development Community, Kathmandu between February 2014 and February, 2015. Total 347 participants of age 18 to 70 years were selected randomly. Data were collected using WHO STEPS questionnaire for CVD risk factors and analyzed with SPSS V.16.0.

Result: The mean age of respondents was 42.5±13.2 years. The majority of them were female (n= 206; 59.4%), one-third(34%) represented the upper caste, and over a quarter (29.1%) did not attend school. Cardiovascular disease risk factors includedimmediate risk factors- obesity (14.9%), hypertension (34.4%), diabetes (14.8%), and high triglyceride levels (10.8%), and intermediate risk factors- smoking (17.6 %), alcohol consumption (29.4%), insufficient fruit and vegetable intake (98%) and insufficient physical activity (21%). The average daily salt intake per capita remained high at 9.57 gm± 5.49 gm.There was a significant inverse relationship between physical activity and waist hip ratio(WHR) ($r= -0.115$, $p<0.05$), fasting blood glucose (FBS) ($r= -12$, $p<0.05$), systolic blood pressure (SBP) ($r= -073$, $p<0.05$) and triglycerides (TG) ($r= -0.126$, $p<0.05$).Blood pressure level was also positively correlated with FBS, TG, cholesterol and low density lipoprotein (LDL).

Conclusion: A high prevalence of cardiovascular disease risk factors and strong inter-relationships suggesteda high risk of cardiovascular events in the study population. The findings have implications for planning and the implementation of cardiovascular disease risk factor prevention programs in rural communities in Kathmandu.

Keywords: Cardiovascular diseases; Cardiovascular risk factors;Kathmandu; Nepal,

CHAPTER ONE

Introduction

1.1 Background

Non-communicable diseases (NCDs) make the largest contribution to mortality globally which account 60% (35 million) of global deaths[1]. Low- and middle- income countries (LMICs) disproportionately share the largest proportion of burden - 80% (28 million) of all global death due to NCDs[1]. Cardiovascular diseases (CVDs), a major part of NCDs, are the number one cause of death accounting 30% of all global deaths [2].The number of people who died from CVDs, mainly from heart disease and stroke, was 17.3 million in 2008[2]. The rapidly increasing CVD death toll is predicted to rise to 23 million by 2030 [3]. More importantly, CVD, once regarded as diseases of affluence, is now wildly spreading among low and middle income countries contributing more than three-quarters of all CVD deaths in the globe [4]. People in low- and middle-income countries (LMCs) who suffer from CVDs have less access to effective and equitable health care services which respond to their needs. As a result, many people die younger from CVDs, often in their most productive years[2].

In the same vein, noncommunicable diseases including CVD are exerting enormous burden on life of poor and marginalized people reducing labor productivity and increasing out of pocket expenditure; and ultimately creating more pressure on poor healthcare system and debilitating national economy [5, 6]. These diseases are estimated to reduce GDP by up to 6.77% in low- and middle-income countries experiencing rapid economic growth, as many people die prematurely[2].More than that, the cost for direct health care expenditure and loss of productivity due to disability and death is expected to rise by 22 % by 2030[7].

The increasing CVDs epidemic is mainly attributable to the major determinants like modernization, rapid unplanned urbanization, globalization, and socio-epidemiological, demographic and nutritional transition, among others[8, 9]. More than that, cardiovascular diseases share common risk factors like tobacco use, physical

inactivity, unhealthy diet, harmful use of alcohol, diabetes, high blood pressure and raised lipid which are responsible for sharp increase in CVDs. Among them, intermediate risk factors such as unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol, alone contributes 80% of coronary heart disease and cerebrovascular disease [10]. Smoking is estimated to cause nearly ten per cent of all CVD followed by physical inactivity (6%), and overweight and obesity (5 %) [11]. Low fruits and vegetables intakes also caused death of approximately 16 million people [11].

Similarly, high blood pressure, increased blood sugar and raised lipid have been identified as the immediate or metabolic risk factors for cardiovascular diseases. Blood pressure levels is positively related to the risk of stroke and coronary heart disease[12]. The risk of cardiovascular disease doubles for each increment of 20/10 mm Hg of blood pressure, starting as low as 115/75[13].It leads to complications like heart failure,peripheral vascular disease, renal impairment, fundal hemorrhages, and papillodema[14]. Likewise, impaired glucose tolerance and impaired fasting glucose are risk categories for future development of diabetes and cardiovascular disease[15]. The age-adjusted mortality, mostly dueto coronary heart disease in many diabetic populations, is 2-4 times higher than in the non-diabeticpopulation[16]. People with diabetes have also a twofold increase risk of stroke[17].Dyslipidemia, mainly hypercholesterolemia and hypertriglyceridemia, is also a major metabolic risk factor for cardiovascular diseases. Raised cholesterolis estimated to cause 18% of the global cerebrovascular disease and 56% of global ischemicheart disease resulting in approximately 4.4 million deaths (7.9% of total) and 40.4 million DALYs (2.8% of total) [18]. In the same way, increased triglyceride also acts as an independent risk factor for coronary heart disease after controlling for LDL and HDL cholesterol [19]. However, plasma HDL cholesterol is inversely related to coronary artery disease incidence, and the relationship is independent of total cholesterol, LDL and triglyceride levels[20].

Nepal, a small country situated in between India and China contains about 28 million people with vast ethnic diversities. It is a developing country with a low income economy, ranking 145th of 187 countries on the Human Development Index (HDI) in 2014[21]. It continues to struggle with high levels of hunger, poverty, political instability and internal conflict[21].Like many low- and middle-income countries (LMICs), Nepal is also battling with soaring internal migration, unplanned urbanization and air pollutions.With crippling health system, Nepal is now fighting against the double burden of disease, communicable and non-communicable diseases (NCDs), with cardiovascular

diseases (CVDs) being the most common among the latter. Latest estimation showed thatNCDs are responsible for 60 % of total death in Nepal[1]. CVDs alone are expected to contribute for 25 % of all mortality in Nepal[10].Statistics suggest that CVDs are emerging as a major killer even in Nepal where mortality attributed to CVD has swiftly increased from 22% to 25 % between 2004 and 2008 [10]. A hospital based study conducted in five development regions of Nepal pointed out a fact that among all NCDs cases diagnosed, heart diseases account 40%[22].Research work done particularly in the last decade has shown that the conventional risk factors are present in a high proportion in the Nepalese population. .Recent studies have reported high prevalence of CVD risk factors in Nepal [23, 24]. National NCD risk factors survey 2013 detected considerably high proportions of smoking (18.5%), alcohol consumption (17.4%), insufficient fruits and vegetables consumption (98.9%) , obesity (4 %), hypertension (25.7%), diabetes (3.6%) and hypercholesterolemia (22.7%) among Nepalese [25]. In comparison to NCD risk factor survey 2013, NCD risk factor survey 2007 reported very less proportions insufficient fruit and vegetable intake (61.9%), obesity(5.5 %) and hypertension (21.5%)[23, 24].This shows the increasing trend of CVD risk factors among Nepalese.

Kathmandu, the capital city, is one of the most densely populated areas in Nepal and home to 2.8 million people[26].The valley houses all the major amenities and institutions, governmental and non- governmental. Because of major pull factors like uneven distribution physical infrastructure and resources, and institutional centralization, large pocketsof populationmove into the city from neighboring districts. Besides, better job opportunities in Kathmandu than elsewhere in Nepal, is also responsible for excessive migration and inflow of people from other parts of the country.Kathmandu consists of both urban and rural area. The urban area mostly comprises the metropolitan city, whereas rural areas divided into 57 village development committees (VDCs) including Sitapaila VDC. Sitapaila VDC is the main center of attraction for people in-migrating from western part of country.It one of the rapidly urbanizing places positioned nearby Kathmandu metropolitan with soaring in-migration and is inhabited by 7,785 people of having age 18 years and more. Recent report suggested that progressive urbanization and the coinciding “globalization of unhealthy lifestyles, which are facilitated by urban life – tobacco use, unhealthy diets, physical inactivity and harmful use of alcohol has played a substantial role to rise the CVDs in LMCs[27].But we lack the CVD risk factors studies in rural communities of Kathmandu which share the similar characteristics ofunplanned urbanization, changing socio-demographic parameters and unhealthy lifestyles.

1.2 Rationale

In a recent report, World Health Organization has pointed out that the ongoing socio-epidemiological, demographic and nutritional transitions have increased the vulnerability of various non-communicable diseases including CVDsamong rapidly urbanizing communities of LMCs [27]. These communities are battling with both rural carryover effects likethe persistent poverty, illiteracy, poor health literacy and almost non-existence of health facility, and the newly emerging challenges like growing aging population, unplanned urbanization, market globalization, and environmental pollution [27]The report further underlined the issues of unplanned urbanization and its association with CVDs. It tends to hinder heart-healthy lifestyles by creating unsupportive physical and economic environments. People are also heavily influenced by industry marketing and development via which the consumption of unhealthy food or tobacco becomes intrinsic to their life [27].

Studies conducted in India, Malaysia and Nigeria also concluded that urbanizing communities are possessinghigh prevalence of CVD risk factors [28-33]. These studies also suggested that the problems are bound to increase substantially in future [34]. Some of them revealed that there was a negative association of education and socio-economic status to smoking, alcohol consumption, hypertension [32] and low fruits intake [30]. In the meantime, a study conducted in rural community of Eastern Nepal found a striking result. One in each two persons was taking alcohol. More than one fourth respondent were current smokers. Insufficient fruits and vegetables intake was rampant (96.6%). Even though study site was hilly region, half of people were less physically active. The majority of people, in the other hand, were without formal education and low socio-economic status, which had inverse relationship with hypertension[35].

Even though, sufficient evidences are available to prove CVDs and other non-communicable diseases have higher propensity to spread in low socioeconomic status leading life of the poorest to abysmal poverty, and urbanization exacerbates the problem[5, 36],there is dearth of studies related to CVDs risk factors particularly among Nepalese rural population living in outskirt of Kathmandu.These communities should also be tracked well on time for understanding the ongoing epidemiological transition. Therefore, the primary purpose of the study was to estimate the prevalence of CVD risk factors among people living in rural part of Kathmandu, Nepal where poor hygiene and

sanitation, unplanned urbanization, changing socio-epidemiologicalcharacteristics and unhealthy lifestyles remains a prevailing problem. Study finding would be useful for identifying the extent of the problem and implementing CVD prevention programs among similar communities in Nepal.

1.3 Research Questions

- What is the prevalence of different layers of CVD risk factors among adults of a selected community in Kathmandu district?
- Is there any relationship among different layers of CVD risk factors in a selected rural community of Kathmandu district?

1.4 Research Objectives

1.4.1 General

To determine the prevalence of cardiovascular risk factors ina selected rural community of Kathmandu District.

1.4.2 Specific

- To estimate the prevalence of CVD risk factors in different layers (non-modifiable primary, modifiable intermediate and immediate) in a selected rural community of Kathmandu District.
- To determine the relationship betweendifferent layers of CVD risk factors in a selected rural community of Kathmandu District.

1.5 Variables

1.5.1 Non-modifiable primary risk factors

- Age
- Gender
- Ethnicity

1.5.2 Other primary risk factors

- Educational level
- Employment/ Occupation
- Socio-economic status

1.5.3 Modifiable intermediate risk factors

- Tobacco consumption
- Alcohol consumption
- Physical activity level
- Fruits, vegetables and salt consumption

1.5.4 Immediate risk factors

1.5.4.1 Anthropometric measurements

- Height
- Weight
- Waist circumference
- Hip Circumference

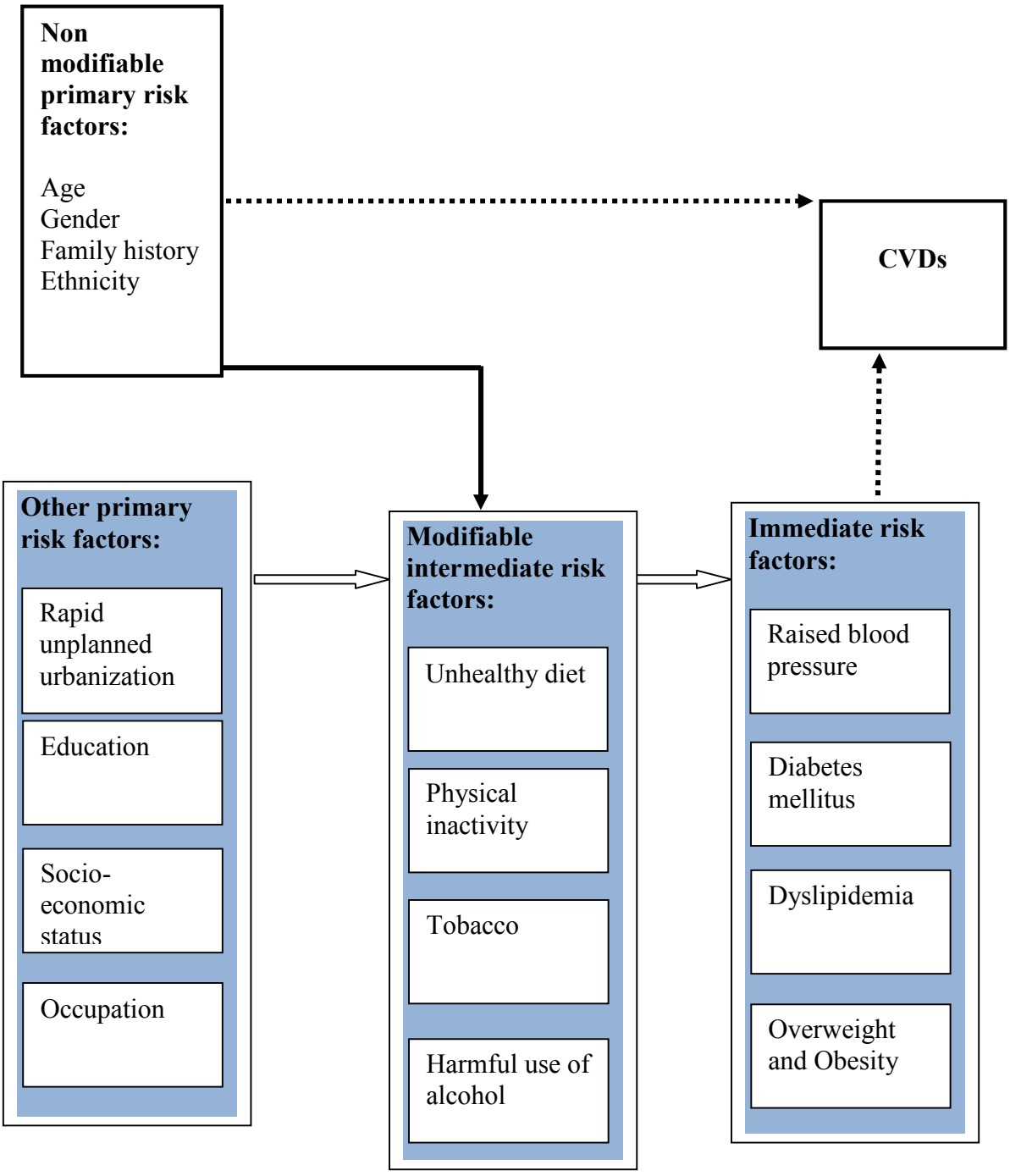
1.5.4.2 Clinical measurements

- Systolic blood pressure (SBP)
- Diastolic blood pressure (DBP)

1.5.4.3 Biochemical

- Fasting blood sugar (FBS)
- Total cholesterol (TC)
- Triglycerides (TG)
- High density lipoprotein (HDL)
- Low density lipoprotein (LDL)

1.6 Conceptual frameworks



1.7 Operational definitions

Standard operational definitions were adopted for behavioral, anthropometric, clinical and biochemical measurements to ensure uniformity and minimize error**.**

Key words	**Definitions**
Current smokers	Those report smoking any tobacco product within last 30 days[24]
Current daily smoker	Person who smokes daily[24]
Current alcohol drinkers	Person who engages in alcohol drinking within last 30 days[24]
Current episodic heavy drinking	Five and more drinks on any day in past 30 days[24]
One standard drink (13.6 gm of pure alcohol)	Consuming 341 ml of beer or Zaand or Tongba; and 43 ml of local Raksi[24]
Sufficient intake of fruit and vegetables	Fruits and vegetables intake for at least five portions (400 gm) of a day[37]
Sufficient physical activity	At least 600 MET vigorous and moderate activities in a week[38]
Vigorous physical activity	Vigorous physical activity was defined as any activity that had more than six METs value, for example digging or ploughing fields, lifting heavy weights, etc. [38].
Moderate physical activity	Moderate physical activity was any activity that had METs value between three and six [38]. Examples include domestic chores, gardening, lifting light weights, etc.
Light physical activity	Physical activity having less than three METs like spending time sitting at a desk, sitting with friends, travelling in a car, bus or train, reading a book etc was considered low or sedentary physical activity[38].
Obesity[39, 40]	
Underweight	<18.5 kg/m^2
Normal weight	18.5 to 25 kg/m^2
Overweight	25 to 30 kg/m^2
Obese Class I	30 to 35 kg/m^2
Obese Class II	35 to 40 kg/m^2

Obese Class III	> 40 kg/m^2
Abdominal obesity	Waist–hip ratio ≥0.90 cm for male; ≥0.85 cm for women[41].
Hypertension	Systolic blood pressure ≥ 140 mmHg and/or a diastolic blood pressure ≥ 90 mmHg or the persons who are using antihypertensive medicine [13]
Impaired fasting glucose	fasting blood sugar level between 100 and 125 mg/dl[42]
Diabetes	A fasting blood sugar level of 126 mg/dl and higher or taking any anti-diabetic medicines[42]
Total cholesterol[43]	
Desirable	Below 200 mg/dl
Borderline high	200-239 mg/dl
High	240 mg/dl and above
LDL cholesterol[43]	
Ideal	Below 70 mg/dl
Ideal for people at risk of heart disease	Below 100 mg/dl
Near ideal	100-129 mg/dl
Borderline high	130-159 mg/dl
High	160-189 mg/dl
Very high	190 mg/dl and above
HDL cholesterol[43]	
Poor	Below 40 mg/dl (men) Below 50 mg/dl (women)
Better	40-49 mg/dl (men) 50-59 mg/dl (women)
Best	60 mg/dl and above
Triglycerides[43]	
Desirable	Below 150 mg/dl
Borderline high	150-199 mg/dl
High	200-499 mg/dl
Very high	500 mg/dl and above

CHAPTER TWO

Literature reviews

2.1 Cardiovascular diseases and their burden in society

Cardiovascular disease refers to diseases of heart and blood vessels. Cardio refers to heart and vascular to the entire blood vessel system within the body including brain, neck, chest, abdomen and legs. CVD is a class of diseases involving principally cardiac disease, vascular diseases of the brain and kidney, and peripheral arterial disease [44].

