A Study on Behavioral and Biological Risk Factors Determination of Non-Communicable Diseases at Narayanganj

A Research Paper Submitted to the Department of Pharmacy for the Partial Fulfillment of the Degree of Bachelor of Pharmacy.

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DECLARATION BY THE RESEARCH CANDIDATE

I, **Md. Delowar Hossain, ID: 2013-3-70-030**, hereby declare that the dissertation entitled **"A Study on Behavioral and Biological Risk Factors Determination of Non-Communicable Diseases at Narayanganj''** submitted to the Department of Pharmacy, East West University, in the partial fulfillment of the requirement for the degree of Bachelor of Pharmacy (Honors) is a genuine & authentic research work carried out by me. The contents of this dissertation, in full or in parts, have not been submitted to any other institute or University for the award of any degree or Diploma of Fellowship.

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CERTIFICATION BY THE SUPERVISOR

This is to certify that the dissertation, entitled **"A Study on Behavioral and Biological Risk Factors Determination of Non-Communicable Diseases at Narayanganj"** is a bonafide research work done by **Md. Delowar Hossain (2013-3-70-030**) in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy under my supervision.

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DEDICATION

*This research paper is dedicated to my respected parents **Md. Akram Hossain & Ms. Nazma Begum** and my beloved siblings **Tania Akter & Tanvir Hossain** for their unconditional support.*

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List of Abbreviations

CDC	Center for Disease Control
NCD	Non-Communicable Diseases
HHS	Human Health Service
STEPS	Stepwise approach to surveillance
DALYS	Disability Adjusted Life Years

Abstract

Non-communicable diseases (NCDs) are the leading cause of mortality worldwide and NCDs along with infectious diseases are now considered as the serious public health threat to the developing countries like Bangladesh. The goal of the study was to determine the distribution of the risk factors of NCDs, the prevalence of NCDs and the knowledge of the population about the risk factors. A total of 290 respondents of ≥ 18 ages of different regions of Narayanganj district of Bangladesh participated in the study and responded to a structured questionnaire. About 23.79% of the people were suffering from hypertension, 12.76% from diabetes mellitus, 7.24% from asthma. Regarding the family history of the respondents smoking (57.93%), smokeless tobacco use (58.62%), hypertension (49.31%) and diabetes mellitus (33.10%) were prevalent. The major concerning issue was that 25.86% of study population used tobacco products whereas 20.34% and 5.86% of the people had stage1 hypertension & stage2 hypertension respectively. About 34.83% population used to add additional salt always and 20.62% of the people took at least a meal per day outside of home. According to BMI, almost half of the populations were overweight and majority of the female respondents were obese according to their waist circumference. Almost half of the study populations did not comply with the physical activity standard which might increase their chances for suffering from NCDs. The better part of the respondents took fruits and vegetable 5 or more days per week but didn't comply with the standard. A prominent portion of the study populations were advised by doctors to change their lifestyle. But after analysis, it can be mentioned that respondents had enough knowledge about the association of health problems with these modifiable risk factors of NCDs but they had the lack of proper practice. Action to reduce should focus on preventing and controlling the risk factors in a unified manner. Intervention at all levels of society is essential for prevention by increasing awareness of people about a perfect and healthy lifestyle.

Keywords: *NCDs, Hypertension, Diabetes, Modifiable risk factors, Non modifiable risk factors.*

Chapter 1

Introduction

1.1 Overview

Non-communicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviors factors. NCDs disproportionately affect people in low- and middle-income countries where more than three quarters of global NCD deaths – 31 million – occur (WHO, 2017).

The World Health Organization (WHO) has identified four main categories of NCDs: cardiovascular diseases such as heart attacks and strokes; chronic respiratory diseases like chronic obstructive pulmonary disease and asthma; cancers; and diabetes. These diseases share four key risk factors— tobacco use, harmful use of alcohol, physical inactivity, and unhealthy diet—all modifiable behaviors typically established during adolescence or young adulthood, and ones that set the stage for NCDs later in life (Naik and Kaneda, 2015).

World Health Organization (WHO), has recognized that it's a right of every human being to live a healthy life. However, based on the research evidence, a number of risk factors associated with non-communicable diseases (NCDs) jeopardize lives of millions of people world-wide. There are differences in risk factors exhibited per person depending on a number of distinguishing characteristics. The burden obviously increases cumulatively with the number of risk factors borne by an individual (Wesonga *et al*., 2016).

For a long time non communicable diseases (NCDs) were discussed as burden of the developed world. Recent alarming data show a reverse trend and a dramatic increase of NCDs in the developing world, in particular in highly populated transition countries. This is true for the main mortality triggering diseases such as CVD, cancer or diabetes. Almost 4 out of 5 NCD based deaths happen in low- and middle income countries. This development is multi-factorial and is based on some main trends such as globalization, supermarket growth, rapid urbanization and increasingly sedentary lifestyles. The latter leads to overweight or obesity, which again promotes NCDs similar as high blood pressure, high cholesterol and elevated blood glucose (Wagner and Brath, 2012).

This burden is one of the major public health challenges facing all countries, regardless of their economic status. NCDs threaten economic and social development and, without concerted efforts at country level, are predicted to increase in the coming decade. The rise

of no-communicable diseases and their impact in low- and middle income countries has gained increased attention in recent years (Swinburn, *et al*., 2013).

Non-communicable diseases (NCDs), such as cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases, are now the leading cause of death in most regions of the world (Naik and Kaneda, 2015).

Non-communicable diseases (NCDs) are the pivotal cause of disease burden and mortality in the Asia Pacific region, claiming 55% of total life in the South East Asia region each year and 75% in the Western Pacific region. The Asia Pacific region is experiencing a rapid increase in NCD-related deaths; the World Health Organization estimates that the highest worldwide increment in total mortality in a 10-year time frame (2005–2015) will be observed in the South-East Asia and Western Pacific regions with 21% increase in the South-East Asia region and 12.3 million deaths in the Western Pacific region. This increase in NCDs presents a major barrier to global development, specifically to the achievement of the Millennium Development Goals in low-and-middle income countries (Low, Lee and Samy, 2015).

The leading causes of NCD deaths in 2008 were cardiovascular diseases (17 million deaths, or 48 percent of all NCD deaths), cancers (7.6 million, or 21 percent of all NCD deaths), and respiratory diseases, including asthma and chronic obstructive pulmonary disease (4.2 million). Diabetes caused another 1.3 million deaths. Diabetes rarely is listed as the cause of death on a death certificate. Many people with diabetes die of a heart attack or stroke and their deaths are reflected in cardiovascular disease statistics (Hunter and Reddy, 2013).

1.2 Global Conditions of NCD

Non-communicable diseases (NCDs), including cardiovascular diseases, cancer, diabetes and chronic respiratory diseases, and their key risk factors– tobacco, harmful use of alcohol, unhealthy diet and physical inactivity – remain the leading causes of death globally. NCDs are currently responsible for almost 70% of global deaths, the majority occurring in low- and middle-income countries. In recent years NCDs have been increasingly in the spotlight of the global public health community and national leaders (WHO, 2015).

The latest Global Burden of Disease 2013 study, covering 188 countries, showed the rising importance of NCDs as a cause of global death and disability (GBD 2013 Mortality

and Causes of Death Collaborators, 2013). NCDs are now the leading cause of death in most countries in the Pacific, ranging from an estimated 60 percent of deaths in Solomon Islands to 77 percent of deaths in Fiji (WHO, 2014). NCDs are also an important driver of premature (< age 70 years) deaths in most of the Pacific, with rates measurably higher than lower middle-income global averages. Over half (54 percent) of all male deaths and nearly half (48 percent) of all female deaths were premature in Nauru (WHO, 2011).

The health care needs of the world's population are likely to undergo dramatic changes due to the ongoing demographic transition. Non-communicable diseases (NCDs), such as diabetes, cancer, depression and heart disease, are rapidly replacing infectious diseases and malnutrition as the leading causes of disability and premature death. Eighty per cent of total deaths due to non-communicable diseases occur in the low income countries. Men and women are equally affected. Cancer, cardiovascular diseases (CVD) and diabetes are becoming of serious concern, accounting for 52 per cent of deaths and 38 per cent of disease burden in the WHO South East Asia Region (SEAR). With the current trends, the top five causes of disability adjusted life years (DALYs) lost in 2020 are likely to be ischemic heart disease, unipolar major depression, road traffic injuries, cerebrovascular diseases, and chronic obstructive lung disease. It has been estimated that a 2 per cent reduction in chronic diseases death rates per year globally could result in saving about 36 million premature deaths by the year 2015 (Mathur and Shah, 2010).

Current global mortality from non-communicable diseases (NCDs) remains unacceptably high and is increasing. Thirty-eight million people die each year from NCDs, mainly from cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. Over 14 million deaths from NCDs occur between the ages of 30 and 70, of which 85% are in developing countries. These premature deaths are largely preventable by governments implementing simple measures which reduce risk factors for NCDs and enable health systems to respond (WHO, 2014).