Types of CVDs[45]

- Coronary artery disease (also known as coronary heart disease and ischemic heart disease)
- Cardiomyopathy – diseases of cardiac muscle
- Hypertensive heart disease – diseases of the heart secondary to high blood pressure
- Heart failure
- Pulmonary heart disease – a failure at the right side of the heart with respiratory system involvement
- Cardiac dysrhythmias – abnormalities of heart rhythm
- Inflammatory heart disease
- Endocarditis – inflammation of the inner layer of the heart, the endocardium. The structures most commonly involved are the heart valves.
- Inflammatory cardiomegaly
- Myocarditis – inflammation of the myocardium, the muscular part of the heart.
- Valvular heart disease
- Cerebrovascular disease – disease of blood vessels that supply blood to the brain such as stroke
- Peripheral arterial disease – disease of blood vessels that supply blood to the arms and legs
- Congenital heart disease – heart structure malformations existing at birth
- Rheumatic heart disease – heart muscles and valves damage due to rheumatic fever caused by Streptococcus pyogenes

2.2 Burden of CVDs

CVDs have tremendous socio-economic burden in our society. An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths [10]. The number of people who die from CVDs mainly from heart disease and stroke, will increase to reach 23.3 million by 2030 [3, 10]. Out of total CVD deaths in 2008, South East Asia accounted 3616000 which was nearly equal to CVD deaths in Europe and Western Pacific, and almost double than remaining regions[46]. Notably, Low- and middle-income countries are disproportionally affected by CVDs where over 80% of CVD deaths take place [2]. The prevalence increases with advancing age and varies within racial, ethnic, geographic, and sociodemographic groups. In South Asia, the age standardized mortality rate due to CVDs per 100000 is the highest in Afghanistan (511), followed by India (306), Bangladesh (283), Pakistan (274), Srilanka (271), Nepal (270) and Maldives (211)[46]. The data shows industrialized countries like USA (136) and Japan (81) have remarkably lower CVD deaths compared to South Asian countries[46].

Heart disease and stroke are the first and third leading causes of death due to CVDs[47]. Among the 71.3 million American adults with one or more forms of CVD, the most prevalent conditions are hypertension or high blood pressure (65 million), coronary heart disease (13.2 million), stroke (5.5 million), heart failure (5 million), and congenital heart defects (1 million) [48].

2.3 Economic burden of CVD

High proportion of medical expenditures attributable to four major chronic cardiovascular diseases: stroke, hypertension, congestive heart failure, and other heart diseases[48]. At the household level, sufficient evidence is emerging to prove that CVDs and other non-communicable diseases contribute to poverty due to catastrophic health spending and high out of pocket expenditure[2].

At macro-economic level, CVDs place a heavy burden on the economies of low- and middle-income countries. Non-communicable disease including cardiovascular disease and diabetes are estimated to reduce GDP by up to 6.77% in low- and middle-income countries experiencing rapid economic growth, as many people die prematurely [2]. It is also the most costly disease in the United States. Using data from multiple sources, the American Heart Association has compiled a detailed table of 2006 estimates of the direct and indirect costs of heart diseases, coronary heart disease, stroke, hypertensive heart disease, heart failure, and total CVD [48]. The estimated health care

spending and lost productivity (direct and indirect costs) of total CVD exceed $400 billion [48].

2.4 Cardiovascular risk factors

Most cardiovascular diseases possess constellation of risk factors. These risk factors have conventionally been classified as non-modifiable risk factors like age, gender, ethnicity and family history; modifiable behavioural risk factors like unhealthy diet, physical activity, tobacco use and harmful use of alcohol; and metabolic/physiological risk factors like raised blood pressure, diabetes, dyslipidemia and obesity. However, we have stratified them into primary, intermediate and immediate CVD risk factors with respect to their nature.

2.5 Primary risk factors

Age, gender, family history of CVDs, religion and ethnicity are non-modifiable primary risk factors. With increase in age, there is more likelihood of developing CVDs. After 40 years of age, the lifetime risk of developing CHD is 49% for men and 32% for women. Fur out of five people dying from CHD are 65 years of age or older[49] . Similarly, heredity represents nature's involvement in putting people at risk for CVD, while other primary risk factors like rapid unplanned urbanization, education, socio-economic status and occupation inversely nurture the dimension for developing the disease[30, 50-52].

2.6 Modifiable intermediate risk factors related variables

2.6.1 Tobacco consumption

About 1.3 billion people worldwide smoke any tobacco product today. Among them, about 84% live in developing and transitional economy countries[53].On the other side, tobacco is the fourth most common risk factor for disease and the second major cause of death worldwide. It is currently responsible for the death of one in ten adults worldwide (about 4.9 million deaths each year)[18]. If the current smoking pattern continues, it is estimated that deaths from tobacco consumption was about 10 million people per year by 2020[18].Smoking is markedly attributable for multiple cancers, particularly lung cancer and is at far greater risk of heart disease, stroke, Chronic Obstructive Pulmonary Disease (COPD), diabetes, and other fatal and non-fatal diseases. People who chew tobacco risk cancer of the lip, tongue and mouth[54].

2.6.2 Alcohol consumption

Alcohol consumption is the leading risk factor for disease burden in low mortality developing countries and the third largest risk factor in developed countries[55]. The proportion of disease burden attributable to alcohol use in the developing world is between 2.6% to 9.8% of the total [56].Besides the direct toxic effects of intoxication and addiction, alcohol use causes about 20% to 30% of each of esophageal cancer, liver disease, homicide, epileptic seizures, and motor vehicle accidents worldwide [55]. It also increases the risk of cardiovascular[57]. Alcohol consumption during pregnancy is related to various risks to the fetus, including Fetal Alcohol Spectrum Disorders, spontaneous abortion, low birth weight and prematurity, and intra-uterine growth retardation[58, 59].

2.6.3 Physical inactivity

Physical inactivity is a major risk factor in promoting obesity, which itself is a risk factor for other chronic diseases[60]. It causes about 1.9 million avoidable deaths per year worldwide[61]which accounts for 21.5% of ischemic heart disease, 11% of ischemic stroke, 14% of diabetes, 16% of colon cancer and 10% of breast cancer[62]. Physically inactive persons have a 20% to 30% increased risk of all-cause mortality as compared to those who adhere to 30 minutes of moderate intensity physical activity on most days of the week[60]. In contrast to this, physical activity may have a protective effect against development of cognitive impairment and dementia, and reduces severity of symptoms among the depressed[63, 64]. Physical activity is associated with the prevention of osteoporosis and related fractures[60].

2.6.4 Fruits, vegetables, fat and salt consumption

Low fruits and vegetable consumption is responsible for loss of 2.7 million lives and 26.7 million (1.8%) DALYs worldwide[18, 65]. Of the burden attributable to low fruit and vegetable intake, about 85% was from cardiovascular diseases and 15% from cancers[18]. Moreover, it is estimated to cause about 19% of gastrointestinal cancer, 31% of ischemic heart disease and 11% of stroke worldwide[18].

The consumption of at least 400g of fruit and vegetables per day is recommended as a population intake goal, to prevent diet-related chronic diseases[66]. Adequate consumption of fruit and vegetables reduces the risk for cardio vascular diseases, stomach cancer and colorectal cancer[66].

There is convincing evidence that high intake of high-energy foods such as processed foods high in fats and sugars promote obesity compared to low-energy foods

such as fruits and vegetables[66]. Higher unsaturated fatty acids from vegetable sources and polyunsaturated fatty acids have been associated with a reduced risk of type 2 diabetes[67, 68].They also lower coronary heart disease risk [69].In the contrary, partial hydrogenation to increase the shelf life of poly-unsaturated fatty acids creates trans fatty acids[66]. Such trans-fatty acids increase the risk of coronary heart disease and render the plasma lipid profile even more atherogenic than saturated fatty acids by elevating LDL cholesterol and decreasing HDL cholesterol.

2.7 Immediate risk factors related variables

2.7.1 Obesity

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance[18]. There is slightly increased risk of co-morbidities for BMI 25.0 to 29.9, and moderate to severe risk of co morbidities for BMI greater than 30[40]. With increasing degree of BMI, risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus also increaseresulting in high Mortality rates [66].At least 2.6 million people die each year as a result of being overweight or obese [65].WHO has recommended the median BMI for an adult population should be in the range of 21 to 23 kg/m2, while the goal for individuals should be to maintain BMI in the range 18.5 to 24.9 kg/m2 to achieve optimum health[65]. More than BMI, waist circumference is an approximate index of intra-abdominal fat mass and total body fat. Changes in waist circumference reflect changes in risk factors for cardiovascular disease and other forms of chronic diseases [66].

2.7.2 High blood pressure

Raised blood pressure is a major risk factor for coronary heart disease and ischemic as well as hemorrhagic stroke[66]. Blood pressure levels is positively related to the risk of stroke and coronary heart disease[12]. The risk of cardiovascular disease doubles for each increment of 20/10 mm Hg of blood pressure, starting as low as 115/75[13]. Complications of raised blood pressure include heart failure, peripheral vascular disease, renal impairment, fundal hemorrhages, and papillodema[14].Treating systolic blood pressure and diastolic blood pressure to targets that are less than 140/90 is associated with a decrease in cardiovascular complications[70]. Stage 1/Grade 1 hypertension, is defined in a clinical setting when the mean blood pressure is equal to or above 140/90 and less than 160/100 on two or more measurements on each of two or more visits on separate days[13, 66,

71].Stage 2/Grade 2 hypertension is defined in a clinical setting when the mean blood pressure is equal to or more than 160/100 and less than 180/110 on two or more measurements on each of two or more visits on separate days[13, 66, 71]. Stage 3/Grade 3 hypertension is defined in a clinical setting when the mean blood pressure is equal to or more than 180/110 during two or more measurements on each of two or more visits on separate days[13, 66, 71].

2.7.3 Raised blood glucose

It is predicted that there will be at least 366 million people in the world with diabetes by the year 2030[72]. The excess mortality attributable to diabetes in the year 2000 was estimated to be 2.9 million deaths, equivalent to 5.2% of all deaths. In people 35-64 years old, 6-27% of deaths were attributable to diabetes[73].Impaired glucose tolerance and impaired fasting glycemia are risk categories for future development of diabetes and cardiovascular disease[15]. The age-adjusted mortality, mostly due to coronary heart disease in many populations, is 2-4 times higher than in the non-diabetic population[16]. People with diabetes have a twofold increase risk of stroke[17]. It is also the leading cause of renal failure in many populations in both developed and developing countries[74]. Lower extremity amputations are at least 10 times more common in people with diabetes than in non-diabetic individuals in developed countries, and more than half of all non-traumatic lower limb amputations are due to diabetes[75]. People with diabetes require at least 2-3 times the health care resources than people who do not have diabetes, and diabetes care accounts for up to 15% of national healthcare budgets [76].

2.7.4 Raised lipid

Raised total cholesterol is a major cause of disease burden in both the developed and developing world as a risk factor for Ischemic heart disease and Stroke[77]. It is estimated to cause 18% of the global cerebrovascular disease and 56% of global ischemic heart disease. Overall this amounts to about 4.4 million deaths (7.9% of total) and 40.4 million DALYs (2.8% of total)[18]. A 10% reduction in serum cholesterol in men aged 40 can result in a 50% reduction in heart disease within 5 years, while an average of 20% reduction in heart disease occurs within 5 years in men aged 70 years[78]. A 4.6% reduction of population mean of total cholesterol had the greatest impact of all risk factors in decreasing CHD mortality in Ireland; a full 30 % reduction in mortality was attributable to this reduction alone[79]. Plasma HDL cholesterol is inversely related to coronary artery disease incidence, and the relationship is independent of total cholesterol, LDL and

triglyceride levels[20]. Increased triglycerides is an independent risk factor for coronary heart disease after controlling for LDL and HDL cholesterol[19].

2.8 Cardiovascular risk factors in Nepal

There are some studies conducted in Nepal which has partially covered the information about CVD risk factors. A study was carried out in Western Nepal in 2009 to identify prevalence of cardiovascular risks factors[23]. It also established the inter-relationship of cardiovascular risk factors and lifestyle. This study screened 14,425 subjects aged 20-100 (mean 41.4 ± 15.1) and measured anthropometric and biochemical parameters. Study found that 34% of the participants were hypertensive, 6.3% were diabetic, 28% were overweight and 32% were obese. Risk factor prevalence was higher in the less educated, people working at home, and females. However, study lacks unbiased sampling method. Taking sample from screening camp might have over reported the prevalence. Nevertheless, large sample size can be considered as the strength of the study. Result can cautiously be generalized to outside of study area.

High prevalence of CVD risk factors is not merely present in the poor, illiterate and low socio-economic status population. It has equally showed its strong presence in other specific strata in our society. For instance, a study conducted among medical students in Kathmandu revealed that approximately one out of four students were current smokers, indulged in episodic heavy drinking and were overweight[80]. Only 21 % were engaged in recommended amount of physical activity. Though study findings were not the representative of overall population, it reflects an alarming situation that must be promptly addressed.

Nepal NCD risk factors surveys 2007 and 2013 have also assessed some of CVD risk factors[24, 25]. According to 2007 NCD risk factor survey report, among 4328 participants, current tobacco use was found in 37.1%, 26.2 % of respondents being current smoker. In the same way, 28.5 percent were found to be currently consuming alcoholic drinks, 61.9% were taking fewer amounts of fruit and vegetables than recommended, 5.5 % were involving in less than 600 MET moderate physical activities per week and 1.5 had obesity. That study could not account the measurement of biochemical risk markers. Similarly, the results are highly inconsistent with the findings of NCD risk factors survey 2013. The latter survey reported the prevalence of smoking as nearly half (18.5%) of the 2007 proportion. In the same vein, insufficient fruit and vegetables consumption was found in considerably larger population (98.9%) than that of 2007. The percentage of obesity (4 %) reported in 2013 was also almost three times

higher than that of 2007. However, the most important part of 2013 survey was the measurement of biochemical risk factors. The study found that 3.6% participants had raised blood sugar level, and 22.7 % had raised total cholesterol. However, both studies could not consider the sub group analysis of findings by rural, semi urban and urban area. We found very few studies that were conducted in rural community of Nepal.

A study conducted in rural community of Eastern Nepal found striking result[35]. One in each two persons was taking alcohol. One fourth respondent were current smokers. Insufficient fruits and vegetables intake was rampant (96.6%). Even though study site was hilly region, half of people were less physically active. The majority of people were without formal education and low socio-economic status, which had inverse relationship with hypertension.However, we did not find single study related to CVD risk factors that was conducted among rural communities of Kathmandu.

CHAPTER THREE

Methodology

3.1 Study design

This was an analytical, community based, cross-sectional study,conducted between February 2014 and February 2015. Quantitative method was applied for assessing the status of CVD risk factors among adults of Sitapaila VDC, Kathmamandu, Nepal.

3.2 Study area

Study was conducted in Sitapaila Village Development Committee, Kathmandu, Nepal. Study site is located on western outskirts of Kathmandu metropolitan city. It is one of the rapidly urbanizingplaces nearby Kathmandu. High number of people is in-migrating into the place. In the same way, study population is also highly influenced from the lifestyle of urban inhabitants.

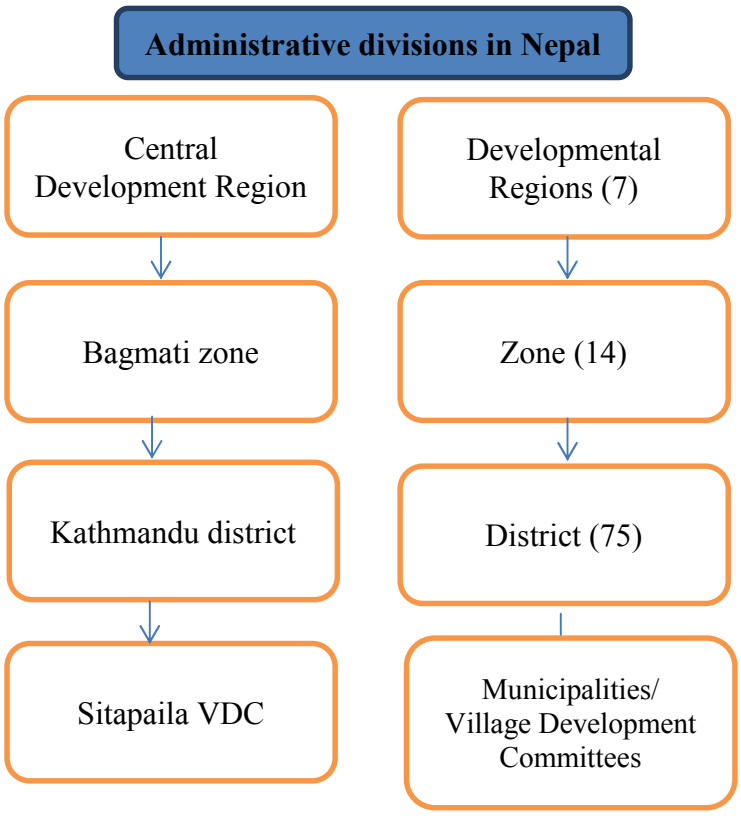


Figure 1. Map of Nepal

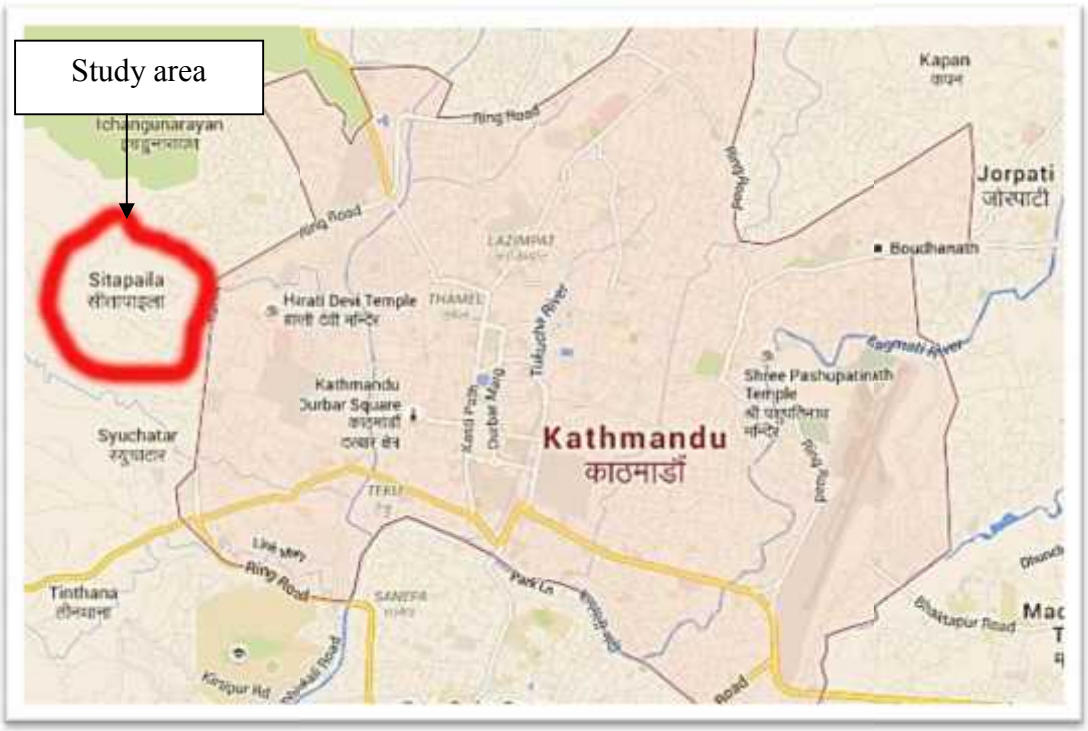


Figure 2. Map of Kathmandu

Figure 3. Map of Sitapaila

3.3 Study duration

The timeline for thesis work was one year starting from February 2014 and ending in February 2015. Data collection started from the first week of September 2014 and completed on first week of November 2014. Data entry and analysis was carried out till the fourth week of January. Final draft was prepared by the end of August.

3.4 Study population

Study site contained 1903 households where 7785 population more than 18 years old were residing[26].

3.3.1 Inclusion criteria

- Permanent residents of Sitapaila VDC, Kathmandu district
- Adult (more than 18 years)
- Both Sex

3.3.2 Exclusion criteria

- People with established myocardial infarction , angina, stroke, intermittent claudication and other cardiovascular diseases
- Pregnant, having any mental disorders
- Temporary residents

3.4 Sample size

We calculated the sample size using one sample situation of estimating population proportion with specified absolute precision formula [81]. The estimation of population prevalence of risk factors was considered as 25.7% with equal percent (5%) of allowable error, level of significance and non-response rate.

Here,

$N= Z^2pq/d^2$

The estimated prevalence of Hypertension was 25.7%[25].

Allowable error: 5%

Level of significance: 5%

Non response rate: 15 %

Step 1: Initial calculation

$$n= \frac{3.8416 \quad (\ 0.26 \ (1- \ 0.26 \ ))}{0.05 \ * \ 0.05} = \mathbf{293.4229446}$$

Step 2: Adjusted for expected non-response to get final sample size

$$n= \quad 293 \quad / \quad 0.85 \quad = \quad \boxed{\mathbf{345}}$$ **FINAL SAMPLE SIZE**

3.5 Sampling method

Data collectors including the Principal Investigator (PI) initiated data collection from the Northern-East part of the study site. We first stood on the first lane of that area facing west. Moving forward, we counted the households anti-clockwise and assigned them a number sequentially. We then performed the same procedure clockwise from the same

starting point. The first household was selected randomly by generating a random number between one and 13. Following this, every thirteenth household was chosen systematically until the final of 347 households. Finally, one individual from each household was enrolled into the study by applying the Kish method, given that written consent was provided.

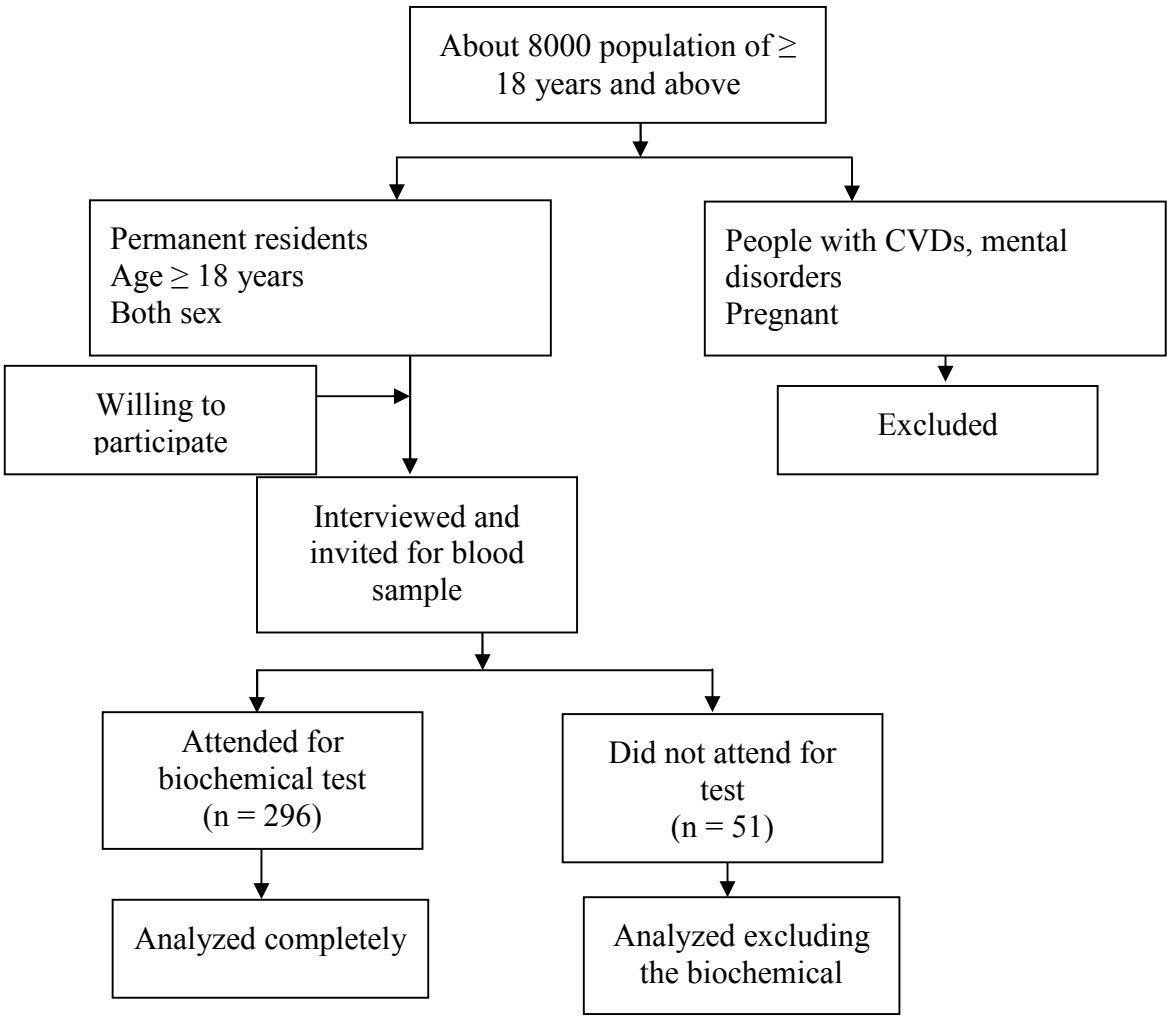


Figure 4. Study Selection flow diagram

3.6 Data collection techniques and tools

All data enumerators were trained in research protocol, interviewing and measuring the variables. They were supervised by field co-coordinators experienced in national NCD risk factors surveillance. Research tool was appropriately modified after undertaking a pretest.

3.6.1 Face to face interview

Face to face interviews were taken from the participants at their respective homesin a natural and neutral setting. Special attention was paid on the dress of enumerators to ensure that it confirms to locally prevalent dress code and does not create communication gap. Enumerators were instructed to build good rapport with respondents before taking interview. Interview was initiated in open space in relaxed manner to encourage participants to express their views openly without any inhibitions using structured questionnaires.The survey questionnaire covered the demographics and health behavior of respondents. Demographic information included date of birth (age), sex, ethnicity, marital status, years at school and primary occupation. The health behaviour covered in the questionnaire related to tobacco use, alcohol consumption, fruit and vegetable consumption, physical activity, history of raised blood pressure and dietary salt consumption.

3.6.1.1 Tobacco use

Information on both forms of tobacco use – smoking and smokeless – was collected. Questions were asked to identify current users (those who are smoking or using smokeless tobacco in the past 30 days), daily users and past users. Detailed information was taken from daily users regarding their age at starting tobacco use, frequency of use of tobacco products in a day or week, types of tobacco products using and so on. Information such as age at which the respondent stopped smoking was taken from past users. Pictorial cards showing different tobacco products were shown during data collection.

3.6.1.2 Alcohol consumption

Questions were asked to determine the percentage of current users of alcohol. Detailed information, such as the number of standard drinks consumed and frequency of consuming standard drinks in the last 30 days,was obtained from current users. Pictorial cards showing different kinds of glasses and bowls most commonly use in Nepal wasused

to help the participants recall the amount of alcohol consuming. The amount, as identified by the respondent, was then used to calculate the number of standard drinks of alcohol consuming (one standard drink contains 10 grams of ethanol).

3.6.1.3 Diet

Information was taken from respondents by 72 hours recall method. It contained information about types, amount and servings of vegetables and fruits they consumed in last three days. Measurement of the amount of fruit and vegetables was aided by pictorial show cards and measuring cups (show cards attached in annex) [25]. One medium sized piece of apple, banana, orange or half cup of chopped or canned fruit or fruit juice was considered as 80 grams. Similarly, one cup of raw green leafy vegetables or half cup of cooked vegetable or half cup of vegetable juice was also weighted as 80 grams [25]. They were also asked about the types and amount of cooking oil they were using.

3.6.1.4 Physical activity

Physical activity related to work, transport and recreational activities werecategorized into vigorous, moderate and low levels of activityin accordance with CDC and ACSM guidelines[38]. Vigorous physical activity was defined as any activity that had more than six METs value, for example digging or ploughing fields, lifting heavy weights, etc. Continuous engagement in such activity for at least 10 minutes was considered as involvement in vigorous activity. Moderate physical activity was any activity that had METs value between three and six[38]. Examples include domestic chores, gardening, lifting light weights, etc. Continuously engaging in such activity for atleast 30 minutes is considered involvement in moderate activity[38]. Physical activity having less than three METs like spending time sitting at a desk, sitting with friends, travelling in a car, bus or train, reading a book etc was considered low or sedentary physical activity. The references for METs of each activity were taken from 2011 Compendium of Physical Activities[82].

3.6.1.5 History of raised blood pressure and diabetes

Participants were asked about their history of raised blood pressure and diabetes, the medications they were taking during interview.

3.6.1.6 Dietary salt

Information was obtained on amount of salt they were using. Participants were also asked about the addition of salt to food just before eating and during food preparation at home.

3.6.2 Anthropometric Measurement

For assessing the obesity level among participants, anthropometric parameters like height, weight, waist circumference and hip circumference were measure and body mass index and waist hip ratio were also calculated.

3.6.2.1 Height

Height was measured with a portable standard stature scale. For the height measurement, respondents were asked to remove footwear (shoes, slippers, sandals) and any hat or hair ties. Respondents stood on a flat surface facing the interviewer with their feet together and heels against the backboard with knees straight. They were asked to look straight ahead and not tilt their head up, making sure that their eyes was at the same level as their ears. Height was recorded in centimeters.

3.6.2.2 Weight

Weight was measured with a portable digital weighing scale. The instrument was placed on a firm, flat surface. Participants were requested to remove their footwear and socks, wear light clothes, stand on the scale with one foot on each side of the scale, face forward, place arms at their side and wait until they was asked to step off. Weight was recorded in kilograms. Height and weight were measured, form which body mass index (BMI) was calculated.

3.6.2.3 Waist and hip circumference

Waist and hip circumference were also measured in order to determine the waist-hip ratio. Waist and hip circumference were measured using a constant tension tape. A private area, such as a separate room within the house, was used and the measurement was taken over light clothing. Waist circumference was taken at the end of a normal expiration with the arms relaxed at the sides at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest (hip bone). Hip circumference was taken at the maximum circumference over the buttocks. Participants were requested to wrap the tape around

them. The measurement was read at the level of the tape to the nearest 0.1 cm, making sure to keep the measuring tape snug.

3.6.3 Clinical examination

Blood pressure was measured with a Doctor's Aneroid Sphygmomanometer (BP Set). A medium sized cuff was used for all participants. The sphygmomanometer cuff was placed on the left arm while the participant was resting their forearm on a table with the palm facing upward. Participants were requested to remove or roll up clothing on the arm. Before taking the measurements, participants were asked to sit quietly and rest for 15 minutes with legs uncrossed. Three readings of the systolic and diastolic blood pressure were obtained. Participants took a rest for three minutes between each reading. The mean of the second and third readings was calculated. Hypertension was defined as having systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg during the study, or being previously diagnosed as having hypertension was determined by sighting documentation such as a treatment record book or by the history of the participant taking medicine for high blood pressure.

3.6.4 Biochemical measurements

The biochemical parameters: fasting blood glucose and lipid profile were measured to assess the metabolic risk factors among participants. Participants were handed over a token during the interview and requested to present with it at the blood collection point on next day. Theywere instructed to fast overnight for 12 hours. Diabetic patients on medication were reminded to bring their medicine/insulin with them and take their medicine after providing the blood sample. A venous blood sample (4 ml of blood) was taken using a flashback needle with an aseptic technique and kept in plain and fluoride treated tubes. First, the collected sample was kept in an ice pack carrier and brought to the hospital laboratory within one hour.Biochemical measurements of blood glucose and lipids were done using semi-automated procedures and commercially available kits (Acurex). Plasma glucose was estimated using the GOD-PAP (glucose oxidase/peroxidise – phenol-4-amenophenazone) method. Serum total cholesterol was determined by an enzymatic endpoint method using the CHOD-PAP (cholesteroloxidase/peroxidase – 4-phenol-aminoantipyrine) method. Serum triglyceride was estimated using the GPO-PAP (glycerol-3-phosphate oxidase/peroxidase-4-chlorophenol and 4-aminophenazone) method. For the determination of HDL cholesterol and low-density lipoproteins from the serum samples was first precipitated out. The clear supernatant was then analysed using

the method described above for cholesterol. Reports were made available to each respondent at their home.

3.7 Validity and reliability

STEPwise questionnaires has already been used in Nepal previously for NCDs risk factors survey[24, 25]. Moreover, the tool was amended appropriately for comprehensively addressing all the specific objectives of this study. Before using the tool, piloting was done among 20 respondents and changes had been adopted. Operational definitions were followed as per the WHO, international and national guidelines. Sample size calculation and statistical methods were conducted scientifically to ensure representativeness and statistical power. Quality control during data collection was maintained well.

3.8 Ethical consideration

Study protocol was reviewed and approved by Ethical Review Board of Nepal Health Research Council, Kathmandu. We obtained the verbal consent from all participants after detailed explanation of research purpose, and assurance of maintaining privacy and confidentiality. Those who needed further treatment were referred to higher centers.

3.9 Data management and analysis

Data were compiled, edited and checked to maintain consistency. Repetitions and omissions of data were corrected before coding and entering them in Epidata V.2.1. Recorded data were, then, exported to SPSS V.16.0 for further analysis. R i386 2.15.3 was used for comparing proportions and calculating confidence interval.

Data were expressed in frequency, proportion and mean±one standard deviation (SD), and presented in table. Chi-square and independent t test were conducted for comparing proportions of categorical and mean of continuous variables. All tests were two-tailed and $p < 0.05$ was considered statistically significant.Correlation matrix was calculated to investigate interrelationship.

Multivariable analyses were conducted by binary logistic regression. Separate multivariable models were constructed for each dependent dichotomous variable: Hypertension, diabetes, hypertriglyceridemia, obesity, physical inactivity, alcohol consumption and smoking. Variables those were significantly associated with dependent variables in bivariate analyses were entered into multivariable models through stepwise (Forward Conditional) method. The probabilities for entry and removal of variable in

each step were set as 0.05 and 0.1 respectively. Categorical variables were coded appropriately before entering them into the model.

Age, sex, ethnicity, education, occupation, smoking, BMI, fasting blood glucose, triglycerides and cholesterol were significantly associated with hypertension in bivariate analysis. They were entered into the multivariable model as explanatory variables of hypertension. Similarly, for diabetes: Age, education, alcohol consumption, average green leafy vegetable intake, physical activity, BMI, hypertension and triglycerides; for hypertriglyceridemia: Age, sex, occupation, average green leafy vegetable intake, physical activity, BMI, hypertension , fasting blood glucose, cholesterol and HDL; for smoking: Age, sex, ethnicity, education, income and alcohol consumption; for alcohol consumption: Age, sex, ethnicity, income , smoking; and for physical inactivity: age, sex, ethnicity and occupation were entered into the model.

CHAPTER FOUR

Results

This was a community based cross-sectional study aimed to estimate prevalence and assess the inter-relationship of the cardiovascular risk factorsin a selected rural community of Kathmandu, Nepal. This study consisted of total 347 participants.First, systematic random method was applied to select 347 household from 1903 households, then KISH gird was used to choose the single participant from each household. Data were collected, edited, and entered into Epidata 3.01 and analyzed by SPSS using appropriate statistical methods. Findings were presented in a table and graphs in the following sections.

4.1 Baseline characteristics

4.1.1 Socio-demographic characteristics

Of the 347 participants, there were 141 (40.6%) male and 206 (59.4%) female. The mean age was 42.55±13.26 years with a median of 40 years. The majority of was belonged to Brahmin caste (34%), and were married (83%). Approximately a hundredof them (29.1 %) never attended school and 36.6% were homemakers. The mean and median household incomes were 23584±18862 and 20000 Nepalese rupees respectively.

4.1.2 Prevalence of cardiovascular risk factors

Smoking was present in 17.6 % of participants. Out of 347, 102 (29.4%) respondents had a habit of drinking alcohol. Similarly, the majority (98%) of participants were taking fewer amounts of fruit and vegetable than recommended.Average daily salt intake per capita was 9.57 gm± 5.49 gm.Almost one fourth (21%) of participants had an insufficient physical activity level.

Obesity was seen among 15.3% of participants. Among them, six participants had the third grade obesity. In the same way, one third (34.4 %) of participants were identified as hypertensive. One tenth of (10.1%) of participants had impaired fasting blood glucose, whereas 14.8% had diabetes. Similarly, 10.8% of participants had high triglycerides level. But, only few (<2%) participants had high cholesterol level.

Table 1.Baseline characteristics of respondents

Baseline characteristics	Categories	Total No (%)
Age group (in years)	<30 years	65(18.7)
	30 to 39 years	85(24.5)
	40to 49 years	87(25.1)
	50 to 59 years	68(19.6)
	≥60 years	42(12.1)
Ethnicity	Brahman	118(34)
	Chetri	92(26.5)
	Newar	84(24.2)
	Other	53(15.5)
Marital status	Unmarried	40(11.5)
	Married	288(83)
	Other	19 (5.5)
Education level	No formal education	101(29.1)

Baseline characteristics	Categories	Total No (%)
	Primary education	50(14.4)
	Secondary education	64(18.4)
	Higher secondary education	61(17.6)
	Bachelor and Higher education	71(20.5)
Occupation	Government job	20(5.8)
	Non-governmental job	51(14.7)
	Self-employed	94(27.1)
	Students	23(6.6)
	House maker	127(36.6)
	Others (Unemployed and Retired)	32(9.2)
Smoking	Yes	61 (17.6)
	No	286 (82.4)
Alcohol consumption	Yes	102 (17.6)
	No	235 (82.4)
Fruit and vegetable intake (in total)	Sufficient	7 (2)
	Insufficient	340 (98)
Physical activity	Sufficient	274 (79)
	Insufficient	73 (21)
Body Mass Index (kg/m^2)	Below normal	18 (5.2)
	Normal	121(34.9)
	Overweight	155 (44.7)
	Obesity	53 (15.3)
Waist-hip ratio	Normal	160 (46.1)
	Substantially increased	187 (53.9)
Hypertension	Yes	120 (34.6)
	No	227 (65.4)
Fasting blood glucose	Normal	248 (71.5)
	Impaired fasting glucose	35 (10.1)
	Diabetes	45 (14.8)
Triglycerides	Normal	194 (65.5)
	Borderline	70 (23.6)
	High	32 (10.8)
Cholesterol level	Normal	251 (84.8)
	Borderline	40 (13.5)
	High	5 (1.7)
LDL level	Normal	147 (49.7)
	Near Ideal	121 (40.9)
	Borderline high	23 (7.8)
	High	5 (1.7)
HDL	Poor	202 (68.2)
	Better	94 (31.8)