The international health focus in the past two decades has been on the problem of infectious diseases, with non-communicable diseases (NCDs) given a low priority at global level. However recognition is increasing of the double burden in developing countries of chronic communicable diseases (e.g. tuberculosis and HIV) and chronic NCDs, based on emerging country-level evidence. Attention to chronic NCDs is now increasing for several reasons: 1) they have a huge negative economic impact and represent a significant impediment to human development; 2) the effects of globalization

are likely to have a particular impact on chronic NCDs, including diabetes, hypertension, smoking-related conditions and obesity; and 3) recent progress in mobilizing funds and improving the response to infectious diseases (especially HIV/AIDS, tuberculosis and malaria) has enabled a shift to a broader global health outlook (Maher *et al*., 2009).

63% of all deaths worldwide currently stem from NCDs – chiefly cardiovascular diseases, cancers, chronic respiratory diseases and diabetes. These deaths are distributed widely among the world's population – from high-income to low-income countries and from young to old (about one-quarter of all NCD deaths occur below the age of 60, amounting to approximately 9 million deaths per year). NCDs have a large impact, undercutting productivity and boosting healthcare outlays. Moreover, the number of people affected by NCDs is expected to rise substantially in the coming decades, reflecting an ageing and increasing global population (Bloom, *et al*., 2012).

The UN High-Level Meeting on Non-Communicable Diseases (NCDs) in September, 2011, is an unprecedented opportunity to create a sustained global movement against premature death and preventable morbidity and disability from NCDs, mainly heart disease, stroke, cancer, diabetes, and chronic respiratory disease. The increasing global crisis in NCDs is a barrier to development goals including poverty reduction, health equity, economic stability, and human security. *The Lancet* NCD Action Group and the NCD Alliance propose five overarching priority actions for the response to the crisis— leadership, prevention, treatment, international cooperation, and monitoring and accountability—and the delivery of five priority interventions—tobacco control, salt reduction, improved diets and physical activity, reduction in hazardous alcohol intake, and essential drugs and technologies. The priority interventions were chosen for their health effects, cost-effectiveness, low costs of implementation, and political and financial feasibility. The most urgent and immediate priority is tobacco control. We propose as a goal for 2040, a world essentially free from tobacco where less than 5% of people use tobacco. Implementation of the priority interventions, at an estimated global commitment of about US$9 billion per year, will bring enormous benefits to social and economic development and to the health sector. If widely adopted, these interventions will achieve the global goal of reducing NCD death rates by 2% per year, averting tens of millions of premature deaths in this decade (Beaglehole, *et al*; 2011)

The 2010 NCD CCS was undertaken by sending a written questionnaire, during 2009 and 2010, to NCD focal points or designated colleagues within the ministry of health or a

national institute or agency in all 193 WHO Member States. Upon receipt of the completed questionnaires, additional validation on a number of survey item responses was carried out by the WHO Secretariat. A further round of consultation and updating with Member States was undertaken during July 2011. The final completion rate was particularly high – 96% (i.e. 185 countries). The results from the 2010 survey were compared with results from an earlier survey conducted by WHO in 2000 to assess changes in capacity and response over this 10-year period. In the 2000 survey, fewer Member States responded (163 countries) and the questionnaire was less comprehensive, allowing for only a limited number of questions to be compared across the two surveys.

Analysis of responses from the 2010 survey showed that 89% of countries reported having a unit, branch or department in their ministry of health with responsibility for NCDs. Eighty per cent (80%) of countries reported that funding is available for NCD treatment and control and 81% had funding for NCD prevention and health promotion. Major sources of funding for NCDs included government revenues (84% of countries), international donors (56%), health insurance (39%), and earmarked taxes (20%). Ninety per cent of countries (90%) have at least one agency, institute, academic centre or other government department that supports the ministry of health (or equivalent) in their NCD efforts.

Ninety-two per cent of countries (92%) have developed at least one policy, plan, or strategy to address NCDs and/or their risk factors. However, many fewer reported that such policies were operational or funded. While 92% of countries have at least one policy, only 79% have at least one operational policy and only 71% have at least one operational policy with dedicated funding.

For NCD surveillance, only 48% of countries reported including population-based mortality data and only 23% reported including population-based morbidity data in their national health reporting systems. Fifty-nine per cent of countries (59%) include data on NCD risk factors in their national health reporting system and 49% have population-based NCD risk factor data.

Eighty-five per cent of countries (85%) provide primary prevention and health promotion risk factor detection (77%) and risk factor and disease management (81%) in their primary health care systems. However, fewer countries have support for self-help and

self-care (58%) or home-based care (50%) in their primary health care systems (WHO, 2011).

1.3 List of Non-communicable Diseases

In this, we will give some examples of non-communicable disease and a non-communicable diseases list. Genetic diseases are caused by hereditary factors passed down by parents to children and also along extended generational lines. Chromosomal errors passed on to offspring result in a long list of recognized clinical diseases. Environmental diseases often are the result of the interplay between a combination of environmental exposures, lifestyle factors, diet and occupational hazards.

Table 1.1: List of Non-communicable Diseases

Genetic Diseases	Environmental Diseases
✓ Achondroplasia,	✓ Appendicitis
✓ Albinism	✓ Anorexia nervosa
✓ Bardet- Biedl syndrome	✓ Arteriosclerosis
✓ Bipolar disorder	✓ Asthma
✓ Canavan disease	✓ Carpal tunnel syndrome
✓ Color blindness	✓ Chronic obstructive pulmonary diseases
✓ Cystic fibrosis	
✓ Down's syndrome	✓ Emphysema
✓ Fragile X syndrome	✓ Fetal alcohol syndrome
✓ Galactosemia	✓ Glaucoma
✓ Hemophilia	✓ Fibromyalgia
✓ Krabbe disease	✓ Hyperthyroidism
✓ Muscular dystrophy	✓ Hypothyroidism
✓ Neurofibromatosis	✓ Irritable Bowel Syndrome
✓ Noonan syndrome	✓ Liver cirrhosis
	✓ Narcolepsy

✓ Osteogenesis

✓ Patau syndrome

✓ Sickle-cell disease

✓ Tay-Sachs disease

✓ Triple X syndrome

✓ Turner syndrome

✓ Usher syndrome

✓ Von Hippel -Lindau syndrome

✓ Waardenburg syndrome

✓ Wilson's disease

✓ Osteoporosis

✓ Sudden infant death syndrome

(SIDS)

✓ Tick paralysis

(WMA, 2016)

1.4 Major Non Communicable Diseases

1.4.1 Cardiovascular disease (CVD)

CVD is the name for the group of disorders of the heart and blood vessels and include hypertension (high blood pressure), coronary heart disease (heart attack), cerebrovascular disease (stroke), peripheral vascular disease, heart failure, rheumatic heart disease, congenital heart disease and cardiomyopathies. Many of these conditions can be life-threatening. Worldwide, an estimated 17 million people die of these diseases, particularly heart attacks and strokes, every year. Once associated with industrialized countries, CVDs are now emerging or rapidly increasing in developing countries. Indeed, in 1998, 86% of the DALYs caused by CVDs were attributed to developing countries and in 1999 CVDs contributed to a third of global deaths with 78% in low- and middle-income countries. The trend is increasing, indicating that by the year 2010 CVDs will be the leading cause of death in developing countries as a consequence of lifestyle changes brought about by industrialization and urbanization in developing countries engaged in the socio-economic transition. CVDs are promoted by risk factors like tobacco use, alcohol, physical inactivity and unhealthy diet. Unfortunately, the harm caused by these

risk factors affects the rise of life expectancy in developing countries (Boutayeb and Boutayeb, 2005).

1.4.1.1 Hypertension

Blood pressure is the force of blood against the artery walls as it circulates through the body. High blood pressure or hypertension is the constant pumping of blood through blood vessels with excessive force.

An elevated blood pressure (BP) is defined as a systolic blood pressure (SBP) > 140 mm Hg or diastolic blood pressure (DBP) > 90 mm Hg or both. Hypertension is one of the most prevalent and powerful contributors to cardiovascular diseases, the leading cause of death in the United States. There is, on average, a 20 mm Hg systolic and 10 mm Hg diastolic increment increase in blood pressure from age 30 to 65 years. Isolated systolic hypertension is the dominant variety. There is no evidence of a decline in the prevalence of hypertension over 4 decades despite improvements in its detection and treatment. Hypertension contributes to all of the major atherosclerotic cardiovascular disease outcomes increasing risk, on average, 2- to 3-fold. Coronary disease, the most lethal and common sequela, deserves highest priority. Hypertension clusters with dyslipidemia, insulin resistance, glucose intolerance, and obesity, occurring in isolation in less than 20%. The hazard depends on the number of these associated metabolically linked risk factors present. Coexistent overt cardiovascular disease also influences the hazard and choice of therapy (Kannel, 1996).

1.4.1.2 The AHA Recommendation for Healthy Blood Pressure

This blood pressure chart reflects categories defined by the American Heart Association.