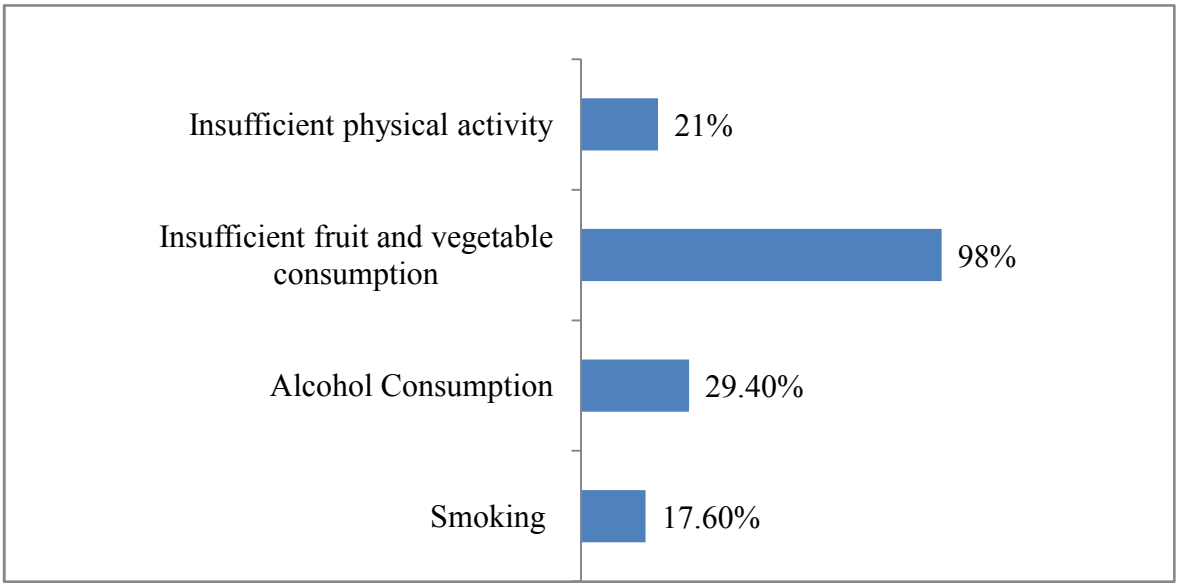


Figure 5: Proportions of modifiable intermediate risk factors

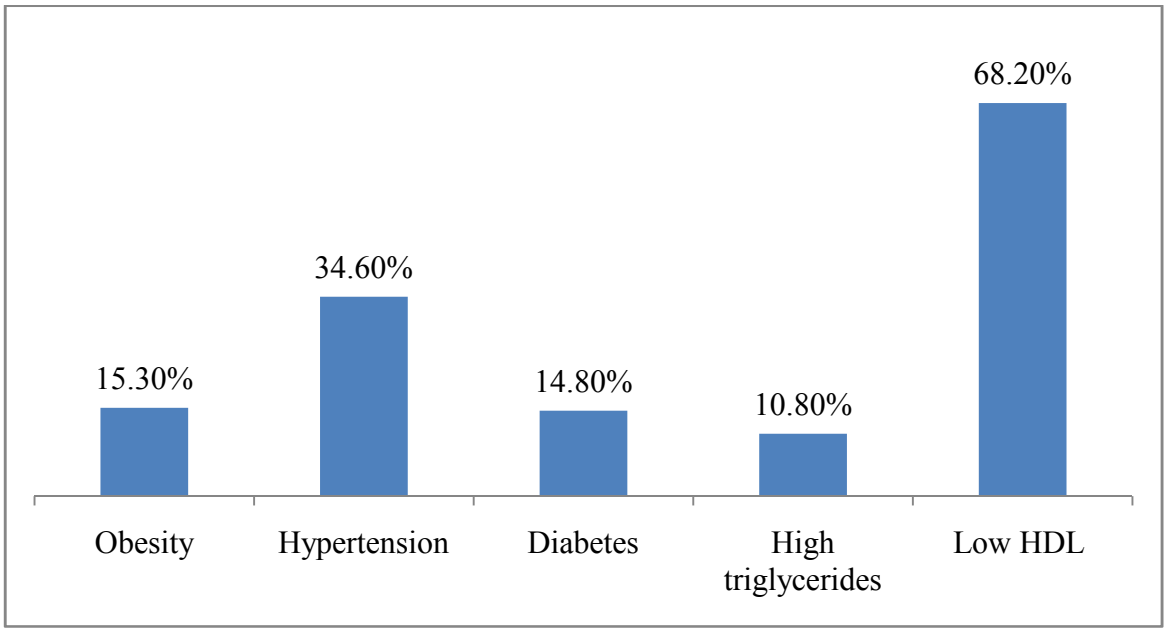


Figure 6: Proportions of immediate risk factors

Table 2.Distributionof anthropometric, clinical and biochemical characteristics

Biochemical	Minimum	Maximum	Mean	Std deviation
BMI(kg/m^2)	16.10	42.54	26.03	4.40
Waist(cm)	57.00	120.00	85.04	11.00
Hip(cm)	69.00	118.00	91.27	8.63
SBP(mmHg)	80.00	210.00	122.58	16.98
DBP(mmHg)	50.00	120.00	81.13	9.9
FBS(mg/dl)	58.00	280.00	92.01	24.47
TG(mg/dl)	103.00	296.00	167.93	31.54
Cholesterol(mg/dl)	55.00	479.00	136.93	67.32
HDL(mg/dl)	27.00	59.00	42.54	6.50
LDL(mg/dl)	26.40	185.00	98.00	26.38

4.2 Immediate cardiovascular risk factors

4.2.1 Obesity

The mean body mass index of total participants was 26.2 kg/m^2±5.1kg/m^2. Obesity (BMI≥30 kg/m^2) was present in 15.3 % of people. The proportion of overweighed respondents was three times higher than that of obesity (47.4%). Obesity was relatively high in 30-39 age group, female, self-employed and people without any formal

education.Abdominal obesity marker-waist hip ratio was above normal cut off point (≥0.90 cm for male; ≥0.85 cm for women) in 53.9 % of participants.

4.2.2 Hypertension

The estimated prevalence of hypertension was 34.6%(29.6-39.6). Almost half of hypertensive participants (74 out of 120) were unaware about their raised blood pressure level. One fourth (29 out of 113) of participants those aware of their hypertension status were not taking any antihypertensive medication. Only 46.4 % of hypertensive participants were taking medicines for it. Half of the participants who were taking antihypertensive medicine (42 out of 84) had controlled blood pressure level. In strata-wise analysis, hypertension had an inverse relationship with age. It was relatively higher in elderly people, people without any formal education, married, Newar caste and housemakers than others.

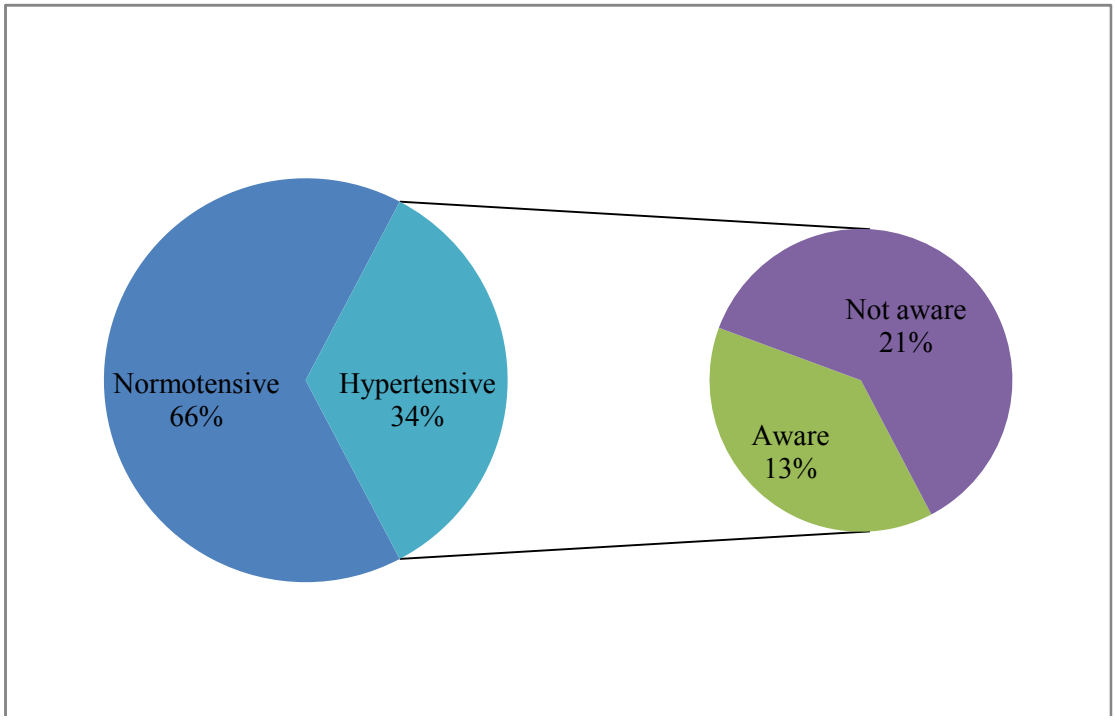


Figure 7. Aware and unware hypertensive respondents

4.2.3 Diabetes

The mean fasting glucose among participants was 91.9 mg/dl ±25 mg/dl. Diabetes was present on 14.8% respondents. It was higher than the proportions of respondents having impaired fasting glucose (10.1%). Among total respondents, 9.8% of people were taking anti-diabetic medicines. Diabetes was significantly high among elderly people, higher caste group and house makers.

4.2.4 Lipid

Triglycerides (TG) level was higher than normal limit among 34.4% participants. Borderline high was seen among 23.6% of respondents whereas substantially high in 10.8 %. The average score of triglycerides among respondents was 133.5 mg/dl. The high TG level was statistically significant difference among different age groups; in gender; and with occupation level.

Compared to TG, substantial increased in cholesterol was found among very less proportion of participants (1.7%). However, 13.5% of people had borderline cholesterol level. The proportional of high LDL cholesterol (1.7%) was exactly equal to total cholesterol. But, the proportion of respondents having borderline LDL cholesterol (7.8%) was almost half than that of total cholesterol. In contrast to other lipid, poor HDL level was seen in more than two thirds of respondents (68.2%).

4.3Intermediate risk factors

4.3.1 Smoking

Among total participants, 61(17.6%) were smoking until last 30 days of interview and 52 (15 %) were smoking daily. Among smokers, 50.8 % of people started smoking before 17 years of age and 20 % of people were smoking continuously from last 40 years. Almost all (57) smokers were smoking manufactured (branded) cigarette with an average of 10 cigarette per day. Nevertheless, 16.1% of respondents who used to smoke in the past had quitted smoking.

Table 3.Distribution of the respondents according to the smoking history

Characteristics	Categories	Number	Percentage (%)
Smoking (current)	Yes	61	17.6
	No	286	82.4
Smoking daily	Yes	52	15.0
	No	295	85
Smoking (past)	Yes	56	16.1
	No	230	66.3
Smoking in the past (daily)	Yes	39	11.2
	No	18	5.2
Smokeless tobacco use	Yes	38	11.0
	No	309	89.0
Smokeless tobacco use (daily)	Yes	28	8.1
	No	13	3.7

Similarly, smokeless tobacco use was seen among 11 % of respondents [table 2]. Most of them (28 out of 38) were taking it daily. In the distribution in different socio-economic strata, smoking rate was significantly higher among 40-49 age-group, male,

Chetri, married people and illiterate (no formal education) than others [Table 4].

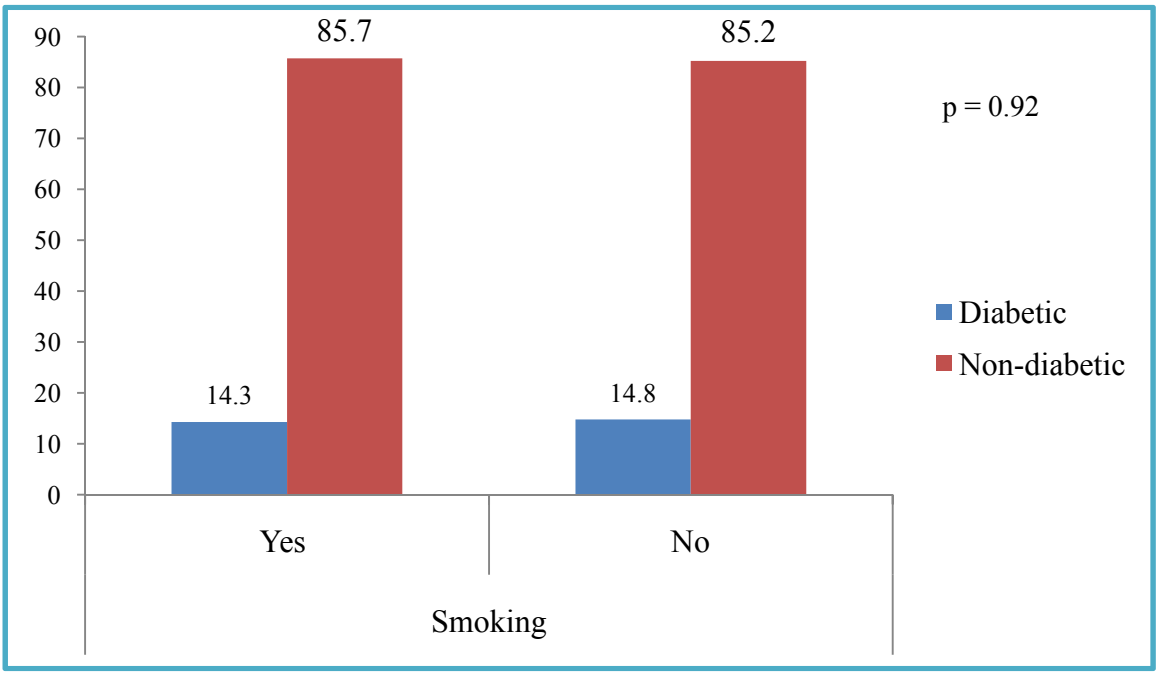


Figure 8. Diabetes (%) among smokers and non-smokers

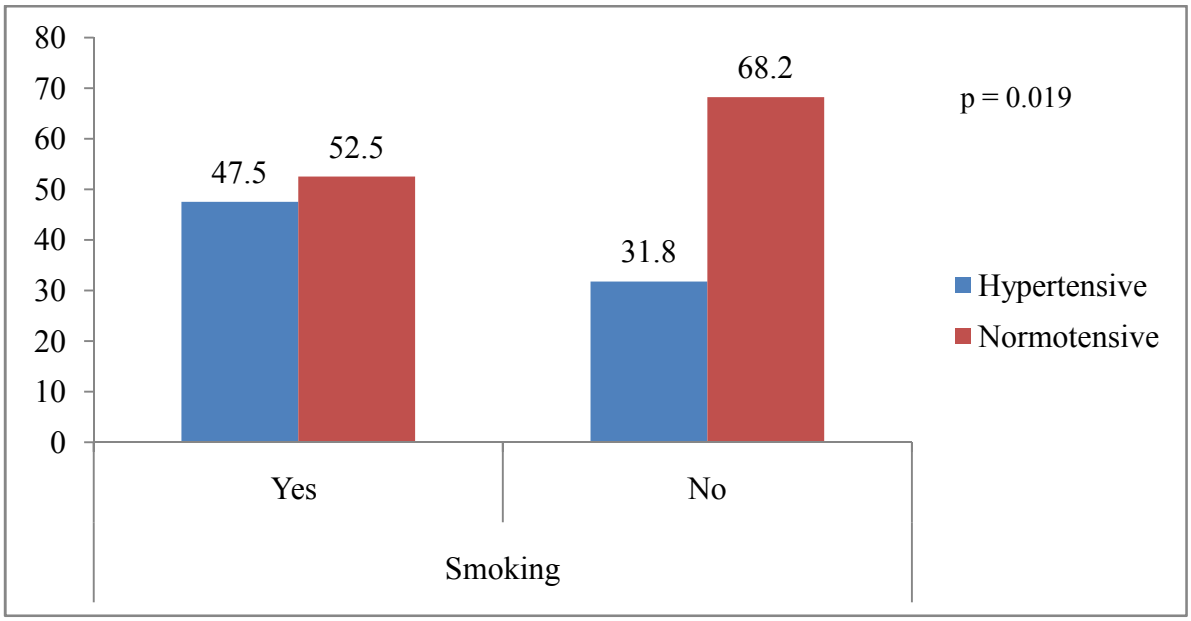


Figure 9. Hypertension (%) among smokers and non-smokers

4.3.2 Alcohol consumption

Total 102 (29.4%) participants had a history of drinking alcohol at least once in past 30 days of time of interview [table 4]. Among them, 16.7% (17 out of 102) people were taking alcohol daily. Comparatively people without formal schooling, of age 40-49 years, from Newar caste and male group had significantly high indulgence to alcohol than others. The average number of standard drinking in 30 days was 8.94 with maximum

limit to 30. Among alcohol users, 19.6 % respondents consumed equal or more than five standard drinks at any day during last month (current episodic heavy drinker).

4.3.3 Fruit and vegetable consumption

Sufficient fruits and vegetables consumption (≥400gm / day) was lacking in 98% of respondents. Average amount of fruits and vegetables consumed in three days were less than 150 grams per person. They were mainly consuming seasonable vegetables and fruits like cauliflowers and guava.

Mostly illiterate (no formal education), socially adjudged higher caste group (Brahman and Chhetri) and female had high proportion of inadequate amount of fruits and vegetables consumption. But, the difference was minimal and statistically non-significant.

4.3.4 Cooking oil and salt intake

Almost all (99.4%) of respondents were using vegetables oil (mustard, soybean, sunflower oil) for cooking purpose. The average amount of cooking oil used by respondents in their house was 3.93 liters per month. Similarly, daily salt intake per person in an average was 9.57 gm ±5.49 gm. Only few numbers of respondents (4 out of 346) were using extra salt to meal at the table.

4.3.5 Physical activity

Though the study population was residing in rural area, nearly a quarter (21%) of respondents were insufficiently (<600 METs) involved inmoderate and vigorousphysical activity.The median of METs of moderate and vigorous activities per week was 1800 METs. People with age above 50 years, male and married respondents were significantly involving in less physical activity [Table 4]. Though there was no significant difference in physical activity level by ethnicity and education status, comparatively higher percentage of upper caste people and highly educated participants had low physical activity than others.

Table 4.Distribution of CVD risk factors among socio-demographic characteristics

Characteristics	Smoking (%)	Alcohol consumption (%)	Insufficient fruits and vegetables intake (%)	Insufficient physical activity (%)	Obesity (%)	HTN (%)	DM II (%)	High TG (%)	Low HDL (%)
Total (CI)	17.6 (13.6-21.6)	29.4 (24.6-34.2)	98 (96.5-99.5)	21 (16.7-25.3)	15.3 (11.5-19.1)	34.6 (29.6-39.6)	14.8 (11.7-19.3)	10.8 (7.3-14.3)	68.2 (69.9-73.5)
Age in years									
<30	1.4	5.2	18.4	2.3	0.9	0.9	0.3	0.7	15.5
30 to 39	2.9	10.7	23.9	4.3	4.6	3.7	.7	1.0	16.6
40 to 49	6.6	11.8	24.8	5.2	4.3	13.5	4.6	4.4	15.5
50 to 59	3.7	5.8	19.0	4.6	4.0	9.2	5.9	3.7	11.8
≥60	2.9	3.7	11.8	4.6	1.4	7.2	3.3	1.0	8.8
P value	0.015*	0.039*	0.941	0.025*	0.071	0.001*	0.001*	0.004*	0.099
Gender									
Male	11.2	21.6	39.2	13.8	4.9	17.0	6.2	6.4	16.2
Female	6.3	15.6	58.8	7.2	10.4	17.6	8.5	4.4	52.0
P value	0.001*	0.001*	.198	0.001*	0.168	0.004[8]	.869	0.02*	0.001
Ethnicity									
Brahman	4.0	8.6	32.9	9.2	4.6	9.2	5.2	5.1	24.3
Chetri	5.8	6.9	26.2	5.2	3.5	8.9	3.9	2.4	18.9
Newar	3.5	14.4	23.9	5.5	4.0	10.1	3.3	3.0	16.9
Janajati	2.9	5.5	10.7	0.6	1.7	3.5	1.0	.3	6.8
Dalit and others	1.4	1.7	4.3	0.6	1.4	2.9	1.3	0	1.4
P value	0.062	0.001*	0.699	0.059	0.338	0.019*	0.281	0.277	0.689
Marital status									
Unmarried	1.4	4.0	11.2	2.6	0.6	1.4	0.3	0.7	9.1
Married	15.6	31.1	81.6	15.9	14.1	30.3	12.5	9.1	54.7

Characteristics	Smoking (%)	Alcohol consumption (%)	Insufficient fruits and vegetables intake (%)	Insufficient physical activity (%)	Obesity (%)	HTN (%)	DM II (%)	High TG (%)	Low HDL (%)
Others	0.6	2.0	5.2	2.6	0.6	2.9	2.0	1.0	4.4
P value	0.449	0.954	0.556	0.013*	0.118	0.003*	0.015*	0.427	0.583
Educational status									
No education	7.8	10.4	28.8	6.3	4.6	13.0	5.6	4.4	21.6
Primary	3.5	5.8	14.4	2.3	3.5	6.9	3.6	1.4	9.8
Secondary	2.6	6.1	17.9	3.5	2.0	5.5	2.0	1.0	9.8
Higher secondary	2.0	7.8	17.6	4.0	2.6	4.0	0.7	1.7	12.8
Bachelorand above	1.7	7.2	19.3	4.9	2.6	5.2	3.0	2.4	14.2
P value	0.009*	0.695	0.95	0.828	0.369	0.004*	0.020*	0.538	0.288
Occupation									
Government job	0.9	3.9	5.5	2.3	1.4	1.7	1.0	0.7	2.4
Non-governmental job	2.3	13.2	14.7	2.0	2.3	4.9	1.3	1.7	6.8
Self-employed	6.6	28.7	25.9	7.5	5.2	8.4	3.9	5.1	16.2
Students	0.6	5.4	6.6	1.4	0.3	0.3	0	0	5.4
House maker	4.9	18.6	36.3	5.8	4.9	15.6	6.2	3.0	31.8
Others	2.3	9.3	8.9	2.0	1.2	3.7	2.3	0.3	5.7
P value	0.199	0.403	0.309	0.06	0.389	0.015*	0.273	0.043*	0.001*
***. Association is significant at the 0.05 level (2-tailed)**									

4.4 Inter-relationship of CVD risk factors

In bivariate analysis, income was found to be positively related with fruit ($r = 1.39$, $p< 0.01$), green leafy vegetable ($r=.115$, $p<0.05$) and other vegetable intake ($r=.18$, $r<0.01$) and WHR ($r=.14$, $p<0.01$). Similarly, physical activity level had a significant inverse relationship with WHR ($r= -0.115$, $p<0.05$), FBS ($r= -12$, $p<0.05$), systolic blood pressure ($r= -073$, $p<0.05$) and TG ($r= -0.126$, $p<0.05$). But, BMI and WHR had a significant positive relationship with BPD, BPS, FBS, cholesterol, triglycerides and LDL cholesterol [Table 5].The result also pointed that with increase in systolic and diastolic blood pressure, participants had also raised FBS, TG, cholesterol and LDL cholesterol. Fasting blood glucose was also positively associated with cholesterol ($r=.14$, $p<0.05$) and triglycerides level ($r=0.27$, $p<0.01$).

In chi-square test, smoking was significantly associated with hypertension (ch.sq =5.5, df=1, p=0.019). However, alcohol consumption was not significantly associated any immediate cardiovascular risk factors except blood cholesterol level.

Table 5.Interrelationship of Cardiovascular risk factors

	Income	GLV	Fruit	Vegetables	PAL	BMI	WHR	BPD	BPS	FBS	Cho	TG	HDL	LDL
Income	10.001													
GLV	0.115*	10.001												
Fruit	0.139**	-0.039	10.001											
Vegetables	0.180**	0.011	0.047	10.001										
PAL	-0.030	0.033	0.029	-0.024	1.00									
BMI	0.033	0.059	0.019	0.076	0.029	10.001								
WHR	0.14**	0.135*	0.056	0.067	-0.1*	0.326**	10.001							
BPD	-0.094	0.038	0.003	-0.080	-0.070	0.245**	0.306**	10.001						
BPS	-0.083	0.044	-0.093	-0.073	-0.075	0.261**	0.272**	0.73**	10.001					
FBS	-0.013	0.131*	0-.029	0.082	-0.1*	0.249**	0.370**	0.119*	0.17**	10.001				
Cho	0.039	0.18**	-0.047	-0.023	0.046	0.193**	0.233**	0.21**	0.220**	0.147*	10.001			
TG	0.085	0.118*	0.100	0.067	-0.1*	0.213**	0.330**	0.25**	0.190**	0.27**	0.31**	10.001		
HDL	-0.051	0.099	-0.1**	-0.034	0.056	0.001	-0.049	.042	.026	-.049	.568**	-0.2**	10.001	
LDL	0.004	0.132*	-0.078	-0.055	0.090	0.145*	0.130*	0.130*	0.166**	0.048	0.92**	0-.005	0.59**	10.001

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Income: Household income, GLV: Green Leafy Vegetables, Vegetables: Vegetables without GLV, PAL: Physical Activity Level, BMI: Body Mass Index, WHR: Waist Hip Ratio, BPD: Diastolic Blood Pressure, BPS: Systolic Blood Pressure, FBS: Fasting Blood Sugar, Cho: Cholesterol, TG: Triglycerides, HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein

Multivariate analysis underscored male sex as a strong predictor of hypertension. Male had almost two times higher likelihood of having hypertension than female [table 6]. Age was also positively associated with hypertension. Every year increase in age heightened the probability of being hypertensive by 7.4 %. Similarly, one unit addition in body mass index could heighten the risk by 0.068 times for being hypertensive, holding other predictors constant. But, in separate multivariable analysis, only age and triglycerides were identified as the significant predictors of diabetes [table 6]. Result showed that one year increase in age shifted odds of having diabetes by 1.055. In the same way, the multivariable model for triglycerides showed a negative relationship of HDL with triglycerides. One unit increase in HDL reduced the odds of having high triglycerides level by one third, whereas the same unit increase in cholesterol resulted in odds of 1.062 for being hypertriglyceridemia [table 6].

Similarly, age (β=-0.35, p=0.01) and gender (β=-1.339, p<0.01) were listed as significant explanatory variables in physical activity model [table 6]. Both increasing age and male sex were negatively associated with physical activity. In the same vein, model constructed for alcohol consumption showed that tendency to be current alcohol users were 9.1 and 5.6 times higher in Newar and Other ethnic group than Dalit; 4.4 times higher in male than female; and 5 times higher in current smokers than non-smokers [table 6]. Likewise, likelihood of being smoker among male was 6.6 times higher than female; and respondents without formal schooling had 19.6 times higher chance to be current smoker than people having bachelor study –in multivariable model where smoking was considered as dependent variable [table 6].

Table 6. Different multivariable models for CVD risk factors

Dependent variables	Variables in the Equation		B	S.E.	P value	Odds Ratio
Hypertension (0 = No, 1= Yes)	Age		0.072	.012	0.001	1.074
	BMI		0.066	.034	0.052	1.068
	TG		0.006	.002	0.012	1.006
	Gender(male)		0.674	.296	0.023	1.963
	Ethnicity	Dalit	Reference		0.074	
		Brahman	-2.999	1.157	0.010	.050
		Chetri	-2.712	1.158	0.019	.066
		Newar	-2.358	1.155	0.041	.095
		Other	-2.570	1.203	0.033	.077
	Constant		**-4.031**	**1.556**	**0.010**	**0.018**
Physical activity (0= insufficient, 1 = Sufficient)	Age		-0.035	0.011	.001	0.966
	Gender(male)		-1.339	0.283	0.001	0.262
	Constant		3.530	0.547	0.001	34.125
Alcohol consumption (0 = No, 1= Yes)	Age		-0.023	0.011	.037	0.978
	Gender(male)		1.489	0.296	0.001	4.431
	Smoking		1.614	0.363	0.001	5.025
	Ethnicity	Dalit	Reference		0.001	
		Brahman	0.126	0.783	0.872	1.134
		Chetri	0.083	0.788	0.916	1.087
		Newar	2.212	0.786	.005	9.130
		Other	1.733	0.830	.037	5.658
	Constant		**-1.881**	**0.884**	**.033**	**0.152**
Smoking (0 = No, 1= Yes)	Gender(male)		1.894	0.429	0.001	6.645
	Alcohol consumption		1.809	0.409	0.001	6.102
	Ethnicity	Dalit	Reference		0.007	
		Brahman	-0.744	0.722	0.303	0.475
		Chetri	0.023	0.710	0.974	1.023
		Newar	-1.869	0.775	0.016	0.154
		Other	-0.531	0.794	0.503	0.588
	Education	Bachelor and higher	Reference		0.001	
		No formal education	2.980	0.625	0.001	19.695
		Primary education	2.114	0.642	0.001	8.282
		Secondary	0.857	0.619	0.166	2.357
		Higher secondary	0.458	0.646	0.479	1.581
	Constant		**-4.144**	**0.900**	**0.001**	**.016**

CHAPTER FIVE

Discussion

This study presented the CVD risk factors burden among rural population in suburb of Kathmandu, Nepal and found comparatively high prevalence of smoking, alcohol consumption, insufficient fruits and vegetables consumption, salt intake, physical inactivity, obesity, and hypertension, diabetes and hyperlipidemia among respondents. Findings were well comparable with the studies conducted in rural communities of other neighboring countries like India, Bangladesh, China and Malaysia [31, 83-92].

The prevalence of current smoking was 17.6 % which was slightly lower than the result presented by Vaidya et al (33.3%) [29] and WHO referred age standardized smoking rate (30 %) in Nepal [93]. But it was almost equal to prevalence (18.5%) demonstrated by nationwide NCD risk factors survey 2013 [25]. Particularly, proportion of male smokers was larger than that of female. Reason could be presence of predominant numbers of 41-50 years aged male participants in study. It was found that respondents with age between 41 and 50 years were more indulgent to smoking than other age groups. Similarly, presence of significant numbers of smokers among people without formal education suggested smoking was inversely related with education. After signing the WHO Framework Convention on Tobacco Control (WHO FCTC), Nepal is trying to implement tobacco free initiatives such as health warnings on tobacco products; prohibition of smoking in public places; heavy taxation to the tobacco industries; and public awareness of harmful effect of tobacco. This might be the reason for decreasing trend in prevalence of smoking in Nepal [94, 95]. The presence of large proportion of past smokers (16.1%) in current study might also suggest the trend of quitting smoking in city areas. However, recent study conducted in rural Nepal identified the large proportion of people (28.6%) as current smoker [35]. Weak implementation of tobacco control initiatives in rural areas could be one reason, among others, behind the upsurge of prevalence of smoking.

It is well established fact that smoking increases the blood pressure level. However, our study could notshow that smoking increased the risk of hypertension.

Smoking and hypertension was found to be associatedin the studies conducted in India and China [96-98].Some observational studies showed smokers tend to have lower risk of hypertension than do nonsmokers, which contrasted to our finding[99-104]. Therefore, one of the reasons for the aforementioned inconsistency in findings could be thevariations in frequency and total duration of smoking. Also, quitting smoking by hypertensive patients as per the clinician suggestion might have resulted in protective effect because of reverse causality, obliterating the association. So analyzing history of smoking along with current smoking status could be of additional advantage.

Current study showed that one out of three participants (29.4 %) had a history of taking alcohol within last 30 days. But NCD risk factors survey 2013 in Nepal had only detected one in every six people (17.4%) as a current alcohol drinker [25]. Notably higher numbers of indigenous people (Newar and Janajati) at study site had a strong influence on prevalence of alcohol consumption. Almost twice the numbers of Newar than other caste were indulged to alcohol. The predominance of less educated people also stimulated a surge of alcohol consumption rate.

Contrasting to the findings reported by Todkar et al in India and Wei et al in China in their studies [105, 106], our study could not find an association of alcohol consumption and hypertension.There, however, are some studies that found the protective effects of alcohol on hypertension [107, 108]. Some also failed to demonstrate any significant association of alcohol consumption with hypertension [97, 102]. These differences in findings might have occurred because of difference on amount and concentration of alcohol consumed. Sacco et al and Kannel et al concluded that protective effect of alcohol in hypertension and other cardiovascular diseases was mainly detected among the moderate alcohol users (up to two standard drinks per day). The effect was opposite among those consuming seven and more drinks per day [107, 108]. A meta-analysis of 15 randomized controlled trials observed a dose response relationship of alcohol reduction and on blood pressure [109]. But, there is no clear explanation on such bi-directional effects of alcohol on hypertension.

This study revealed high percentage (98%) of fruits and vegetables consumption less than the minimum recommended five daily servings per day among study population, which was also consistent with results of other national studies [24, 25].

However, it was substantially higher than that of low- and middle-income countries (77.6% of men and 78.4% of women), India (74%) and Bangladesh (76.3%) [110]. Complete reliance on seasonal fruits and vegetables might be a big hurdle in sufficient fruits and vegetables intake in study site. However, recall bias during dietary history taking could not also be neglected as the fruit and vegetable consumption decreased gradually on second and third day.

Similar to low amount of fruits and vegetables consumption, excess daily salt intake per capita (9.57 gm) also persisted as a great health concern among study population. It was two times higher than WHO recommended amount of salt intake (5 gm) and more than mean dietary salt intake (8.5 gm) by urban south Indian population [111]. But, data available from other studies like a research in Khotang, Nepal (10-13 gm per person per day) [112], Indian Council of Medical Research (ICMR) study in India (13.8 gm per person per day)[113] and National Heart Foundation Hospital and Research Institute (NHFH& R) study in Bangladesh (17 gm per person per day) [114] indicate that high salt consumption is rather a regional problem.

Despite the well-recognized inverse relationship between fruit and vegetable consumption and hypertension [115, 116], our study showed no association between them. A study conducted in rural Nepal also reported the same result like ours [35].The contrasting finding might have resulted because of the dietary assessment methods we used. In the place of commonly used food frequency questionnaires, we applied 72 hour recall method to collect information on dietary intake assuming that study population might have similar type of dietary pattern over the years. The other logic behind the use of 72 hour dietary recall method was that Nepalese do not consume fruit regularly and amount of intake fluctuate as most of them solely depend on seasonal fruit [35]. The food frequency questions cannot be recommended for assessing fluctuating patterns of fruit consumption accurately in the Nepalese community. Nor is 72 hour dietary recall method sufficient for it because current dietary habit might not be as much responsible as what one used to have before for getting hypertension. Similarly, Nepal's unique culinary practice of mixing potatoes in every vegetable curry might have resulted in unprecise dietary assessment, obscuring the true association between fruit and vegetable intake and

hypertension. Fruit and vegetable consumption and its appropriate assessment in Nepalese community, therefore, warrant a discussion.

Current study findings suggested that increasing age and higher social caste were negatively associated with physical activity level. However, with increased in education level, insufficient physical activity level was, on the other hand, decreased. Most strikingly, this study also found that more males than females were insufficiently involving in moderate physical activity. It was because the community had only scarce number of young males. Most of them had either moved to city or abroad or not available during survey leaving only elderly and female residents in community.

However, this unequal distribution of demographic characteristics (mainly age and gender) might not have influential on high prevalence of overweight (44.7%) and obesity (15.3 %) among study population as no group differed significantly. Though proportion of overweight and obese persons were similar to earlier rural community based study [29], it was relatively much higher than prevalence reported on both NCD risk factor surveys conducted in 2007(obesity- 1.7%) [24] and 2013 (overweight-21.6%, obesity-4%) [25]. Prevalence of obesity in current study also strongly contrasts with WHO estimated age standardized obese person's proportion in Nepal (1.5%) [93]. This rejects the assumption that rural populations are physically more active and less obese than urban dwellers. Result also substantiates the idea that rural population should also be provided equal attention on CVD prevention programs.

Our study found hypertension as burgeoning burden in the study population. The proportion of hypertension (34.6%) was higher than those of NCD surveys in Nepal (21.5% in 2007; 25.7% in 2013) [24, 117]. The disparities in findings might be because of study settings. NCD surveys were conducted both in urban and rural areas. Rural Nepal has less burden of hypertension than urban[35]. Similarly, the finding was nearly the double of the hypertension prevalence (19.7%) reported by a study conducted in similar setting of Kathmandu in 2005[118]. Almost twofold increase in prevalence of hypertension in ten years might be because of the change in living environment and people's lifestyle. This is further supported by the evidence from a study conducted in rural Kathmandu thatpointed out a three-fold increment in hypertension prevalence in last two and half decades and presumed increasing BMI could be one reason behind it [119].

In a recent community based study conducted among women in rural community of eastern Nepal, prevalence of hypertension was only 3.3 % [120], which is largely differed from another hospital based study that identified 34 % people had hypertension out of total admitted patients [121]. Such inconsistency in findings necessitates a nationwide population survey for estimating prevalence of hypertension. Furthermore, presence of significantly high proportion of hypertensive people in 40-49 age-group signified future surged in prevalence of hypertension in the community. Similarly, Newari people who had significantly high exposure to all CVD risk factors including hypertension are highly prone to develop CVDs in future if left unconcerned.

The present study also identified an association of smoking and hypertension. Furthermore, systolic and diastolic blood pressure had significant relationship with BMI, waist hip ratio, fasting blood sugar, cholesterol and triglyceride. Preponderance of evidences has already been there to establish smoking and obesity as risk factors for hypertension [11, 122,123]. A study conducted in rural Nepal also identified that increased in body mass index contributed for three fold rise in prevalence of hypertension during 25 years [34]. The findings were in line with the results of other studies conducted in Nepal [35, 119]. Like physical inactivity, obesity has also well recognized independent relationship with a spectrum of cardio-metabolic disorders including hypertension [124]. There are several mechanisms hypothesized linking obesity with hypertension [124-127]. But, the quintessence is that the accumulation of visceral fat and ectopic fat in a number of tissues and organs might alter the metabolic and hemodynamic pathways for the development of hypertension in obese people [124, 127]. And, the best way to deal with it is through adopting healthy lifestyle particularly eating healthy food and involving in regular physical activity [128].

In spite of established relationship between alcohol and hypertension [129, 130], our study could not determine a relationship between alcohol consumption and hypertension. We have no clear explanation for it. However, this study corroborated the earlier study findings [30, 32] that prevalence of smoking, alcohol consumption, fruits and vegetables intake and hypertension were comparatively high among less educated and low socio-economic status group.

Just similar to San Antonio Heart Study: a population-based longitudinal study[131], our study also showed a strong inter-relationship between cardiovascular risk factors, including obesity, elevated triglyceride levels, low levels of high-density lipoprotein (HDL) cholesterol, and elevated blood pressure.Diabetes mellitus and hypertension are interrelated diseases. Essential hypertension accounts for the majority of hypertension in individuals with diabetes, particularly those with type II diabetes.More than that, an estimated 35% to 75% of diabetic cardiovascular and renal complications can be attributed to hypertension[132, 133].The finding was consistent with the result of the studies conducted in similar settings of Kathmandu, Nepal [134, 135] and outside the country [136, 137]. Hypertension is often reported to be one of the most common co-morbid conditions in those suffering from diabetes. For instance, around half of diabetic patients have hypertension in Australia[138]. On the other hand, almost one fourth of the hypertension patients were found to have diabetes in China and India.[139, 140]The co-existence of hypertension and diabetes might be because of sharing common risk factors like smoking, alcohol consumption, unhealthy diets and physical inactivity. Due to nature of this study, it is difficult to state with certainty whether diabetes led to hypertension or hypertension led to diabetes. Similarly, we only accounted the self-reported diabetic cases. This could not give the precise estimate of diabetes in the study population, with the possibility of both under and over estimation of the condition. Apart from that, this study also found an association of advancing age and low literacy with diabetes, which is in line with other two nationwide surveys [24, 25]. A cohort study conducted in USA also reported a negative association between education and diabetes [141].

Consistent with other studies[134, 142,143], diabetes, in one hand had a negative association with physical activity level whereas it was positively associated with BMI, WHR and triglycerides among study population. Some studies even identified fivefoldhigher prevalence ofdiabetes among overweight andobese people than the normal weight people[143].