Table 1.2: Blood Pressure Chart

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Low blood pressure (Hypotension)	less than 90	or	less than 60
Normal	90 to 120	and	60 to 80
Prehypertension	120-139	or	80-89
High Blood Pressure (Hypertension Stage 1)	140-159	or	90-99
High Blood Pressure (Hypertension Stage 2)	160 or higher	or	100 or higher
High Blood Pressure Crisis (Seek Emergency Care)	180 or higher	or	110 or higher

(American Heart Association, 2016)

1.4.1.3 Causes of Hypertension

Primary hypertension is unlikely to have a specific cause but is instead usually a result of multiple factors, including blood plasma volume and activity of the renin-angiotensin system, the hormonal regulator of blood volume and pressure. Primary hypertension is also influenced by environmental factors, including lifestyle-related issues as outlined above.

Secondary hypertension has specific causes - that is, it is secondary to another problem. One example, now thought to be one of the most common causes of treatment-resistant hypertension, is primary aldosteronism, a hormone disorder causing an imbalance between potassium and sodium levels, thus leading to high blood pressure.

Primary aldosteronism may account for some 5-15% of cases of hypertension. It is important that physicians determine if the condition is caused by hyperplasia of the a drenal gland(s) or an adrenal gland tumor as treatments differ between the two.

Common reversible causes are excessive intake of alcohol and use of oral contraceptives, which can cause a slight rise in blood pressure; hormone therapy for menopause is also a culprit. Secondary hypertension can also result from:

- ✓ Diabetes (both due to kidney problems and nerve damage)

- ✓ Kidney disease

- ✓ Pheochromocytoma (a cancer)

- ✓ Cushing syndrome (which can be caused by use of corticosteroid drugs)

- ✓ Congenital adrenal hyperplasia (disorder of the adrenal glands, which secrete the hormone cortisol)

- ✓ Hyperthyroidism (overactive thyroid gland).

- ✓ Hyperparathyroidism (which affects calcium and phosphorous levels)

- ✓ Pregnancy

- ✓ Sleep apnea

- ✓ Obesity (MacGill, 2016a)

1.4.1.4 Secondary Hypertension

In 5-10 percent of high blood pressure cases, the HBP is caused by a pre-existing problem. This type of HBP is called secondary hypertension because another problem was present first. Factors that may lead to secondary hypertension include:

- ✓ Kidney abnormality, including a tumor on the adrenal gland, which is located on top of the kidneys

- ✓ A structural abnormality of the aorta (the large blood vessel leaving the heart) that has existed since birth

- ✓ Narrowing of certain arteries

High blood pressure is just one condition that increases your risk of heart disease and stroke (American Heart Association, 2016).

1.4.1.5 Consequences of High Blood Pressure

Uncontrolled high blood pressure (HBP) can injure or kill you. It's sometimes called "the silent killer" because HBP has no symptoms, so you may not be aware that it's damaging

your arteries, heart and other organs. Possible health consequences that can happen over time when high blood pressure is left untreated include:

✓ Damage to the heart and coronary arteries, including heart attack, heart disease, congestive heart failure, aortic dissection and atherosclerosis (fatty buildups in the arteries that cause them to harden) – HBP can damage arteries that can become blocked. HBP can cause the heart to enlarge and fail to supply blood to the body.

✓ Stroke- HBP damage arteries that burst or clog more easily.

✓ Kidney damage- HBP can cause arteries around the kidneys to narrow and weaken or harden so that kidneys lose their ability to filter blood.

✓ Vision loss- HBP can strain the vessels in the eyes.

✓ Erectile dysfunction- HBP leads to erectile dysfunction because of reduced blood flow throughout the body.

✓ Memory loss

✓ Fluid in the lungs

✓ Angina

✓ Peripheral artery disease (American Heart Association, 2016).

1.4.1.6 Risk Factors of High Blood Pressure

✓ Age

✓ Heredity (including race)

✓ Gender (male)

✓ Overweight or obesity

✓ Smoking

✓ Excess salt intake

✓ Drinking alcohol

✓ Family history

✓ High cholesterol

✓ Diabetes

✓ Physical inactivity (American Heart Association, 2016).

1.4.1.7 Prevention and Treatment

Lifestyle changes are important for both treatment and prevention of high blood pressure, and they can be as effective as a drug treatment. The added advantage is that here are wider effects on heart health. The lifestyle measures that are recommended by experts and shown to reduce blood pressure are:

✓ **Salt restriction** - typical salt intake is between 9 and 12 g a day and modest blood pressure reductions can be achieved even in people with normal levels by lowering salt to around 5 g a day - with a bigger effect in hypertensive people

✓ **Moderation of alcohol consumption** - expert guidelines say moving from moderate to excessive drinking is "associated both with raised blood pressure and with an increased risk of stroke"

✓ **High consumption of vegetables and fruits and low-fat** - the Mediterranean diet has been found to be protective, and people with high blood pressure are advised to eat fish at least twice a week and between 300 and 400 g of fruit and vegetables a day

✓ **Reducing weight and maintaining it** - hypertension is closely correlated with excess body weight, and weight reduction is followed by a fall in blood pressure

✓ **Regular physical exercise** - guidelines say "hypertensive patients should participate in at least 30 min of moderate-intensity dynamic aerobic exercise (walking, jogging, cycling or swimming) on 5 to 7 days a week."

Smoking can also raise blood pressure, and because of its wider heart and other health risks, too, giving up is also a lifestyle measure people with blood pressure can benefit from (MacGill and Webberley, 2016).

1.4.1.8 Drug treatments for Hypertension

Doctors will prescribe medication alongside lifestyle measures to lower blood pressure in people with a level above 140 over 90, although lifestyle measures are usually pursued first.

Drugs are usually started as monotherapy (just one drug) and at a low dose initially. If there are any side-effects associated with drugs, they are usually minor. A number of different classes of drug are available and all are suitable for lowering blood pressure:

- ✓ Diuretics (including thiazides, chlorthalidone and indapamide),
- ✓ Beta-blockers
- ✓ Calcium antagonists
- ✓ Angiotensin-converting enzyme (ACE) inhibitors
- ✓ Angiotensin receptor blockers.

The choice of drug depends on the individual and any other conditions they may have. While a single drug is usually tried in monotherapy first, a combination of at least two antihypertensive drugs is usually required (MacGill and Webberley, 2016).

1.4.2 Diabetes

The recent statistics released by the World Health Organization and the International Diabetes Federation are alarming. The number of diabetes in the world is expected to increase from 194 Million in 2003 to 330 in 2030 with three in four living in developing countries. Moreover, in developed countries most people with diabetes are above the age of retirement, whereas in developing countries those most frequently affected are aged between 35 and 64 which makes the burden in terms of DALYs and YLDs heavier in poorer countries. The burden is exacerbated by the complications such as blindness, amputations and kidney failure for which diabetes is the leading cause, and the interfering action of CVDs which are responsible for between 50 and 80% of deaths in people with diabetes. The burden of premature death from diabetes is similar to that of HIV/AIDS, yet the problem is largely unrecognized (Boutayeb and Boutayeb, 2005).

1.4.2.1 Diabetes Mellitus

Whether glucose is absorbed by the digestive tract or manufactured and released by the liver, very little glucose leaves the body once it has entered the bloodstream. The kidneys reabsorb virtually all glucose, so glucose does not appear in the urine. However, in diabetes mellitus, glucose accumulates in the blood and urine as a result of faulty glucose metabolism. Diabetes mellitus can be caused by genetic abnormalities, and some of the genes responsible have been identified. Mutations that result in inadequate insulin

production, the synthesis of abnormal insulin molecules, or the production of defective receptor proteins produce comparable symptoms. Under these conditions, obesity accelerates the onset and severity of the disease. Diabetes mellitus can also result from other pathological conditions, injuries, immune disorders, or hormonal imbalances (Martini, Nath and Bartholomew, 2015).

1.4.2.2 Type 1 Diabetes

Type 1 diabetes is usually diagnosed in children and young adults, and was previously known as juvenile diabetes. Only 5% of people with diabetes have this form of the disease. In type 1 diabetes, the body does not produce insulin. The body breaks down the sugars and starches you eat into a simple sugar called glucose, which it uses for energy. Insulin is a hormone that the body needs to get glucose from the bloodstream into the cells of the body. With the help of insulin therapy and other treatments, even young children can learn to manage their condition and live long, healthy lives (American Diabetes Association, 2017).

1.4.2.3 Causes of Type 1 Diabetes

Type 1 encompasses the majority of cases which are primarily due to pancreatic islet beta-cell destruction leading to absolute insulin deficiency and are prone to ketoacidosis. Type 1 includes those cases attributable to an autoimmune process, as well as those with beta cell destruction and who are prone to ketoacidosis for which neither an aetiology nor a pathogenesis is known (idiopathic). It does not include those forms of beta-cell destruction or failure to which specific causes can be assigned (e.g. cystic fibrosis, mitochondrial defects). Some subjects with this type can be identified at earlier clinical stages than 'diabetes mellitus' (Alberti, 1998).