The study identified age, BMI, TG, male sex, and lower ethnic group as significant predictors of hypertension. If a person gets older, there was more likelihood of getting hypertension. Excessive fat deposition on body also had high tendency to increase blood pressure. The result was consisted with other two studies conducted in rural

community of Nepal[34, 35]. This study also substantiated the established fact that advancing age is the strong predictor of diabetes. Similar to advancing age, triglycerides also positively explained in possessing diabetes among study population. Whereas, hypertriglyceridemia, itself was explained by HDL and cholesterol. Like our study, the inverse relationship of TG and HDL has also been reported in many studies[144, 145].The positive relationship of TG and cholesterol was also in line with these studies[146].

Similarly, this study, as expected, showed an inverse relationship of advancing age and physical activity level. But, study found a contrasting result that male had lesser propensity to engage in physical activity than female in study population. Nevertheless, it was consistent with other similar study conducted in rural community of Nepal[35] and could be because the community had only scarce number of young males. Most of them had either moved to city or abroad leaving only elderly and female residents in community.

Current study showed male and ethnic groups were more likeliness to be alcohol users than the others. It is mainly because of drinking alcohol is socially acceptable practice among indigenous people and male compared to other groups in study site. In contrast to alcohol consumption, lower caste group had higher likelihood to be smokers than indigenous group. Most importantly, illiteracy had been identified as the strong predictor of smoking among study population which was consistence with other study findings[24, 25,35].

Overall, the current study identified prevalence of cardiovascular risk factors and their interrelationship in rural population of Kathmandu, Nepal. This is the first study to record complete physical activities inrespected MET value and use 72 hours recall method to collect information about diet among study population. Our study has major implication for the development of patient centered intervention in prevention and management of cardiovascular diseases in rural Kathmandu. Addressing CVD risk factors early can provide the opportunity to improve their cardiovascular health risk behaviors and can achieve significant positive influences on disease outcomes [147, 148]. However, it was only an analytical cross sectional study. This negates the ability to decide the causality. Recall bias is also concerning limitation of the study.

CHAPTER SIX

6.1 Conclusions

The study showed the presence of high burden of smoking, alcohol consumption, insufficient fruit and vegetable intake, physical inactivity,obesity, hypertension and diabetes in the study population.

Smoking was significantly higher among 40-49 age-group, male, Chetri, married people and illiterate (no formal education) than others. Similarly, comparatively people without formal schooling, of age 40-49 years, from Newar caste and male group had significantly high indulgence to alcohol than others. Mostly, illiterate (no formal education), socially adjudged higher caste group (Brahman and Chhetri) and female had high proportion of inadequate amount of fruits and vegetables consumption. But, the difference was minimal and statistically non-significant.

Though there was no significant difference in physical activity level by ethnicity and education status, comparatively higher percentage of upper caste people and highly educated participants had low physical activity than others.

Obesity was relatively high in 30-39 age group, female, self-employed and people without any formal education. Likewise, hypertension was higher in elderly people, people without any formal education, married, Newar caste and housemakers than others. Increasing age, being male and having high body mass index heightened the risk of hypertension in the study group. Diabetes was significantly high among elderly people, higher caste group and house makers.

In correlation analysis, physical activity level had a significant inverse relationship with waist hip ratio (WHR), fasting blood glucose (FBS), systolic blood pressure and triglycerides. Body mass index (BMI) and WHR had a significant positive relationship with blood pressure, FBS, cholesterol, triglycerides and LDL cholesterol. The result also pointed out that with increase in systolic and diastolic blood pressure, participants had

also raised FBS, TG, cholesterol and LDL cholesterol. Fasting blood glucose was also positively associated with cholesterol and triglycerides level

6.2 Recommendation

From the current research findings, it can be inferred that remote rural community has also been infiltrated by high prevalence of CVD risk factors. Cases of CVD are likely to increase in near future if these risk factors continue unabated. Therefore, the recommendations for reducing the cardiovascular risk factors and preventing CVDs are as follows

- Enhancing awareness about CVD risk factors through public education and community empowerment to promote a whole of society response to CVD prevention and control
- Effective implementation of public health policies related to harmful use of alcohol, tobacco use and food products
- Creating supportive environments and encouraging people to adopt healthy lifestyles
- Generating evidence-based information on CVD prevention, including leading risk factors, and CVD treatment and care

6.3 Study limitation

Significantly high numbers of female and indigenous group participants were involved in study. However, it was unintentional and was true representation of the present community where mainly women and indigenous people were living. Study findings should cautiously be generalized to other remote rural communities. Method used for measuring daily salt intake per person could be inaccurate. A more accurate way to determine dietary sodium, such as 24-hour urine collection, is warranted to confirm our findings.

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CHAPTER SEVEN

Annexes

Annex I: Informed consent form (Nepali)

Annex II: Interview questionnaire (English)

Annex III: Interview questionnaire (Nepali)

Annex IV: Kish Household Coversheet

Annex V: Multivariable analysis tables

Annex VI: Work plan

Annex VII: Show cards

Annex I: Informed consent form (written)

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- d cGtjf{tf lbg rfxfGg .

Annex II: Questionnaires (English)

Survey Information

Participant Id Number ⌊_⌊_⌊_⌋ ⌊_⌊_⌊_⌋ ⌊_⌊_⌊_⌋			
Consent, Interview Language and Name		**Response**	**Code**
1.	Family Surname		I8
2.	First Name		I9
Additional Information that may be helpful			
3.	Contact phone number		I10

Demographic Information

CORE: Demographic Information				
Question		**Response**		**Code**
4	Sex (*Record Male / Female as observed)*	Male	1	C1
		Female	2	
5	How old are you?	Years	⌊_⌊_⌋	C3

Demographic Information				
8	What is the **highest grade of education** you have completed?	No formal education	1	C5
		Primary and lower	2	
		Secondary	3	
		Higher secondary	4	
		Bachelor and higher	5	
9	What is your**background**?	Bhramhan	1	C6
		Kshetri	2	
		Newar	3	
		Janajati	4	
		Dalit	5	

		Other cast	6	
		Refused to answer	88	
10	What is your **marital status**?	Unmarried	1	C7
		Married	2	
		Separated	3	
		Widow		
		Refused	88	
11	Which of the following best describes your **mainwork** status over the past 12 months?	Government employee	1	C8
		Non-government employee	2	
		Self-employed	3	
		Non-paid	4	
		Student	5	
		Homemaker	6	
		Retired	7	
		Unemployed (able to work)	8	
		Unemployed (unable to	9	
		Refused	88	
12	How many people older than 6 months, including yourself, live in your household?	Number of people	⌊_⌊_⌋	C9
13	Taking **the past year**, can you tell me what the average earnings of the householdhave been monthly?	⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌋		C10b

Step 1 Behavioural Measurements

Tobacco Use

Now I am going to ask you some questions about tobacco.

Question		Response		Code
14	Do you currently smoke any **tobacco products**, such as cigarettes, cigars or pipes? *(USE SHOWCARD)*	Yes	1	T1
		No	2*If No, go to T8*	
15	Do you currently smoke tobacco products **daily**?	Yes	1	T2
		No	2	
		Don't know	77	
16	Do you remember how long you are smoking ? *(RECORD ONLY 1, NOT ALL 3)*	In Years	⌊_⌊_⌋	T4
		OR in Months	⌊_⌊_⌋	
		OR in Weeks	⌊_⌊_⌋	
17	On average, **how many** of the following products do you smoke **each day/week?**		DAILY↓ WEEKLY↓	
		Manufactured cigarettes	⌊_⌊_⌊_⌊_⌋ ⌊_⌊_⌊_⌊_⌋	T5a/T5aw

	(IF LESS THAN DAILY, RECORD WEEKLY) *(RECORD FOR EACH TYPE, USE SHOWCARD)* *Don't Know 7777*	Hand-rolled cigarettes ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋	T5b/T5bw
		Pipes full of tobacco ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋	T5c/T5cw
		Cigars, cheroots, cigarillos ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋	T5d/T5dw
		Number of Shisha sessions ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋	T5e/T5ew
		Other ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ *If Other, go to T5other, else go to T6*	T5f/T5fw
		Other (please specify): ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋	T5other/ T5otherw

18	In the past, did you **ever** smoke **daily**?	Yes	1	T8
		No	2	
		Don't Know 77		
19	Do you **currently use** any **smokeless tobacco** such as *[snuff, chewing tobacco, betel]*? *(USE SHOWCARD)*	Yes	1	T9
		No	2	
20	Do you **currently usesmokeless tobacco** products **daily?**	Yes	1	T10
		No	2	
		No	2	

CORE: Alcohol Consumption			
The next questions ask about the consumption of alcohol.			
Question		**Response**	**Code**
21	Have you **ever** consumed an alcoholic drink such as beer, wine, spirits, fermented cider local rakshi, tomba ? *(USE SHOWCARD OR SHOW EXAMPLES)*	Yes 1 No 2	A1
22	Have you consumed an alcoholic drink within the **past 30 days**?	Yes 1 No 2	A3
23	During the past 30 days, when you drank alcohol, **on average**, how many**standardalcoholicdrinks** did you have during one drinking occasion? *(USE SHOWCARD)*	Number Don't know 77 ⌊_⌋⌊_⌋	A5
24	During the past 30 days, how many times did you have for **men**: **five or more** for **women**: **four or more** standardalcoholic drinks in a single drinking occasion?	Number of times Don't Know 77 ⌊_⌋⌊_⌋	A7

Diet
The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving.

Day 1

Time	**Types of Fruit consumed**	**Whole fruit**	**Chopped, cooked, canned**	**Juice**
Breakfast	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Morning meal	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Snacks afternoon	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			

	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Evening meal	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			

Day 2				
Time	**Types of Fruit consumed**	**Whole fruit**	**Chopped, cooked, canned**	**Juice**
Breakfast	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			

	Apple			
	Watermelon			
Morning meal	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Snacks afternoon	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Evening meal	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			

	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			

Day 3				
Time	**Types of Fruit consumed**	**Whole fruit**	**Chopped, cooked, canned**	**Juice**
Breakfast	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Morning meal	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
Snacks afternoon	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
	Junar Orange			

	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			
	Mango			
	Raspberry (yellow, red, black)			
	Plum			
	Guava			
	Pomegranate			
	Grape			
	Pineapple			
	Chinese Pear			
	Grape			
Evening meal	Junar Orange			
	Banana			
	Musk Melon			
	Orange (sweet)			
	Pear			
	Papaya			
	Custard Apple			
	Jack Fruit			
	Custard Apple or Sugar Apple			
	Apple			
	Watermelon			

Day 1				
Time	**Types of vegetable consumed**	**Raw**	**Cooked, chopped**	**Juice**
	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
Breakfast	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			

	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Morning meal	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Snacks (Afternoon)	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			

	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Evening meal	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			

Day 2				
Time	**Types of vegetable consumed**	**Raw**	**Cooked, chopped**	**Juice**
Breakfast	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			

	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Morning meal	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Snacks (Afternoon)	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			

	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Evening meal	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Day 3				
Time	**Types of vegetable consumed**	**Raw**	**Cooked, chopped**	**Juice**
Breakfast	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			

	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Morning meal	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Snacks (Afternoon)	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			

	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			
Evening meal	Cabbage			
	Brinjal			
	Broccoli			
	Beans			
	Garden Cress			
	Serpent or Snake Gourd			
	Carrot			
	SpongeGourd			
	Tomato			
	Cucumber			
	Karkalo			
	Bitter Gourd			
	Jack Fruit			
	Cauliflower			
	Garden Peas			
	Bauhinia			
	Common Asparagus			
	Nepalese Hog Plum			
	Bottle Gourd			
	Fenugreek Leaf			
	Radish			
	Radish Greens			
	Spinach			
	Pointed Gourd,Patol			
	Gourd, Pumpkin			
	Pumpkin Shoots			
	Ladies Finger			
	Leaf Mustard			
	Mixed vegetable			

Oil consumption				
Sn	Questions	Response		code
25	What type of **oil or fat is most often** used for meal preparation in your household? *(USE SHOWCARD)* *(SELECT ONLY ONE)*	Vegetable oil	1	D5
		Lard or suet	2	
		Butter or ghee	3	
		Margarine	4	
		Other	5 *If Other, go to D5 other*	
		None in particular	6	
		None used	7	
		Don't know	77	
		Other	⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌊_⌋	D5

26	How much oil you use in a typical month?	⌊__⌋⌊__⌋ in liters	

Salt consumption				
27	For how many days you use one packet (one kg) of salt in typical month?	⌊__⌋⌊__⌋		
		Don't know		
28	Do you use same salt for other purposes (eg, for cattle)	Yes 1		
		No 2		
29	How much of salt (of that packet or kg) do you use for that purpose?	3/4 parts	1	
		1/2 parts	2	
		1/3 parts	3	
		1/4 parts	4	
		100 gm	5	
		50 gm	6	
		Or ⌊__⌋⌊__⌋⌊__⌋ gms		
30	Do you regularly take extra salt to meals at the table?	Yes 1		D6
		No 2		

	Physical Activities						
	Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment						
	Types of physical activities in a typical week	**Minutes / Day**	**Times /Day**	**Days / 7 Days**	**Total hours**	**MET value**	**Total MET**
	ডড়ৎশ ৎবষধঃবফ ধপঃরারঃরবং						
	Home related light activities						
	kitchen activity, general, (e.g., cooking, washing dishes, cleaning up),					2.8	
	Cleaning					**৩.৫**	
	laundry, hanging wash, washing clothes by hand, moderate effort					**৪**	
	Planting and harvesting crops					**৪**	
	Milking a cow (by hand)					**৪**	
	Office related light activity						

	Desk work					২	
	Other work related activities						
	Laboring (shoveling sand)					৬.৫	
	Digging dry soil (with spade)					৪	
	Ploughing					৮	
	Gardening					৪	
	Digging dry soil (with spade)					৪	
	Weaving					৪	
	Woodwork (chiseling, sawing softwood)					৪	
	Mixing cement (with shovel)					৪	
	Laboring (pushing loaded wheelbarrow, operating jack hammer)					৪	
	Digging dry soil (with spade)					৪	
	Instructing spinning (fitness)					৮	
	Instructing sports aerobics					৮	
	Sorting postal parcels (fast pace)					৮	
	Grinding (with pestle)					৮	
	Labouring (shoveling sand)					৮	
	Loading furniture (stoves, fridge)					৮	
	Instructing spinning (fitness)					৮	
	Instructing sports aerobics					৮	
	Sorting postal parcels (fast pace)					৮	
	Instructing spinning (fitness)					৮	
	Instructing sports aerobics					৮	
	Sorting postal parcels (fast pace)					৮	
	Travel related activities						
	Walking					২.৫	
	Brisk walking					৪	
	Running					৮	
	Bicycling, <10 mph, leisure, to work or for pleasure					৪	
	Bicycling, to/from work, self selected place					৬.৮	
	motor scooter, motorcycle					২.৫	

	truck, semi, tractor, > 1 ton, or bus, driving					২.৫	
	Recreational activities						
	Yoga					৪	
	Jogging					৪	
	Dancing					৪	
	Horse riding					৪	
	Tai chi					৪	
	Pilates					৪	
	Low-impact aerobics					৪	
	Soccer					৮	
	Tennis					৮	
	High-impact aerobics					৮	
	Aqua aerobics					৮	
	Ballet dancing					৮	
	Fast swimming					৮	
	Grand total Met						

History of Diabetes					
Question		**Response**			**Code**
32	Have you ever been told by a doctor or other health worker that you have raised blood sugar or diabetes?	Yes No	1 2	 *If No, go to H11*	H7
33	Are you currently receiving any treatments for diabetes prescribed by a doctor or other	Yes No	1 2		H8

History of Menopause (only for female)		
Question	**Response**	**Code**

34	Are you menstruating	Yes 1 No 2 *If yes, go to M3*	H 13
35	When did your menstruation stop?	Age of stoppage of menstruation ⌊__⌋ years	H14

Physical Measurements

Height and Weight

Question		Response	Code
36	Height	in Centimetres (cm) ⌊__⌋⌊__⌋⌊__⌋.⌊__⌋	M3
37	Weight *If too large for scale 666.6*	in Kilograms (kg) ⌊__⌋⌊__⌋⌊__⌋.⌊__⌋	M4
38	Waist circumference	in Centimetres (cm) ⌊__⌋⌊__⌋⌊__⌋.⌊__⌋ No 2	M5

Waist

39	Hip circumference	in Centimetres (cm) ⌊__⌋⌊__⌋⌊__⌋.⌊__⌋	M7

Blood Pressure

40	Reading 1	Systolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋	M11a
		Diastolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋	M11b
41	Reading 2	Systolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋	M12a
		Diastolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋	M12b
42	Reading 3	Systolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋	M13a
		Diastolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋	M13b

Biochemical Measurements

Blood Glucose

Question	Response	Code
During the past 12 hours have you had anything to eat or drink, other than water?	Yes 1 No 2	B1

Time of day blood specimen taken (24 hour clock)	Hours : minutes	⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	B4
Fasting blood glucose *[CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]*	mmol/l	⌊__⌋⌊__⌋ . ⌊__⌋⌊__⌋	B5
	mg/dl	⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋	
Today, have you taken insulin or other drugs (medication) that have been prescribed by a doctor or other health worker for raised blood glucose?	Yes No	1 2	B6
Blood Lipids			
Total cholesterol *[CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]*	mmol/l	⌊__⌋⌊__⌋ . ⌊__⌋⌊__⌋	B8
	mg/dl	⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋	
During the past two weeks, have you been treated for raised cholesterol with drugs (medication) prescribed by a doctor or other health worker?	Yes No	1 2	B9

Triglycerides and HDL Cholesterol			
Triglycerides *[CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]*	mmol/l	⌊__⌋⌊__⌋ . ⌊__⌋⌊__⌋	B10
	mg/dl	⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋	
HDL Cholesterol *[CHOOSE ACCORDINGLY: MMOL/L OR MG/DL]*	mmol/l	⌊__⌋ . ⌊__⌋⌊__⌋	B11
	mg/dl	⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋	

Annex II: Questionnaires (Nepali)

d'6' tyf /QgnLhGo/f]ux¿sf sf/stTjx¿ ;DaGwL ;j]{lf0f k|ZgfjnL

;j]{lf0f ;DaGwL ;"rgf

---

lgb]{zg M lgDg lnlvt :jLs[lt kq k9]/ ;'gfpg'xf];\ jf k9\g lbg'xf];\ .

…:jLs[lt kqÚ

9fsf ljZjljBfno hg:jf:Yo ljefu / g]kfn ZjfYo cg';Gwfg kl/ifbsf] l:js[ltdf g]kfndf d'6' tyf /QgnLhGo/f]ux¿ a9\b} u}/x]sf] ;Gbe{df o;sf] sf/s tTjx¿sf] l:ylt kQf nufpg] p2]Zosf;fy "d'6' tyf /QgnLhGo/f]ux¿sf sf/stTjx¿" ljifodf cWoog ug]{ qmddf d oxfF cfPsf 5' . o; cWoogdf tkfO{sf] ;xeflutf :j]lR5s x'g]5 .

o;df oxfFsf] ;xof]usf] ck]lff u/]sf] 5f}+ . tkfO{F ;xdt x'g'x'G5 eg] tkfO{FnfO{{ o;;Fu ;DalGwt s]xL k|Zgx¿ ;f]Wg] 5f}+ / z/L/sf] tf}n,/Qmrfk / sDd/sf] gfk cflb klg lng]5f}+ . To;kl5 tkfO{ /fte/ !@ 306f ;Dd kfgL afx]s c? s]lx gvfO{sg xfdLn] tf]s]sf] :yfgdf /ut lbghfg' kg{]5 . pSt :yfgdf tkfO{n] yf]/} /ut lbg' kg]{5 . tkfO{sf] /ut cg'ejk|fKt :jf:YosdL{n] ;+s|d0f /lxt tl/sfn] lgsfNg'x'g]5 . o; cg';Gwfgdf tkfO{nfO{ s'g} /sd lbOg] 5}g tyf lnOg]klg 5}g . s;} s;}nfO{ /ut lgsfNbf b'Vg ;S5 . o; jfx]s o; ;j]{lf0fdf ;xeflunfO{ s'g} xflg gf]S;fgL x'g]5}g .

tkfO{Fn] lbg' ePsf] JolQmut ljj/0fx¿ uf]Ko /flvg]5g\ . tkfO{;Fu lnOPsf] /utsf] gd'gfnfO{ klg hfFrkl5 gi6 ul/g] 5 . cGo ljj/0fx¿ klg tYofÍLo k|of]hgsf nflu dfq k|of]u ul/g]5g\ . cGtjf{tfsf] ;do sl/j #) ldg6sf] x'g] 5 .

s] d oxfFnfO{ k|Zg ;f]Wg ;S5' <

- x'G5 ;f]Wg'xf];\ . –sf]7fdf ;xL ug'{xf];\

- d cGtjf{tf lbg rfxfGg .