1.4.2.4 Treatment for Type 1 Diabetes

Treatment for Type 1 Diabetes involves taking insulin, which needs to be injected through the skin into the fatty tissue below. The methods of injecting insulin include:

- Syringes

- Insulin pens that use pre-filled cartridges and a fine needle

- Jet injectors that use high pressure air to send a spray of insulin through the skin

- Insulin pumps that dispense insulin through flexible tubing to a catheter under the skin of the abdomen (WebMD, 2017).

1.4.2.5 Type 2 Diabetes

Diabetes is a problem with your body that causes blood glucose (sugar) levels to rise higher than normal. This is also called hyperglycemia. Type 2 diabetes is the most common form of diabetes. If you have type 2 diabetes your body does not use insulin properly. This is called insulin resistance. At first, your pancreas makes extra insulin to make up for it. But, over time it isn't able to keep up and can't make enough insulin to keep your blood glucose at normal levels (American Diabetes Association, 2017).

1.4.2.6 Causes of Type 2 Diabetes

Type 2 includes the common major form of diabetes which results from defect(s) in insulin secretion, almost always with a major contribution from insulin resistance (Alberti, 1998). Insulin resistance is usually the precursor to type 2 diabetes - a condition in which more insulin than usual is needed for glucose to enter cells. Insulin resistance in the liver results in more glucose production while resistance in peripheral tissues means glucose uptake is impaired.

Three of the main risk factors for developing type 2 diabetes are:

- age – being over the age of 40 (over 25 for people of south Asian, Chinese, African-Caribbean or black African origin, even if you were born in the UK)

- genetics – having a close relative with the condition, such as a parent, brother or sister

- weight – being overweight or obese (NHS, 2016).

1.4.2.7 Drug Treatment for Type 2 Diabetes

a. **Metformin (Glucophage, Glumetza, others):** Generally, metformin is the first medication prescribed for type 2 diabetes. It works by improving the sensitivity of your body tissues to insulin so that your body uses insulin more effectively.

b. **Sulfonylureas:** These medications help your body secrete more insulin. Examples of medications in this class include glyburide (DiaBeta, Glynase), glipizide (Glucotrol) and glimepiride (Amaryl).

c. **Meglitinides:** These medications work like sulfonylureas by stimulating the pancreas to secrete more insulin, but they're faster acting, and the duration of their effect in the body is shorter.

d. **Thiazolidinediones:** Like metformin, these medications make the body's tissues more sensitive to insulin. Rosiglitazone and pioglitazone are examples of thiazolidinediones. his class of medications has been linked to weight gain and other more-serious side effects, such as an increased risk of heart failure and fractures. Because of these risks, these medications generally aren't a first-choice treatment.

e. **DPP-4 inhibitors:** These medications help reduce blood sugar levels, but tend to have a modest effect. Examples of these medications are sitagliptin, saxagliptin and linagliptin.

f. **GLP-1 receptor agonists:** These medications slow digestion and help lower blood sugar levels, though not as much as sulfonylureas. Their use is often associated with some weight loss. This class of medications isn't recommended for use by itself.

g. **SGLT2 inhibitors:** These are the newest diabetes drugs on the market. They work by preventing the kidneys from reabsorbing sugar into the blood. Instead, the sugar is excreted in the urine. Examples include canagliflozin and dapagliflozin. Side effects may include yeast infections and urinary tract infections, increased urination and hypotension.

h. **Insulin therapy:** Some people who have type 2 diabetes need insulin therapy as well. In the past, insulin therapy was used as a last resort, but today it's often prescribed sooner because of its benefits (Mayoclinic, 2017).

1.4.2.8 Gestational Diabetes Mellitus (GDM)

GDM is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The definition applies whether insulin or only diet modification is used for treatment and whether or not the condition persists after pregnancy. It does not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy (American Diabetes Association, 2003).

1.4.2.9 Prediabetes

Prediabetes is a condition in which individuals have blood glucose or A1c levels higher than normal but not high enough to be classified as diabetes. People with prediabtes have an increased risk of developing type 2 diabetes, heart disease, and stroke. Studies have

shown that people with prediabetes who lose weight and increase their physical activity can prevent or delay type 2 diabetes and in some cases return their blood glucose levels to normal (Centers for Disease Control and Prevention, 2011).

1.4.2.10 Secondary Diabetes

Secondary diabetes this is when diabetes is caused as the result of another condition, e.g. inflammation of the pancreas, or by the use of certain medication such as diuretics or steroids (the most common cause) (Henriksen, Nielsen and Beck-Nielsen, 2015).

1.4.2.11 Diagnosis of Diabetes

1. **Glucose tolerance test**

During this test, a glucose drink is given containing a standard amount of glucose (75g). Blood samples are taken before the drink is given and two hours later. The test is done after an overnight fast.

The following parameters are used to confirm a diagnosis of diabetes after a glucose tolerance test:

- ✓ A two-hour blood glucose level above 11.1mmol/l is a diagnosis of diabetes.
- ✓ A level below 7.8mmol/l is normal.

2. **The A1C test** is a blood test that estimates average glucose levels in your blood over the previous three months. Periodic A1C testing may be advised to see how well diet, exercise, and medications are working to control blood sugar and prevent organ damage. The A1C test is typically done a few times a year.

- ✓ at least 6.5% means diabetes
- ✓ between 5.7% and 5.99% means prediabetes
- ✓ less than 5.7% means normal

3. **The FPG (fasting plasma glucose) test**

- ✓ at least 126 mg/dl means diabetes
- ✓ between 100 mg/dl and 125.99 mg/dl means prediabetes
- ✓ less than`100 mg/dl means normal

An abnormal reading following the FPG means the patient has impaired fasting glucose (IFG)

4. **The OGTT (oral glucose tolerance test)**

   ✓ at least 200 mg/dl means diabetes

   ✓ between 140 and 199.9 mg/dl means prediabetes

   ✓ less than 140 mg/dl means normal

An abnormal reading following the OGTT means the patient has impaired glucose tolerance (IGT) (MacGill, 2016b).

1.4.2.12 Complications of Diabetes

Diabetes is justly recognized as an emerging global epidemic, representing one of the leading causes of morbidity and mortality worldwide. Hyperglycemia, the common characteristic of both type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM), has the potential to cause serious complications due to its insidious and chronic nature (Flower, 2008).

Acute complications

Type 1 and type 2 diabetes both carry a risk of complications, but this risk is dramatically reduced if diabetes, blood pressure and cholesterol levels are well controlled and if abstain from smoking.

The acute complications of diabetes include:

   ✓ low glucose level (called a hypoglycaemic attack or 'hypo'), caused by treatment with insulin or oral hypoglycaemic drugs that increase insulin secretion from the pancreas drugs that increase insulin secretion from the pancreas

   ✓ diabetic ketoacidosis, a life-threatening condition caused by the lack of insulin. This occurs mainly in type 1 diabetes, but a similar high-glucose emergency can occur in Type 2.

Late-stage diabetic complications:

   ✓ Retinopathy (eye disease) – this causes blindness in rare cases.

   ✓ Diabetic kidney disease, which can lead to kidney failure

   ✓ Diabetic neuropathy (nerve disease), which can cause foot ulcers and infections.

   ✓ Atherosclerosis (hardening of the arteries) – this happens in smokers, particularly, and those with high blood pressure and abnormal fat levels in the blood.

The main factors that increase your risk are:

- ✓ Smoking

- ✓ High blood pressure

- ✓ Raised levels of fats such as cholesterol in the blood.

By taking measures to address these issues, you will reduce your chance of developing complications such as heart disease (Henriksen, Nielsen and Beck-Nielsen, 2015).

1.4.3 Cancer

Cancer can be defined as a disease in which a group of abnormal cells grow uncontrollably by disregarding the normal rules of cell division. Normal cells are constantly subject to signals that dictate whether the cell should divide, differentiate into another cell or die. Cancer cells develop a degree of autonomy from these signals, resulting in uncontrolled growth and proliferation. If this proliferation is allowed to continue and spread, it can be fatal. In fact, almost 90% of cancer-related deaths are due to tumor spreading – a process called metastasis.

The foundation of modern cancer biology rests on a simple principle- virtually all mammalian cells share molecular network that control cell proliferation, differentiation and cell death. The prevailing theory which underpins research onto the genesis and treatment of cancer, is that normal cells are transformed into cancers as a result of changes in these networks at the molecular, biochemical and cellular level, and for each cell there is a finite number of ways this disruption can occur. Phenomenal advances in research in the past 50 years have given us an insight into how cancer cells develop this autonomy. We now define cancer as a disease that involves changes or mutations in the cell genome. These changes (DNA mutations) produce proteins that disrupt the delicate cellular balance between cell division and quiescence, resulting in cells that keep dividing to form cancers (Caldwell *et al*, 2010).

1.4.4 Asthma

Asthma is one of the most common chronic diseases of childhood, affecting more than 6 million children. Asthma is a chronic inflammatory lung disease that can cause repeated episodes of cough, wheezing and breathing difficulty. During an acute asthma episode, the airway lining. In the lungs becomes inflamed and swollen. In addition, mucus production occurs in the airway and muscles surrounding the airway spasm. Combined, these cause a reduction in air flow.

Asthma afflicts individuals, families, and society by causing symptoms and morbidity, but it rarely causes death. Thus NCD targets focused largely on preventing deaths are inappropriate for asthma. People with symptomatic asthma lose time off school or work and are less productive, with direct and indirect costs to themselves and society. Asthma most commonly starts in childhood, which is not a target age group of the NCD agenda. The present global prevalence of asthma symptoms (in the previous 12 months) in children is about 15%. The underlying prevalence seems to be lower in adults, but is still substantial, and the international patterns are similar to those in children in terms of geographical spread. The recent Global Burden of Disease report estimated that asthma was the 14th most important disorder in terms of global years lived with a disability (Pearce *et al.*, 2013).

1.4.5 Hyperlipidemia

Hyperlipidemia refers to elevated levels of lipids and cholesterol in the blood, and is also identified as dyslipidemia, to describe the manifestations of different disorders of lipoprotein metabolism. Although elevated low density lipoprotein cholesterol (LDL) is thought to be the best indicator of atherosclerosis risk, dyslipidemia can also describe elevated total cholesterol (TC) or triglycerides (TG), or low levels of high density lipoprotein cholesterol (HDL).

High concentrations of total and LDL cholesterol and low levels of high-density lipoprotein (HDL) cholesterol predict cardiovascular risk in both men and women. High triglyceride levels have been associated with greater risk in women only. The risk of cardiovascular disease increases by an average of 2% for each corresponding 1% rise in total cholesterol.

1.4.5.1 Causes of Hyperlipidemia

1. Lifestyle habits or treatable medical conditions. Lifestyle contributors include obesity, not exercising, and smoking

2. Diabetes (type 2)

3. Kidney disease

4. Pregnancy

5. An under active thyroid gland

6. Environmental and genetic factors

7. Alcohol

8. Monoclonal Gammopathy

9. Nephrotic Syndrome

10. Obstructive Jaundice

11. Hypothyroidism

12. Cushing's Syndrome

13. Anorexia Nervosa

14. Medications-

    - Thiazide Diuretics

    - Ciclosporin

    - Glucocorticoids

    - Beta Blockers

    - Retinoic Acid

15. High dietary simple carbohydrates

16. Estrogen therapy

17. Lipoprotein lipase mutations (Kumar *et al*., 2013).

The causes of hyperlipidemia are either genetic (familial or primary hyperlipidemia) or from a poor diet and other specific factors (secondary hyperlipidemia).

When the body cannot utilize or remove the excess fat, it accumulates in the blood. Over time, the buildup damages the arteries and internal organs. This process contributes to the development of heart disease.

In familial hyperlipidemia, the high cholesterol has nothing to do with poor habits but is caused by a genetic disorder.

A mutated gene passed down from either the mother or father causes a missing or malfunctioning LDL receptor. The LDL accumulates to dangerous amounts in the blood.

Certain ethnic groups such as French Canadians, Christian Lebanese, South African Afrikaners, and Ashkenazi Jews are at a higher risk of hereditary hyperlipidemia.

Other causes of hyperlipidemia may include excessive drinking of alcohol, obesity, side effects of medications such as hormones or steroids, diabetes, kidney disease, underactive thyroid gland, and pregnancy.

Most hyperlipidemia is caused by lifestyle habits or treatable medical conditions. Lifestyle contributors include obesity, not exercising, and smoking. Conditions that cause hyperlipidemia include diabetes, kidney disease, pregnancy, and an underactive thyroid gland (Davis, 2015).

1.4.5.2 Significance

In adults, LDL is strongly associated with a higher risk, and HDL is associated with a lower risk, of coronary heart disease (CHD). Lowering lipids through dietary or pharmacological therapy has been shown to decrease the incidence of atherosclerotic events. Since lipid levels have been observed to track into adulthood, adolescents with hyperlipidemia are also at greater CHD risk. The extent of abnormal lipids and other cardiovascular risk factors during childhood and adolescence is related to the severity of atherosclerosis seen in autopsies of young adults.

1.4.5.3 Risk Factors

Although hyperlipidemia is a frequent finding in all demographic groups that follow Western diets, it occurs somewhat more commonly in men. Additional risk factors include:

Uncontrollable High Cholesterol Risk Factors:

- ✓ **Gender:** After menopause, a woman's LDL cholesterol level ("bad" cholesterol) goes up, as does her risk for heart disease.

- ✓ **Age:** Your risk may increase as you get older. Men aged 45 years or older and women aged 55 years or older are at increased risk of high cholesterol and heart disease.

- ✓ **Family history:** Your risk of high cholesterol may increase if a father or brother was affected by early heart disease (before age 55) or a mother or sister was affected by early heart disease (before age 65).

Controllable Risk Factors for High Cholesterol Include:

- ✓ **Diet :** The trans fats, saturated fat, sugar, and (to a lesser extent) cholesterol in the food you eat raise total and LDL cholesterol levels.

- ✓ **Weight:** Being overweight can make your LDL cholesterol level go up and your HDL level go down.

- ✓ **Physical activity/ exercise :** Increased physical activity helps to lower LDL cholesterol and raise HDL cholesterol (the "good" cholesterol) levels. It also helps you lose weight (WebMD, 2017).

1.4.5.4 Treatment of Hyperlipidemia

Statins (HMG CoA reductase inhibitors)

- ✓ Decrease LDL, decrease TG, and increase HDL.

- ✓ Alcohol and grapefruit juice should be avoided when taking statins as they may interact with the medication.

- ✓ Statins need to be taken with the evening meal or at bedtime.

- ✓ Statins can be associated with mild liver enzyme elevations, GI disturbances, headaches, myalgias, and rash. It is important not to dismiss complaints of muscle aches in youth taking statins as it may indicate a rare side effect, rhabdomyolysis.

Bile-acid binding resins

- ✓ Decrease LDL and increase HDL levels; may n increase TG.

- ✓ GI disturbances (bloating, gas, abdominal pain constipation and heartburn) are common and hard to tolerate. Mixing the drug packet with applesauce or juice may make it more palatable.

- ✓ Absorption of various vitamins and minerals as well as certain medications such as iron, tetracycline, and penicillin is reduced. Therefore, bile acid binding resins should be taken 1 hour before or 6 hours after meals.

Fibrates

- ✓ Fibrates (eg, gemfibrozil, fenofibrate) are used as first-line treatment for elevated triglyceride concentrations and may be prescribed in combination with the above drug classes.

✓ Gallstones, dyspepsia, and myopathy may occur. Myopathy risk may be particularly high when fibrates are combined with statins.

Nicotinic acid (Niacin)

✓ Decrease LDL, decrease TG, increase HDL.

✓ Flushing, GI discomfort, and glucose intolerance are the most common side effects (Adams, 2013).

1.5 Modifiable Behavioral Risk Factors

Tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol increase the risk of NCDs.

✓ Tobacco accounts for around 6 million deaths every year (including from the effects of exposure to second-hand smoke), and is projected to increase to 8 million by 2030.

✓ About 3.2 million deaths annually can be attributed to insufficient physical activity.

✓ More than half of the 3.3 million annual deaths from harmful drinking are from NCDs.

✓ In 2010, 1.7 million annual deaths from cardiovascular causes have been attributed to excess salt/sodium intake (Lim, 2010).

1.5.1 Tobacco Use

Smoking is a major threat to health, given that more than one-fourth of the population are current smokers. A WHO study in 2004 found that 41% of the eight killer diseases (heart attack, stroke, oral cancer, larynx cancer, lung cancer, Buerger's disease, tuberculosis, and COPD) are attributable to tobacco usage. The Global Adult Tobacco Survey (GATS) conducted in 2009 reported data for those aged 15 years or older; ours is for 25 years or older. The prevalence figures in both these studies are almost the same when the analysis is done for the same age group, i.e., 25+ years (data not shown). Using these three sets of data, we suggest that tobacco consumption has reached a plateau in Bangladesh. Unlike in many other nations, smoking is very low among Bangladeshi women (1.3%). Smokeless tobacco is a common problem in both men and women, and deserves special emphasis. Unfortunately, it was not included in the Smoking Control Act 2005. Tobacco

consumption is more prevalent in rural areas compared to urban areas. Use of smokeless tobacco as a component of betel quid has very high cultural acceptance in Bangladesh. Therefore, culturally appropriate campaigning will be required. Considering its public health consequences, the aforesaid Act has already been amended in 2013, incorporating smokeless tobacco (Moniruzzaman *et al*., 2010).