;j]{lf0f ;DalGw hfgsf/L			
:yfg / ;do		**hjfkmx?**	**sf]8**
	jf8{ -sf]8_		I1
	cGt/jftf{stf{sf] kl/ro		I2
	pQ/bftfsf] gfd y/	==========	I4
	pQ/bftfsf] klxrfgg+		I5
	pQ/bftfsf] kmf]gg+	==========	I6

hg;f^{a}\lVos laa/0f				
k|Zgx?		**hjfkmx?**		**sf]8**
6.	lnË	k'?if	!	C1
		dlxnf	@	
7.	k"/f ePsf] pd]/	jif{		C3
8.	tkfO{n] k"/f ug'[{ ePsf] dflyNnf] txsf] slff s'g xf]<	cf}krfl/s ¿kdf :s'n guPsf]	)	C5
		cgf}krfl/s lzlff	!	
		k|fylds eGbf sd	@	
		k|fylds tx	#	
		dfWolds tx	$	
		k|lj0ftf jf pRr lzlff	%	
		sn]h jf ljZj ljBfno k"/f ePsf]	^	
		kf]i6 uf|h'P6 jf ;f] eGbf dfly	&	
		pQ/ lbg grfx]sf]	**	
9.	tkfO{sf] hft s'g xf] <	a|Dx0f	!	C6
		lf]qL	@	

	-hflto al{us/0f sf8{ k|of]u ug]{_	g]jf/	#	
		hghflt	$	
		blnt	%	
		cGo hflt	^	
		pQ/ lbg grfx]sf]]	**	
10	tkfO{sf] xfn j}jlxs l:ylt s] xf] <	cljjflxt	!	C7
		ljjflxt	@	
		5'l6Psf]	#	
		ljb'/÷ljwjf	$	
11	ljut !@ dlxgf b]lv tkfO{ d'Vo s'g k]zfdf ;+nUg x'g'x'G5<	;/sf/L hflu/	!	C8
		u}/;/sf/L hflu/	@	
		cf^g} :jfldTjsf]	#	
		a]tnaL	$	
		ljBfyL{	%	
		3/fo;L sfd	^	
		cjsf; k|fKt	&	
		j]/f]huf/ -sfd ug{ ;Sg]_	*	
		j]/f]huf/ -sfd ug{ g;Sg]_	(	
12	tkfO{sf] 3/df tkfO{ nufot ^ dlxgf dflysf lgoldt ?kdf Pp6} r'nf]df ksfPsf] vfgf vfg] slt hgf ;b:ox? x'g'x'G5 <	;b:ox?sf] ;ª\Vof		C9
13	**ut !@ dlxgfdf** tkfO{Fsf] 3/ kl/jf/sf] cf};t cfDbfgL slt lyof] <	k|lt dlxgf ?k}of		C10a
	<- s'g} Ps pQ/ dfq_	k|ltjif{ ?k}of		C10b

;'lt{hGo kbfy{ ;]jg

ca d tkfOnfO{ ;'lt{hGo w'd|kfg ;DalGw s]lx k|Zgx? ;f]Wg uO/x]sf] 5' .

k|Zgx?		hjfkmx?		sf]8
	tkfO{n] xfn s'g} ;'lt{hGo w'd|kfg ;]jg ug'{x'G5<	u5'{	!	T1
		ul{bgF	@ ,olb ul{b{gF eg] T8 df hfg]	
	-h:t} la8L, r'/f]6, tdfv', x'Ssf jf cGo :yflgo ?kdf pTkfbg x'g] ;'lt{thGo kbfy{x?_			
	s] clxn]b}lgs w'd|kfg	u5'{	!	T2

	ug'{x'G5<	ul{bgF	@		
	s] tkfO{nfO{ ofb 5 slt jif{sf] pd]/df z'? ug'{ ePsf] lyof] <	jif{			T3
	s] tkfO{ ;Demg'x'G5 slt ;do cuf8L z'? ug'{ePsf] lyof]<	jif{df			T4a
		jf dlxgfdf			T4b
		jf xKtfdf			T4c
	Ps hjfkm dfq eg'{xf];\	ofb gePdf	&&&		
	lgDg pNn]lvt w'd|kfg lbgdf jf xKtfdf cf};t slt ;]jg ug'{x'G5<		b}lgs	xKtf	
	-k|To]s k|sf/sf] w'd|kfg /]s8{ ug]{_	pTkfbg ul/Psf] r'/f]6			T5a/T5aw
		xftn] a]/]sf] r'/f]6			T5b/T5bw
	yfxf gePdf &&&	kfOk - x'Ssf, lrlnd cflb			T5c/T5cw
		l;uf/			T5d/T5dw
		cGo			T5e/T5ew
		cGo eP gfdv'nfpg]	olb cGo ePdf T5 other / T6 df hfg]		T5other/T5other
	tkfO{n] ljutdf slxNo}} w'd|kfg ug'{ePsf] 5< (xfn w'dkfg ul//x]sf] JoSltnfO{ g;f]Wg])	5	!		T8
		5}g	@olb 5}g eg] T12 df hfg]		
	ljutdf tkfO{n] s'g} klg k|sf/sf] w'd|kfg b}lgs ?kdf k|of]u ug'{x'GYof]<	uy]{	! olb T1= u5'{ eg] T12 / T10 df hfg]		T9
		ul{bgy]	@ olb T1= u5'{ eg] T12 / T10 df hfg]		
	tkfO{n] xfn w'Fjf/lxt ;"lt{ h:t} -;'lt{, a]6]n, u'6\sf, kfg d;nf, v}gL cflb_ sf] ;]jg ug'{ePsf] 5<	5	!		T12
		5}g	@5}g eg] A1adf hfg]		
	tkfO{n] xfn s'g} w'Fjf/lxt ;"lt{hGo kbfy{ b}lgs ;]jg ug{'x'G5<	u5'{	!		T13
		ulb{g	@olb ul{bgF eg] A1a df hfg]		

dlb/fhGo kbfy{ ;]jg

casf k|Zgx? dlb/fhGo kbfy{ ;]jg **;u ;DalGwt 5g\ .**

23.	tkfO{n] hLjgdf slxNo} dBkfg ug'{ePsf] 5<-h:t} ljo/ ,jfOg,x'l:s ,uf‘p3/d} agfPsf] /S;L, hf+8, tf]Daf_ ;f] sf8{sf] k|of]u ug]{	5 5}g	! @ olb 5}g eg] D1 df hfg]	A1a
24.	tkfO{n] ljt]sf] ! dlxgfdf -#) lbgdf_ s'g} k|sf/sf] dBkfg ug'[{ ePsf] 5 <	5 5}g	! @,olb 5}geg] Dietdf hfg]	A3
25.	ljt]sf] ! dlxgfdf -#) lbgdf_ slt lbg tkfO{n] -slDtdf Ps k6s_ dBkfg ug'{eof] <	lbg ;+Vof yfxf 5}g	 &&	A4
26. t	ljt]sf] ! dlxgfdf -#) lbgdf_ tkfO{n] dBkfg u/]sf] lbgdf cf};tdf slt :6fG88{ l8«S; lng'eof] < **(ᵎ** :6fG88{ l8«S; =lao/, hf8, tf]+Uaf @%) ldln, nf]sn /Sl; $% ldln, jfOg !)% ldln, lx:sL, /d, ef]8\sf #) ldnL **)** ;f] sf8{sf] k|of]u ug]{	:6ofG88{ l8«+S;sf] ;+Vof yfxf 5}g	 &&	**A5**
27. #^	ljt]sf] ! dlxgfdf -#) lbgdf_ tkfO{n] ;a}eGbf a9L lkPsf] lbg slt :6fG88{ l8«S; lkpg'eof] <	:6ofG88{ l8«+S;sf] ;+Vof yfxf 5}g	 &&	A6
28. #&	ljt]sf] ! dlxgfdf -#) lbgdf_ tkfO{n] $ jf $ eGbf w]/} :6fG88l8«+S; slt lbg lkpg'ePsf] lyof] <	slt lbg yfxf 5}g	 &&	A7

Vfgkfg ;DalGw k|ZgfjnL

दिन १				
समय	**तरकारी सागसब्जीका प्रकार**	**काँचो (ग्राम)**	**काटेको, पकाएको वा बट्टामा प्याक गरेको (ग्राममा)**	**रस (मिलि)**
बिहानको खाजा	1. करेला			
	2. कुरिलो			
	3. काउली			
	4. काक्रो			
	5. गाजर			
	6. गोलभेडा			
	7. घिरौंला			
	8. लौका			
	9. बोडी / िं			
	10. बन्दा			
	11. रायोको साग			
	12. भेंडी			
	13. मिसिए			
	14.			
	15.			
बिहानको खाना	16. करेला			
	17. कुरिलो			
	18. काउली			
	19. काक्रो			
	20. गाजर			
	21. गोलभेडा			
	22. घिरौंला			
	23. लौका			
	24. बोडी / िं			
	25. बन्दा			
	26. रायोको साग			
	27. भेंडी			
	28. मिसिए			
	29.			
	30.			
दिउँसोको खाजा	31. करेला			
	32. कुरिलो			
	33. काउली			
	34. काक्रो			
	35. गाजर			
	36. गोलभेडा			

	37. घिरौंला			
	38. लौका			
	39. बोडी / ि			
	40. बन्दा			
	41. रायोको साग			
	42. भैंडी			
	43. मिसिए			
	44.			
	45.			
	46. करेला			
	47. कुरिलो			
	48. काउली			
	49. काक्रो			
	50. गाजर			
	51. गोलभेडा			
बेलुकीको	52. घिरौंला			
	53. लौका			
खाना	54. बोडी / ि			
	55. बन्दा			
	56. रायोको साग			
	57. भैंडी			
	58. मिसिए			
	59.			
	60.			
जम्मा				
दिन १ मा जम्मा खाएको (सबै जोड्ने)				
lbg ! df hDdf vfPsf] xl/of] ;fu;AhL - ;a} xl/of] ;fu;AhL hf]8\g]_				
दिन २				
	1. करेला			
	2. कुरिलो			
	3. काउली			
	4. काक्रो			
	5. गाजर			
	6. गोलभेडा			
बिहानको	7. घिरौंला			
	8. लौका			
खाजा	9. बोडी / ि			
	10. बन्दा			
	11. रायोको साग			
	12. भैंडी			
	13. मिसिए			
	14.			

	15.			
बिहानको खाना	16. करेला			
	17. कुरिलो			
	18. काउली			
	19. काक्रो			
	20. गाजर			
	21. गोलभेडा			
	22. घिरौंला			
	23. लौका			
	24. बोडी / टि			
	25. बन्दा			
	26. रायोको साग			
	27. भैंडी			
	28. मिसिए			
	29.			
	30.			
दिउसोको खाजा	31. करेला			
	32. कुरिलो			
	33. काउली			
	34. काक्रो			
	35. गाजर			
	36. गोलभेडा			
	37. घिरौंला			
	38. लौका			
	39. बोडी / टि			
	40. बन्दा			
	41. रायोको साग			
	42. भैंडी			
	43. मिसिए			
	44.			
	45.			
बेलुकीको खाना	46. करेला			
	47. कुरिलो			
	48. काउली			
	49. काक्रो			
	50. गाजर			
	51. गोलभेडा			
	52. घिरौंला			
	53. लौका			
	54. बोडी / टि			

	55. बन्दा			
	56. रायोको साग			
	57. भैंडी			
	58. मिसिए			
	59.			
	60.			
जम्मा				
दिन २ मा जम्मा खाएको (सबै जोड्ने)				
lbg @ df hDdf vfPsf] xl/of] ;fu;AhL - ;a} xl/of] ;fu;AhL hf]8\g]_				
दिन ३				
बिहानको खाजा	61. करेला			
	62. कुरिलो			
	63. काउली			
	64. काक्रो			
	65. गाजर			
	66. गोलभेडा			
	67. घिरौंला			
	68. लौका			
	69. बोडी / ि			
	70. बन्दा			
	71. रायोको साग			
	72. भैंडी			
	73. मिसिए			
	74.			
	75.			
बिहानको खाना	76. करेला			
	77. कुरिलो			
	78. काउली			
	79. काक्रो			
	80. गाजर			
	81. गोलभेडा			
	82. घिरौंला			
	83. लौका			
	84. बोडी / ि			
	85. बन्दा			
	86. रायोको साग			
	87. भैंडी			
	88. मिसिए			
	89.			
	90.			
दिउसोको	91. करेला			
	92. कुरिलो			

खाजा	93. काउली			
	94. काक्रो			
	95. गाजर			
	96. गोलभेडा			
	97. घिरौंला			
	98. लौका			
	99. बोडी / ि			
	100. बन्दा			
	101. रायोको साग			
	102. भैंडी			
	103. मिसिए			
	104.			
	105.			
बेलुकीको खाना	106. करेला			
	107. कुरिलो			
	108. काउली			
	109. काक्रो			
	110. गाजर			
	111. गोलभेडा			
	112. घिरौंला			
	113. लौका			
	114. बोडी / ि			
	115. बन्दा			
	116. रायोको साग			
	117. भैंडी			
	118. मिसिए			
	119.			
	120.			
जम्मा				
दिन २ मा जम्मा खाएको (सबै जोड्ने)				
lbg @ df hDdf vfPsf] xl/of] ;fu;AhL - ;a} xl/of] ;fu;AhL hf]8\g]_				

दिन १				
समय	फलफूलको प्रक	पूर्ण आव (ग्राममा)	काटेको,पकाएको वा बढ्दामा प्याक गरेको (ग्राममा)	रस (मिलि लि)
बिहानको खाजा	1. केरा			
	2. अम्बा			
	3. श्याउ			
	4. अनार			
	5. भुइकटहर			

	6. ……			
	7. ……			
	8. ……			
	9. ……..			
बिहानको खाना	10. केरा			
	11. अम्ब			
	12. श्याउ			
	13. अनार			
	14. भुइकटहर			
	15. ……			
	16. ……			
	17. ……			
	18. ……..			
दिउसोको खाजा	19. केरा			
	20. अम्ब			
	21. श्याउ			
	22. अनार			
	23. भुइकटहर			
	24. ……			
	25. ……			
	26. ……			
	27. ……..			
बेलुकीको खाना	28. केरा			
	29. अम्ब			
	30. श्याउ			
	31. अनार			
	32. भुइकटहर			
	33. ……			
	34. ……			
	35. ……			
	36. ……..			
दिन १ मा जम्मा खाएव (सबै जोड्ः)				
दिन २				
समय	**फलफूलको प्रक**	**पूर्ण आव (ग्राममा)**	**काटेको, पकाएको वा बट्टामा प्याक गरेको (ग्राममा)**	**रस (मिलि लि)**
बिहानको खाजा	1. केरा			
	2. अम्बा			
	3. श्याउ			
	4. अनार			
	5. भुइकटहर			
	6. ……			
	7. ……			

	8. ……			
	9. ……..			
बिहानको खाना	10. केरा			
	11. अम्ब			
	12. श्याउ			
	13. अनार			
	14. भुइकटहर			
	15. ……			
	16. ……			
	17. ……			
	18. ……..			
दिउसोको खाजा	19. केरा			
	20. अम्ब			
	21. श्याउ			
	22. अनार			
	23. भुइकटहर			
	24. ……			
	25. ……			
	26. ……			
	27. ……..			
बेलुकीको खाना	28. केरा			
	29. अम्ब			
	30. श्याउ			
	31. अनार			
	32. भुइकटहर			
	33. ……			
	34. ……			
	35. ……			
	36. ……..			
दिन २ मा जम्मा खाएके (सबै जोड्नु)				
दिन ३				
समय	**फलफूलको प्रक**	**पूर्ण आव (ग्राममा)**	**काटेको, पकाएको वा बङ्गामा प्याक गरेको (ग्राममा)**	**रस (मिलि लि)**
बिहानको खाजा	1. केरा			
	2. अम्बा			
	3. श्याउ			
	4. अनार			
	5. भुइकटहर			
	6. ……			
	7. ……			
	8. ……			
	9. ……..			