1.5.2 Physical Inactivity

Physical inactivity is a term used to identify people who do not get the recommended level of regular physical activity. The American Heart Association recommends 30-60 minutes of aerobic exercise three to four times per week to promote cardiovascular fitness. National Institutes of Health, recommending adults to accumulate at least 30 minutes of moderate activity most days of the week. Moderate activities include pleasure walking, climbing stairs, gardening, yard work, moderate-to-heavy housework, dancing and home exercise. More vigorous aerobic activities, such as brisk walking running, swimming, bicycling, roller skating and jumping rope — done three or four times a week for 30-60 minutes — are best for improving the fitness of the heart and lungs (New York State, 1999).

Strong evidence shows that physical inactivity increases the risk of many adverse health conditions, including major non-communicable diseases such as coronary heart disease, type 2 diabetes, and breast and colon cancers, and shortens life expectancy. Because much of the world's population is inactive, this link presents a major public health issue. We aimed to quantify the effect of physical inactivity on these major non-communicable diseases by estimating how much disease could be averted if inactive people were to become active and to estimate gain in life expectancy at the population level.

Worldwide, we estimate that physical inactivity causes 6% (ranging from 3·2% in south east Asia to 7·8% in the eastern Mediterranean region) of the burden of disease from coronary heart disease, 7% (3·9–9·6) of type 2 diabetes, 10% (5·6–14·1) of breast cancer, and 10% (5·7–13·8) of colon cancer. Inactivity causes 9% (range 5·1–12·5) of premature mortality, or more than 5·3 million of the 57 million deaths that occurred worldwide in 2008. If inactivity were not eliminated, but decreased instead by 10% or 25%, more than 533 000 and more than 1·3 million deaths, respectively, could be averted every year. We estimated that elimination of physical inactivity would increase the life expectancy of the world's population by 0·68 (range 0·41–0·95) years (Lee, *et al.,* 2012).

1.5.3 Overweight & Obesity

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health.

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

The WHO definition is:

- ✓ BMI greater than or equal to 25 is overweight
- ✓ BMI greater than or equal to 30 is obesity.

BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals (WHO, 2016).

Overweight (refers to an excess amount of body weight that may come from muscles, bone, fat, and water) and Obesity (refers to an excess amount of body fat) lead to adverse metabolic changes such as insulin resistance, increasing blood pressure and cholesterol. Consequently, they promote CVDs, diabetes and many types of cancer. Worldwide, overweight affects 1.2 billion of which 300 million are clinically obese. In some developed countries like USA, the prevalence reaches 60% but developing countries have also a very high prevalence. More and more children are suffering from overweight and obesity. However, the most contrasting phenomenon is to find Overweight/Obesity and malnutrition side by side in low- and middle-income countries and hence contributing to the growing burden afflicting these countries. According to the International Obesity Task Force (IOTF) and the WHO World Health report 2002, about 60% of diabetes globally can be attributable to overweight and obesity. In other respects, it is estimated that 60% of world's population do not do enough physical activity (Boutayeb and Boutayeb, 2005).

1.5.3.1 Causes of Obesity and Overweight

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended. Globally, there has been:

- ✓ An increased intake of energy-dense foods that are high in fat; and

- ✓ An increase in physical inactivity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization.

- ✓ Changes in dietary and physical activity patterns are often the result of environmental and societal changes associated with development and lack of supportive policies in sectors such as health, agriculture, transport, urban planning, environment, food processing, distribution, marketing and education (WHO, 2016).

1.5.3.2 Control of Overweight and Obesity

Overweight and obesity, as well as their related noncommunicable diseases, are largely preventable. Supportive environments and communities are fundamental in shaping people's choices, making the healthier choice of foods and regular physical activity the easiest choice (accessible, available and affordable), and therefore preventing obesity. At the individual level, people can:

- ✓ limit energy intake from total fats and sugars;

- ✓ increase consumption of fruit and vegetables, as well as legumes, whole grains and nuts;

- ✓ Engage in regular physical activity (60 minutes a day for children and 150 minutes per week for adults).

Individual responsibility can only have its full effect where people have access to a healthy lifestyle. Therefore, at the societal level it is important to:

- ✓ support individuals in following the recommendations above, through sustained political commitment and the collaboration of many public and private stakeholders;

- ✓ make regular physical activity and healthier dietary choices available, affordable and easily accessible to all - especially the poorest individuals.

The food industry can play a significant role in promoting healthy diets by:

- ✓ reducing the fat, sugar and salt content of processed foods;

- ✓ ensuring that healthy and nutritious choices are available and affordable to all consumers;

- ✓ practicing responsible marketing especially those aimed at children and teenagers;

✓ Ensuring the availability of healthy food choices and supporting regular physical activity practice in the workplace (WHO, 2016).

1.5.4 Excess Salt Intake

High salt consumption contributes to raised blood pressure and increases the risk heart disease and stroke. Most people consume an average of 9-12 grams of salt each day – twice the recommended daily intake limit of 5 grams (sodium 2g/day). The increasing production of processed foods, rapid urbanization and changing dietary patterns are contributing to increased salt/sodium intake worldwide. If you already suffer from high blood pressure, reducing your salt intake could also reduce your risk of heart disease and stroke, according to the Centers for Disease Control and Prevention. Reducing salt intake has been identified as one of the most cost-effective measures countries can take to improve the health of their population. Reducing salt intake to recommended levels could prevent 2.5 million deaths every year. A 30% relative reduction in the mean population intake of salt/sodium by 2025 (WHO, 2016).

1.5.5 Metabolic/Physiological Risk Factors

These behaviors lead to four key metabolic/physiological changes that increase the risk of NCDs: raised blood pressure, overweight/obesity, hyperglycemia (high blood glucose levels) and hyperlipidemia (high levels of fat in the blood). In terms of attributable deaths, the leading metabolic risk factor globally is elevated blood pressure (to which 18% of global deaths are attributed) followed by overweight and obesity and raised blood glucose. Low- and middle-income countries are witnessing the fastest rise in overweight young children (Lim, 2010).

1.6 Other Conditions

A. Osteoporosis

This condition causes a decrease in bone mass which can make the bones brittle and at higher risk for damage. Around 80 percent of people who have osteoporosis are women. Additional factors which increase the risk of this disease are the presence of diseases such as rheumatoid arthritis, inactivity, low sex hormone levels or smoking.

B. Alzheimer's

This condition causes dementia in those in advanced age, or over 60 years old. Symptoms of this condition can vary but often include getting lost, memory loss, difficulty managing daily tasks or managing money, personality changes, loss of bodily control or delusions.

C. Heart Disease

This is a very broad category of diseases which impact the circulatory system or heart. This can include congenital heart disease, rhythm irregularities, heart failure, heart attack, unstable angina, mitral valve prolapse, aortic regurgitation, cardiogenic shock or endocarditis.

D. Fibromyalgia

This disease causes damage to soft tissue in the body. It can lead to sleep disturbance patterns, widespread pain, exhaustion or irregular heartbeat. With time the symptoms can progress causing cognitive or memory difficulties, jaw pain, nasal congestion, headaches or irritable bowel syndrome.

E. Lung Cancer

Lung cancer causes malignant cell growth in the lung tissue, often as a result of exposure to pollutants or the use of tobacco products. As many as 90 percent of lung cancer cases are caused by smoking with non-smokers having a very small risk of this disease.

F. Leukemia

Leukemia causes the body to produce abnormal blood cells that then release malignant cells into the bloodstream. Since the bloodstream carries these malignant cells throughout the body they can affect other tissues such as the nervous system, skin or liver. While this disease is often associated with children, most patients are actually men over 60.

G. Skin Cancer

Skin cancer is caused when ultraviolet rays damage the skin cells. This can appear anywhere on the body but is most common on the skin. Those that have low pigmentation in the skin such as redheads, blondes or those with blue eyes tend to be at higher risk for this disease. Limiting direct skin exposure can significantly reduce the risk of developing skin cancer and with early detection this disease is 95 percent curable.

H. Bipolar Disorder

Bipolar disorder, also known as manic-depressive illness, is a brain disorder that causes unusual shifts in mood, energy, activity levels, and the ability to carry out day-to-day tasks. There are four basic types of bipolar disorder; all of them involve clear changes in mood, energy, and activity levels. These moods range from periods of extremely "up," elated, and energized behavior (known as manic episodes) to very sad, "down," or hopeless periods (known as depressive episodes). Less severe manic periods are known as hypomanic episodes.

I. Liver Cirrhosis

Cirrhosis is a late stage of scarring (fibrosis) of the liver caused by many forms of liver diseases and conditions, such as hepatitis and chronic alcoholism. The liver carries out several necessary functions, including detoxifying harmful substances in your body, cleaning your blood and making vital nutrients. Decompensated cirrhosis is the term used to describe the development of specific complications resulting from the changes brought on by cirrhosis. Decompensated cirrhosis is life-threatening. The liver damage done by cirrhosis generally can't be undone. But if liver cirrhosis is diagnosed early and the cause is treated, further damage can be limited and, rarely, reversed.

J. Seizures or Epilepsy

Seizures are caused by a neurologic malfunction that causes abnormal electrical activity within the brain. These can be localized or cause symptoms such as numbness that stems from an explosive firing of nerves in the brain. Tumors or brain damage can cause someone to develop this disease. There is no cure for epilepsy but medications can help to reduce the frequency of seizures (Ali *et al*., 2015).

1.7 Prevention and Control of NCDs

To lessen the impact of NCDs on individuals and society, a comprehensive approach is needed that requires all sectors, including health, finance, foreign affairs, education, agriculture, planning and others, to work together to reduce the risks associated with NCDs, as well as promote the interventions to prevent and control them.

An important way to reduce NCDs is to focus on lessening the risk factors associated with these diseases. Low-cost solutions exist to reduce the common modifiable risk

factors (mainly tobacco use, unhealthy diet and physical inactivity, and the harmful use of alcohol) and map the epidemic of NCDs and their risk factors.

Other ways to reduce NCDs are high impact essential NCD interventions that can be delivered through a primary health-care approach to strengthen early detection and timely treatment. Evidence shows that such interventions are excellent economic investments because, if applied to patients early, can reduce the need for more expensive treatment. These measures can be implemented in various resource levels. The greatest impact can be achieved by creating healthy public policies that promote NCD prevention and control and reorienting health systems to address the needs of people with such diseases.

Lower-income countries generally have lower capacity for the prevention and control of non-communicable diseases. High-income countries are nearly 4 times more likely to have NCD services covered by health insurance than low-income countries. Countries with inadequate health insurance coverage are unlikely to provide universal access to essential NCD interventions (Mozaffarian, 2014).

1.8 Global Action Plan for the Prevention and Control of NCDs

More than 36 million die annually from NCDs (63% of global deaths), including 14 million people who die too young before the age of 70. More than 90% of these premature deaths from NCDs occur in low- and middle-income countries, and could have largely been prevented. Most premature deaths are linked to common risk factors, namely tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol.

To strengthen national efforts to address the burden of NCDs, the 66th World Health Assembly endorsed the WHO Global Action Plan for the Prevention and Control of NCDs 2013-2020. The global action plan offers a paradigm shift by providing a road map and a menu of policy options for Member States, WHO, other UN organizations and intergovernmental organizations, NGOs and the private sector which, when implemented collectively between 2013 and 2020, will attain 9 voluntary global targets, including that of a 25% relative reduction in premature mortality from NCDs by 2025.

The WHO Global NCD Action Plan 2013-2020 follows on from commitments made by Heads of State and Government in the United Nations Political Declaration on the Prevention and Control of NCDs, recognizing the primary role and responsibility of Governments in responding to the challenge of NCDs and the important role of international cooperation to support national efforts (WHO, 2013).

Chapter 2

Literature Review

Unlike many low and middle income countries, double burden diseases are serious problem in Bangladesh. Recently, proper understanding and the need for joint interventions against both infectious diseases and non-communicable diseases (NCD's) has been gradually arising. Cardiovascular diseases (CVD's), diabetes, cancers and chronic lung disease are the most frequent NCD's whereas acute respiratory diseases, diarrhea, neonatal sepsis and malaria are considered as infectious disease so far. Excess calories intake and unhygienic conditions are the most common risk factors, along with genetic predisposition and lifestyle choices. In addition, under nutrition in childhood also affects the human development in many aspects. The key controls of the situations are primary prevention through maintaining healthy life style during all phase of life. Action should focus controlling the risk factors in a unified fashion. Intervention at all levels of society, from communities to governments, private organizations and nongovernmental groups, is crucial for prevention by intensifying awareness of people about a perfect and healthy lifestyle (Islam, Rahman and Siddiqui, 2014).

NCDs are the leading cause of mortality worldwide and a serious public health threat to developing countries. Recognizing the importance and urgency of the issue, a one-day symposium was organized on NCDs in Developing Countries by the CIH^{LMU} Center for International Health, Ludwig-Maximilians-Universität, Munich on 22nd March 2014. The objective of the symposium was to understand the current situation of different NCDs public health programs and the current trends in NCDs research and policy, promote exchange of ideas, encourage scientific debate and foster networking, partnerships and opportunities among experts from different clinical, research, and policy fields. The symposium was attended by more than seventy participants representing scientists, physicians, academics and students from several institutes in Germany and abroad. Seven key note presentations were made at the symposium by experts from Germany, UK, France, Bangladesh and Vietnam (Islam *et al.,* 2014).

The most common NCDs are cardiovascular diseases (CVD), diabetes, cancer and chronic respiratory diseases. With the rapid increase in NCD-related deaths in Asia Pacific countries, NCDs are now the major cause of deaths and disease burden in the region. NCDs hamper achievement of the Millennium Development Goals (MDG). People in the low socio-economic group are most affected by NCDs as they have poor access to policies, legislations, regulations and healthcare services meant to combat NCDs. This results in loss of productivity by a decreasing labor force with implications at

the macroeconomic level. The 3 major NCDs in the Asia Pacific region are CVDs, cancer and diabetes due to the increasing loss of disability adjusted life years (DALYs). The 4 major behavioral risk factors for NCDs are: tobacco use, alcohol consumption, inadequate physical activity and unhealthy diet. The underlying risk factors are urbanization, globalization, sedentary lifestyle, obesity and hypertension. Strategies to combat NCDs in the Asia Pacific region are as follows: population-based dietary salt reduction, health education, psychological interventions, i.e., cognitive behavioral therapy and motivational-interviewing, taxation and bans on tobacco-related advertisements, implementing smoke-free zones and surveillance by the World Health Organization. Control measures must focus on prevention and strengthening inter-sectorial collaboration (Low, Lee and Samy, 2014).

Double burden diseases are a serious global problem, which is currently affecting many low and middle income countries, including Bangladesh. However, proper understanding of the need for a joint intervention against both infectious diseases and non-communicable diseases (NCD) has arisen only recently. Excessive intake of calories and poor health hygiene is one of the main common factors behind those conditions and risk factors, along with other lifestyle choices and genetic predisposition. The keys to controlling double burden diseases are primary prevention through promotion of healthy life style which is necessary during all phase of life. Action to reduce should focus on preventing and controlling the risk factors in an integrated manner. Intervention at all levels of society, from communities to governments, private organizations and non-governmental groups, is essential for prevention by amplifying awareness of people about a perfect and healthy lifestyle (Mahmood, Ali and Islam, 2013).

Analyzing cause of death (CoD) revealed that non-communicable diseases (NCDs) were the leading causes of deaths (37%), followed by communicable diseases (CDs) (22%), perinatal and neonatal conditions (11%), and injury and accidents (6%); the cause of remaining 24% of deaths could not be determined. Age specific mortality showed premature birth, respiratory infections, and drowning were the dominant causes of death for childhood mortality (0_14 years), which was inversely associated with socioeconomic status (SES) (pB0.04). For adult and the elderly (15 years and older), NCDs were the leading cause of death (51%), followed by CDs (23%). For adult and the elderly, NCDs concentrated among the population from higher SES groups (pB0.005), and CDs among the lower SES groups (pB0.001). Epidemiologic transition is taking place with a shift

from the dominance of CDs to NCDs. SES inequity in mortality still persists _ the poor suffer from CDs in all age groups, whereas those better off suffer more from NCDs than CDs. Policy makers thus need to consider the social distribution of diseases before developing any public health action targeted towards reducing mortality and the extent of disease burden in an equitable manner (Hanifi, Mahmood and Bhuiya, 2014).

The burden of NCDs in South Asia is rising at a rate that exceeds global increases in these conditions. Shifts in leading risk factors—particularly dietary habits, tobacco use and high blood pressure—are thought to underlie the mounting burden of death and disability due to NCDs. Improvements in life expectancy, increasing socioeconomic development and urbanization in South Asia are expected to lead to further escalation of NCDs. Although NCD burdens are currently largest among affluent groups in South Asia, many adverse risk factors are concentrated among the poor, portending a future increase in disease burden among lower income individuals. There continues to be a notable lack of national surveillance data to document the distribution and trends in NCDs in the region. Similarly, economic studies and policy initiatives addressing NCD burdens are still in their infancy. Opportunities for innovative structural and behavioral interventions that promote maintenance of healthy lifestyles—such as moderate caloric intake, adequate physical activity and avoidance of tobacco—in the context of socioeconomic development are abundant. Testing of health care infrastructure and systems that best provide low-cost and effective detection and treatment of NCDs is a priority for policy researchers (Siegel, Patel and Ali, 2014).

South Africa is in the midst of a profound health transition that is characterized by a quadruple burden of communicable, non-communicable, perinatal and maternal, and injury-related disorders. Non-communicable diseases are emerging in both rural and urban areas, most prominently in poor people living in urban settings, and are resulting in increasing pressure on acute and chronic health-care services. Major factors include demographic change leading to a rise in the proportion of people older than 60 years, despite the negative effect of HIV/AIDS on life expectancy. The burden of these diseases will probably increase as the roll-out of antiretroviral therapy takes effect and reduces mortality from HIV/AIDS. The scale of the challenge posed by the combined and growing burden of HIV/AIDS and non-communicable diseases demands an extraordinary response that South Africa is well able to provide. Concerted action is needed to strengthen the district-based primary health-care system, to integrate the care of chronic

diseases and management of risk factors, to develop a national surveillance system, and to apply interventions of proven cost-effectiveness in the primary and secondary prevention of such diseases within populations and health services (Mayosi, *et al*; 2009).