बिहानको खाना	10. केरा			
	11. अम्ब			
	12. श्याउ			
	13. अनार			
	14. भुइकटहर			
	15. …….			
	16. …….			
	17. …….			
	18. ……..			
दिउसोको खाजा	19. केरा			
	20. अम्ब			
	21. श्याउ			
	22. अनार			
	23. भुइकटहर			
	24. …….			
	25. …….			
	26. …….			
	27. ……..			
बेलुकीको खाना	28. केरा			
	29. अम्ब			
	30. श्याउ			
	31. अनार			
	32. भुइकटहर			
	33. …….			
	34. …….			
	35. …….			
	36. ……..			
दिन ३ मा जम्मा खाएको (सबै जोड्न)				

	tkfO{ cfkm\gf] 3/df vfgf ksfpgsf] nflu k|foh;f] s:tf] k|sf/sf] t]n jf l3psf] k|of]u ug'{x"G5 < ;f] sf8{sf] k|of]u ug]{ -Ps hafkm dfq eg'{xf];_	jg:klt t]n- tf]/L, e6df;, ;'o{d'lv, cflb_	!	D5
		af];f]	@	
		gf}gL jf £o'	#	
		rfprfpsf] t]n	$	
		8fN8f - jg:klt £o'_	%	

		h'g;'s}	^	
		ofb gePdf	&&	
		cGo - gfd v'nfpg]_	==========	D5a
	tkfO{ cfkm\gf] 3/df vfgf ksfpgsf] nflu Ps dlxgfdf slt t]n jf l3psf] k|of]u ug'{x"G5 <	ln6/df n]Vg]	┗━┛┗━┛	D6

vfg] g'g				
31.	tkfO{n] s'g} klg vfgf vfg' cl3 vfgfdf g'g yk]/ vfg' x'G5 < -Ps hafkm dfq eg'{xf];_	;w}+ vfG5'	!	DS1
		k|fo vfG5'	@	
		slxn]sflx vfG5'	#	
		cfSsnem'Sns vfG5'	$	
		slxn] klg vflVbg	%	
		ofb gePdf	&&	
32.	tkfO{sf] kl/jf/n] ! Kofs]6 -! lsnf]_ g'gsf] k|of]u slt lbg;Dd ug{'[x'G5 <		☐	DS2
		ofb gePdf	&&	
33.	tkfO{sf] kl/jf/n] pSt g'g cGo k|of]hgsfnflu klg ug{'x'G5 < -h:t} ufO{j:t'nfO{ _	u5f}{	!	DS3
		ub{]gf}	@	
34.	slt dfqf cGo k|of]hgsfnflu klg ug{'x'G5 <	#÷$ efu	!	DS4
		!÷@ efu	@	
		!÷# efu	#	
		!÷$ efu	$	
		jf ┗━┛┗━━┛┗━┛ u|fd		

शारीरिक क्रियाकलाप सम्बन्धि प्रश्ना

	शारीरिक क्रियाकल	Min /Day	Times /Day	Days / 7 Days	Total hours	MET value	Total MET
घरमा का	भान्छाको काम (खाना पकाउने, भाडा माज्ने, सफा गर्ने)					२.८	
	घर सफा गर्ने					३.५	
	लुगा धुने, सुकाउने					४	
अफिसमा काम	डेस्कमा काम गर्ने					२	

अन्य काम	खेत बारीमा काम गर्ने					४	
	दूध धुने					४	
	लेवर काम					७.५	
	खेत बारी खन्ने					४	
	हलो जोत्ने					८	
	दाउरा काट्ने/ चिर					४	
	सिमेन्ट मुछने					४	
	गरुङ्गो सामानहरु उचाल्ने					४	
	धान मकै गोड्नेलो गर्ने					४	
यातायात सम्बन्धि	हलुका हिडाई					२.५	
	छिटो छिटो हिडाई					४	
	दौडने					८	
	ढिलो साइकल चलाउने					४	
	साइकलमा अफिस वा किनमेलमा जाने					७.८	
	बाईक वा स्कुटरमा हिड्ने					२.५	
	बस, ट्रक , अन्य गाडीमा हिड्ने					२.५	
मनोरंजनात्मक	योग गर्ने					४	
	जगिंग गर्ने (खुला ठाउँमा)					८	
	जगिंग गर्ने (मेसिन)					४.५	
	फुटबल खेल्ने					८	
	क्रिकेट खेल्ने					४.८	
	एरोबिक्स गर्ने					८	
	टेनिस खेल्ने					८	
	डान्स गर्ने					७.२	
	पौडी खेल्ने					८	
	जम्मा मे						
	जम्मा लाइट शारीरिक क्रियाकलाप (मेट भ्यालु <३शारीरिक क्रियाकल हरुको जोड)						
	जम्मा मोडरेट शारीरिक क्रियाकलाप (मेट भ्यालु ३-६ सम्मक शारीरिक क्रियाक हरुको जोड)						

dw'd]xsf] Oltxf;				
k|Zgx?		**hjfkmx?**		**sf]8**
35.	tkfO{n] slxNo} dw'd]xsf] -;'u/_	5	!	H

	hfFr 8fS6/ jf :jf:YosdL{af6 u/fpg' ePsf] 5<	5}g	@,olb 5}g eg] O1 df hfg]	6
36.	tkfO{nfO{ 8fS6/ jf :jf:YosdL{n] dw'd]x /f]u 5 eg]/ eGg'ePsf] 5 .	5	!	H 7a
		5}g	@,olb 5}g eg] O1 df hfg]	
		5}g	@	
37.	slxNo} k/Dk/fut :jf:YosdL{af6 dw'd]x -;'u/_ sf] hfFr u/fpg'ePsf] 5<	5	!	H 9
		5}g	@	
38.	s] clxn] tkfO{n] dw'd]x -;'u/_ /f]usf] nflu cf}ifwL lnO/xg'ePsf] 5<	5	!	H 10
		5}g	@	

अन्य रोगहरुको इतिहास

k|Zgx?		hjfkmx?		sf]8
39.	तपाइलाई चिकित्सक वा स्वास्थ्यकर्मीले कुनै अन्य दिर्घ रोग छ भनेर भन्नु भएको छ ?	5 5}g	! @,olb 5}g eg] CVD1 df hfg]	O 1
40.	त्यो कुन रोग हो ?			O 2
41.	यस समस्याको लागि हाल तपाई कुनै औषधी प्रयोग गर्नु हुन्छ ?	5 5}g	! @	O 3
42.	औषधी चिकित्सक वा स्वास्थ्यकर्मीको सल्लाहमा सेवन गर्नु भएको हो ?			O 4

k./jf/df d'6' tyf /utsf] /Stgln ;DalGw /f]usf] Oltxf;

k|Zgx?		hjfkmx?		sf]8
43.	tkfO{sf] a'jf cfdf bfO{ lblb sf]lx d'6'sf] /f]u, kIff3ft, /StglnhGo /f]usf] sf/0fn] d[To' ePsf] 5 <	5 5}g	! @,olb 5}g eg] Mp1 df hfg]	CV D1
44.	slt jif{sf] pd]/df d[To' ePsf] lyof]<	jif{		CV D2

s

clGtd dlxgfjf/L ;DalGw- dlxnfx?sf] nflu dfq_

k|Zgx?		hjfkmx?		sf]8
45.	tkfO{sf] dlxgfjf/L eO{/fv]sf] 5 ls /f]lSs ;Sof] <	e}/fv]sf] 5 /l]lsoL ;Sof]	! @	Mp 1

46.	olb /f]lSs ;Sof] eg] , slt jif{sf] pd]/df /f]lsPsf] xf] ofb 5 <	jif{	========== =====	Mp 2

r/0f @M zf/Ll/s dfkg				
prfO{ / jhg				
k|Zgx?		**hjfkmx?**		**sf]8**
47	k|fljlws÷cGtjf{tf{stf{sf] cfO{ l8**			M1
48	prfO{	;]lG6ld6/df -;]=ld=_		Ht
49	jhg If too large for scale 666.6	lsnf]u|fddf -s]=u|f_		Wt
sDd/sf] gfk				
50	sDd/sf] rf}8fO -;] dL_	;]lG6ld6/df -l;=Pd=_		Wc
/Qmrfk				
51	/Qmrfk -gfk !_	l;:6f]lns (mmHg) 8fo:6f]lns (mmHg)		BP1a BP1b
52	/Qmrfk -gfk @_	l;:6f]lns (mmHg) 8fo:6f]lns (mmHg)		BP2a BP2b
53	/Qmrfk -gfk #_	l;:6f]lns (mmHg) 8fo:6f]lns (mmHg)		BP3a BP3b
lxksf] gfk				
54	lxksf] df]6fO	;]lG6ld6/df -l;=Pd=_		HC

r/0f #M afof]s]ldsn dfkg		
	pQ/bftf sf] gfd y/, pd]/	==========
	pQ/bftf sf] klxrfg g+	
	pQ/bftf sf] kmf]g g+	==========

58	vfnL k]6df lnPsf] /utdf lrgLsf] dfqf	…..…..……mg/dl		FBS
59	cfh tkfO{n] OG;'lng of cGo s'g} 8fS6/n] lbg'ePsf] cf}iflw lng'ePsf] 5<	5	!	AntiDm
		5}g	@	
60	hDdf sf]n]:6]/f]n	..……mg/dl		TC
61	kl5Nnf] @ xKtf leqdf tkfO{n] cfkgf] sf]n]:6]/f]nsf] nflu 8fS6/n] lbg'ePsf] cf}iflw lng'ePsf] 5 <	5	!	Anti chl
		5}g	@	
62	6«fOUnfO;]/fO8	……mg/dl		Tglc
63	Pr= l8= Pn= sf]n]:6]/f]n	……mg/dl		HDL

Annex IV: Kish table

Number of Eligible Persons in Household	**Last Digit of Household Number**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	1	1	1	1	1	1	1	1	1	1
2	1	2	1	2	1	2	1	2	1	2
3	3	1	2	3	1	2	3	1	2	3
4	1	2	3	4	1	2	3	4	1	2
5	1	2	3	4	5	1	2	3	4	5
6	6	1	2	3	4	5	6	1	2	3
7	5	6	7	1	2	3	4	5	6	7
8	1	2	3	4	5	6	7	8	1	2
9	8	9	1	2	3	4	5	6	7	8
10	9	10	1	2	3	4	5	6	7	8

Annex V

Multivariable analysis

Table 7.Multivariable analysis for hypertension

Steps	Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Age	.077	.011	44.857	1	0.001	1.080
	Constant	-4.046	.542	55.757	1	0.001	.017
Step 2[b]	Age	.073	.012	39.276	1	0.001	1.076
	TG	.006	.002	7.526	1	.006	1.006
	Constant	-4.695	.612	58.865	1	0.001	.009
Step 3[c]	Age	.070	.012	34.264	1	0.001	1.073
	TG	.007	.002	9.465	1	.002	1.007
	Dalit			8.280	4	.082	
	Brahman	-3.024	1.169	6.686	1	.010	.049
	Chetri	-2.733	1.169	5.463	1	.019	.065
	Newar	-2.423	1.168	4.305	1	.038	.089
	Other Janajati	-2.586	1.209	4.576	1	.032	.075
	Constant	-2.065	1.259	2.689	1	.101	.127
Step 4[d]	Age	.071	.012	34.704	1	0.001	1.074
	TG	.006	.002	7.869	1	.005	1.006
	Gender(male)	.589	.290	4.127	1	.042	1.803
	Dalit			8.625	4	.071	
	Brahman	-2.980	1.149	6.731	1	.009	.051
	Chetri	-2.682	1.150	5.443	1	.020	.068
	Newar	-2.331	1.148	4.127	1	.042	.097
	Other Janajati	-2.512	1.194	4.429	1	.035	.081
	Constant	-2.351	1.257	3.497	1	.061	.095
Step 5[e]	Age	.072	.012	32.935	1	0.001	1.074
	BMI	.066	.034	3.779	1	.052	1.068
	TG	.006	.002	6.301	1	.012	1.006
	Gender(male)	.674	.296	5.197	1	.023	1.963

	Dalit			8.529	4	.074	
	Brahman	-2.999	1.157	6.722	1	.010	.050
	Chetri	-2.712	1.158	5.487	1	.019	.066
	Newar	-2.358	1.155	4.164	1	.041	.095
	Other Janajati	-2.570	1.203	4.566	1	.033	.077
	Constant	-4.031	1.556	6.714	1	.010	.018
a. Variable(s) entered on step 1: Age.							
b. Variable(s) entered on step 2: TG.							
c. Variable(s) entered on step 3: Ethnicity							
d. Variable(s) entered on step 4: Gender.							
e. Variable(s) entered on step 5: BMI.							

Table 8. Multivariable analysis for physical activity

Steps	**Variables in the Equation**	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Gender(Male)	-1.318	.278	22.535	1	0.001	.268
	Constant	1.980	.213	86.083	1	0.001	7.240
Step 2[b]	Age	-.035	.011	10.484	1	.001	.966
	Gender(Male)	-1.339	.283	22.391	1	0.001	.262
	Constant	3.530	.547	41.589	1	0.001	34.125
a. Variable(s) entered on step 1: Gender.							
b. Variable(s) entered on step 2: Age.							

Table 9. Multivriable analysis for alcohol consumption

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Gender(1)	1.363	.248	30.198	1	0.001	3.906
	Constant	-1.519	.182	70.037	1	0.001	.219
Step 2[b]	Gender(1)	1.671	.283	34.815	1	0.001	5.315
	Dalit			40.566	4	0.001	
	Brahman	-.260	.727	.128	1	.720	.771
	Chetri	-.053	.738	.005	1	.943	.949
	Newar	1.688	.726	5.407	1	.020	5.408
	Other Janajati	1.515	.773	3.844	1	.050	4.551
	Constant	-2.256	.706	10.223	1	.001	.105
Step 3[c]	Gender(1)	1.470	.292	25.301	1	0.001	4.350
	Smoking(1)	1.470	.348	17.786	1	0.001	4.347
	Dalit			41.729	4	0.001	
	Brahman	.190	.775	.060	1	.806	1.210
	Chetri	.143	.781	.033	1	.855	1.153
	Newar	2.156	.777	7.692	1	.006	8.637
	Other Janajati	1.795	.825	4.729	1	.030	6.017
	Constant	-2.827	.764	13.689	1	0.001	.059
Step 4[d]	Age	-.023	.011	4.340	1	.037	.978
	Gender(1)	1.489	.296	25.373	1	0.001	4.431
	Smoking(1)	1.614	.363	19.759	1	0.001	5.025
	Dalit			43.299	4	0.001	
	Brahman	.126	.783	.026	1	.872	1.134
	Chetri	.083	.788	.011	1	.916	1.087
	Newar	2.212	.786	7.920	1	.005	9.130
	Other Janajati	1.733	.830	4.355	1	.037	5.658
	Constant	-1.881	.884	4.522	1	.033	.152
a. Variable(s) entered on step 1: Gender.							
b. Variable(s) entered on step 2: ethinicity_new.							
c. Variable(s) entered on step 3: Smoking.							
d. Variable(s) entered on step 4: Age.							

Table 10. Multivariable analysis for smoking

Smoking							
Steps	**Variables in the Equation**	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 1[a]	Alcohol consumption (Yes)	1.482	.294	25.371	1	0.001	4.400
	Constant	-2.131	.207	105.538	1	0.001	.119
Step 2[b]	Age	.037	.012	9.336	1	.002	1.037
	Alcohol consumption (Yes)	1.585	.304	27.121	1	0.001	4.881
	Constant	-3.804	.617	38.062	1	0.001	.022
Step 3[c]	Age	.043	.013	11.548	1	.001	1.044
	Alcohol consumption (Yes)	2.015	.360	31.321	1	0.001	7.499
	Dalit			14.280	4	.006	
	Brahman	-1.250	.692	3.265	1	.071	.287
	Chetri	-.477	.677	.497	1	.481	.621
	Newar	-2.029	.734	7.648	1	.006	.131
	Other Janajati	-.835	.761	1.204	1	.273	.434
	Constant	-3.192	.896	12.689	1	0.001	.041
Step 4[d]	Age	.043	.013	11.020	1	.001	1.044
	Gender(1)	.843	.330	6.507	1	.011	2.323
	Alcohol consumption (Yes)	1.730	.376	21.121	1	0.001	5.639
	Dalit			13.898	4	.008	
	Brahman	-1.362	.710	3.675	1	.055	.256
	Chetri	-.501	.695	.519	1	.471	.606
	Newar	-1.955	.749	6.808	1	.009	.142
	Other Janajati	-.710	.779	.831	1	.362	.492
	Constant	-3.469	.921	14.187	1	0.001	.031
Step 5[e]	Age	.017	.015	1.281	1	.258	1.017
	Gender(1)	1.817	.433	17.612	1	0.001	6.155
	Alcohol consumption (Yes)	1.908	.424	20.278	1	0.001	6.741
	Dalit			14.820	4	.005	
	Brahman	-.775	.728	1.134	1	.287	.461
	Chetri	-.011	.716	0.001	1	.988	.989
	Newar	-1.972	.786	6.295	1	.012	.139

	Other Janajati	-.564	.806	.491	1	.484	.569
	No formal education			21.741	4	0.001	
	Primary education	2.770	.651	18.132	1	0.001	15.962
	Secondary education	2.035	.647	9.878	1	.002	7.650
	Higher secondary education	.814	.621	1.721	1	.190	2.258
	No formal education	.520	.649	.642	1	.423	1.683
	Constant	-4.762	1.075	19.612	1	0.001	.009
Step 6[e]	Gender(1)	1.894	.429	19.519	1	0.001	6.645
	Alcohol consumption (Yes)	1.809	.409	19.533	1	0.001	6.102
	Dalit			14.049	4	.007	
	Brahman	-.744	.722	1.060	1	.303	.475
	Chetri	.023	.710	.001	1	.974	1.023
	Newar	-1.869	.775	5.821	1	.016	.154
	Other Janajati	-.531	.794	.448	1	.503	.588
	Bachelor and higher			28.719	4	0.001	
	No formal education	2.980	.625	22.764	1	0.001	19.695
	Primary education	2.114	.642	10.850	1	.001	8.282
	Secondary education	.857	.619	1.921	1	.166	2.357
	Higher secondary education	.458	.646	.502	1	.479	1.581
	Constant	-4.144	.900	21.177	1	0.001	.016
a. Variable(s) entered on step 1: Alcohol consumption (Yes).							
b. Variable(s) entered on step 2: Age.							
c. Variable(s) entered on step 3: Ethnicity.							
d. Variable(s) entered on step 4: Gender.							
e. Variable(s) entered on step 5: Education.							

Annex VI

Work plan

Activities	**Timeline**										
	September		October			November				Dec-Feb	Feb-Sep
	WK 3	WK4	WK2	WK 3	WK4	WK1	WK2	WK 3	WK4		
Training for Data Collector											
Community mobilization											
Pilot testing											
Data collection											
Data Management and Analysis											
Draft Report Writing											
Final Report Submission											

Annex VII

Show cards

Figure. Tobacco products

Figure. Alcohol measuring cups

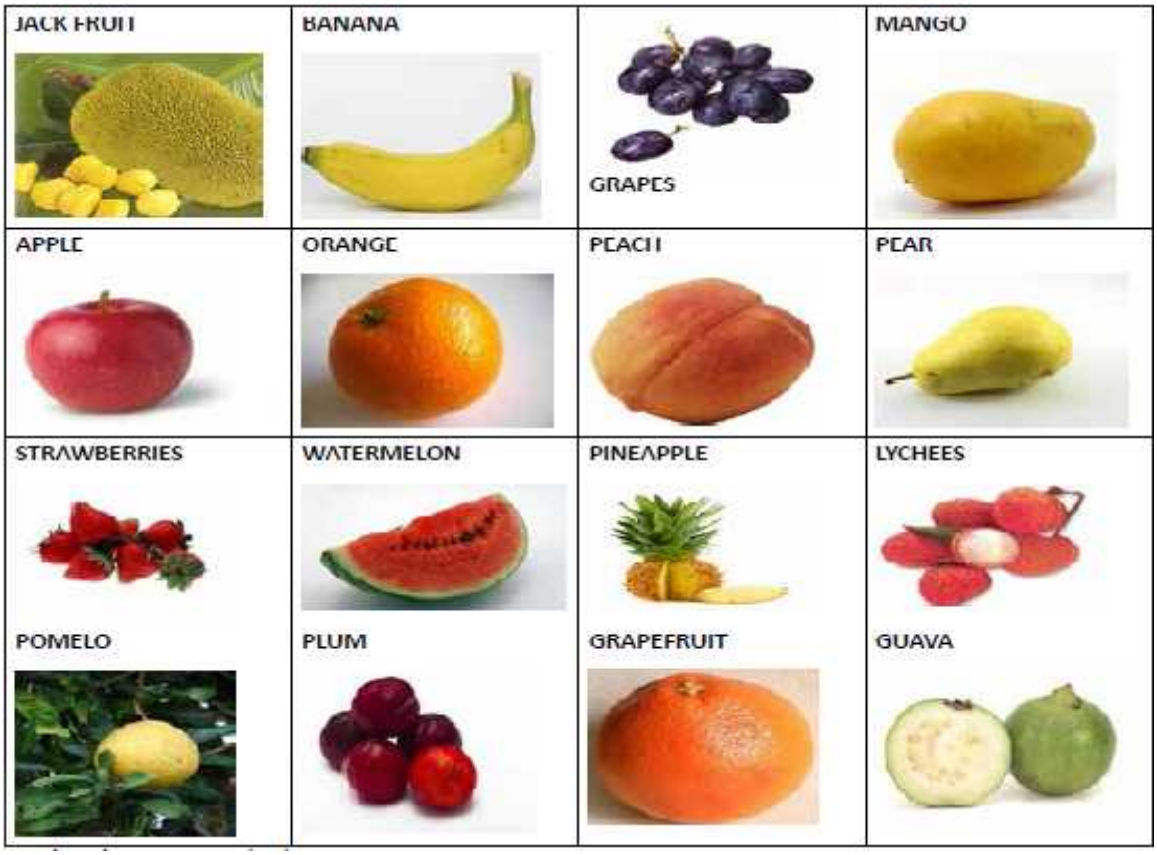

Figure. 80 grams of fruit and vegetables