China has experienced an epidemiological transition shifting from the infectious to the chronic diseases in much shorter time than many other countries. The pace and spread of behavioral changes, including changing diets, decreased physical activity, high rates of male smoking, and other high risk behaviors, has accelerated to an unprecedented degree. As a result, the burden of chronic diseases, preventable morbidity and mortality, and associated health-care costs could now increase substantially. China already has 177 million adults with hypertension; furthermore, 303 million adults smoke, which is a third of the world's total number of smokers, and 530 million people in China are passively exposed to second-hand smoke. The prevalence of overweight people and obesity is increasing in Chinese adults and children, because of dietary changes and reduced physical activity. Emergence of chronic diseases presents special challenges for China's ongoing reform of health care, given the large numbers who require curative treatment and the narrow window of opportunity for timely prevention of disease (Yang, *et al.*; 2008).

High prevalence of smoking (22.8%) and the use of smokeless tobacco (43.4%) were observed among rural men compared to urban men (smoking-12.8% and smokeless tobacco consumption-23.1%). There was a significant difference in the average consumption of fruits and vegetables between urban (2.18±1.59 servings) and rural (1.78±1.48 servings) area. Prevalence of overweight and obesity was observed to be high among urban men and women in all age-groups compared to rural men and women. Prevalence of behavioural risk factors, overweight, and obesity increased with age in both the areas. Twenty-nine percent of the urban residents and 15.4% of the rural residents were found to have raised blood pressure, and the difference was found to be statistically significant (p<0.01). For both men and women, the prevalence of overweight and obesity, hypertension, and lack of physical activities were significantly higher in the urban population while smoking, smokeless tobacco consumption, poor consumption of fruits and vegetables were more prevalent in the rural population. The results highlight the need for interventions and approaches for the prevention of risk factors of non-communicable diseases in rural and urban areas (Bhagyalaxmi, Atul and Shikha, 2013).

Behavioral risk factors reduction is a key to Noncommunicable Diseases (NCDs) control. This survey on NCD risk factors was done in randomly selected cross-sectional sample of 443 rural individuals aged 15 years or older. More than three in ten people used tobacco in some form, and more than nine in ten used extra salt while taking meal. All of them had low fruit and vegetables intake (<5 gm/day). About four and one percent were taking medicines for hypertension and diabetes, respectively. In conclusion, prevalence of tobacco and added salt consumption is fairly high in this rural Bangladeshi sample. Local level health infrastructure and health workers should be used to control these risk factors in rural communities (Banik *et al*., 2017).

There is an increasing trend in developing countries, where the demographic and socio-economic transition imposes more constraints on dealing with the double burden of infectious and non-infectious diseases in a poor environment, characterized by ill-health systems. It is predicted that, by 2020, non-communicable diseases will cause seven out of every ten deaths in developing countries. Among non-communicable diseases, special attention is devoted to cardiovascular disease, diabetes, cancer and chronic pulmonary disease. The burden of these conditions affects countries worldwide but with a growing trend in developing countries. Preventative strategies must take into account the growing trend of risk factors correlated to these diseases. In parallel, despite the success of vaccination programmes for polio and some childhood diseases, other diseases like AIDS, tuberculosis, malaria and dengue are still out of control in many regions of the globe (Boutayeb, 2006).

The escalating burden of non-communicable diseases (NCDs) worldwide warrants an urgent public health response. Resource constraints and other factors necessitate an integrated and concerted approach to the range of NCDs. A necessary prerequisite for effective planning, implementation, and evaluation of NCD prevention programs is access to reliable and timely information on mortality, morbidity, risk factors, and their socioeconomic determinants. However, there is limited experience in the setting up of integrated NCD surveillance models in low-resource settings. As part of the National Action Plan for the Prevention and Control of NCDs in Pakistan, an integrated, systematic, and sustainable population-based NCD surveillance system is being established, and will be maintained and expanded over time. This is a common population surveillance mechanism for all NCDs (with the exception of cancer). The model includes population surveillance of main risk factors that predict many NCDs and combines

modules on population surveillance of injuries, mental health, and stroke. In addition, the model has been adapted for program evaluation; this will enable it to track implementation processes using appropriate indicators, facilitating an assessment of how interventions work and which components contribute most to success (Nishtar *et al.*, 2005).

Almost 4 out of 5 NCD based deaths happen in low- and middle income countries. This development is multi-factorial and is based on some main trends such as globalization, supermarket growth, rapid urbanization and increasingly sedentary lifestyles. The latter leads to overweight or obesity, which again promotes NCDs similar as high blood pressure, high cholesterol and elevated blood glucose. A high quality diet including functional food or functional ingredients, accompanied by physical activity and a non smoking policy, is one of the most promising factors in primary and secondary prevention of NCDs (Wagner and Brath, 2012).

Non-communicable diseases (NCDs) have become a major health priority in Brazil—72% of all deaths were attributable to NCDs in 2007. Morbidity and mortality due to NCDs are greatest in the poor population. Although the crude NCD mortality increased 5% between 1996 and 2007, age-standardised mortality declined by 20%. Declines were primarily for cardiovascular and chronic respiratory diseases, in association with the successful implementation of health policies that lead to decreases in smoking and the expansion of access to primary health care. Of note, however, the prevalence of diabetes and hypertension is rising in parallel with that of excess weight; these increases are associated with unfavourable changes of diet and physical activity. Brazil has implemented major policies for the prevention of NCDs, and its age-adjusted NCD mortality is falling by 1·8% per year. However, the unfavourable trends for most major risk factors pose an enormous challenge and call for additional and timely action and policies, especially those of a legislative and regulatory nature and those providing cost-effective chronic care for individuals affected by NCDs (Schmidt *et al.*, 2011).

Significance of the Study

Non-communicable diseases (NCDs) kill 40 million people each year, equivalent to 70% of all deaths globally. Each year, 15 million people die from a NCD between the ages of 30 and 69 years; over 80% of these "premature" deaths occur in low- and middle-income countries. Cardiovascular diseases account for most NCD deaths, or 17.7 million people annually, followed by cancers (8.8 million), respiratory diseases (3.9million), and diabetes (1.6 million). These 4 groups of diseases account for over 80% of all premature NCD deaths. Tobacco use, physical inactivity, the harmful use of alcohol and unhealthy diets all increase the risk of dying from a NCD (WHO, 2017).

In low and middle income countries, NCDs grew as a share of the major causes of death from 59% in 1990 to 64% in 2010 and were estimated at 67% in 2015 based on Global Burden of Disease report (Pariyo *et al*., 2017).

NCDs are already of major importance in developed countries and are rapidly becoming a major public health threat in the developing world. These diseases constituted 43% of the global burden of disease in 1999. Based on current trends, by 2020 they will account for 73% of deaths and 60% of the disease burden in the developing countries (WHO, 2011).

In Bangladesh (Chakaria), analyzing cause of death (CoD) revealed that non-communicable diseases (NCDs) were the leading causes of deaths (37%), followed by communicable diseases (CDs) (22%), perinatal and neonatal conditions (11%), and injury and accidents (6%); the cause of remaining 24% of deaths could not be determined. For adult and the elderly (15 years and older), NCDs were the leading cause of death (51%), followed by CDs (23%) (Hanifi, Mahmood and Bhuiya, 2014).

NCD associated risk factors are largely modifiable. Therefore, by identifying and preventing the risk factors, NCDs such as coronary heart disease and stroke would be prevented by 80%, cancer by 40% and type 2 diabetes by 90%. Projections by experts estimate that an annual reduction of chronic disease death rates by 2% in the next 10 years will account for 36 million lives be saved.5 In addition, one third of all cancers could be prevented by eating healthy food, maintaining normal weight and being physically active throughout the lifespan (WHO, 2011).

Regarding NCDs a few studies had done determine the presence and risk factors of NCDs in Bangladesh i.e., 'Prevalence of risk factors of non-communicable diseases in a rural

area of Bangladesh' (Ahmed *et al*; 2017); 'Shifting from infectious diseases to non-communicable diseases: A double burden of diseases in Bangladesh' (Mahmood, Ali and Islam, 2013); 'Prevalence of Behavioral Risk Factors of Noncommunicable Diseases in a Rural Population of Bangladesh' (Banik, *et al*., 2017) and 'Cause-specific mortality and socioeconomic status in Chakaria, Bangladesh' (Hanifi, Mahmood and Bhuiya, 2014).But there is no work done in Narayanganj district till now. So we are planning to investigate in Narayanganj people (including rural and urban area) whether they are suffering from NCDs and also determine the prevalence of risk factors among them. By doing this survey we can know which risk factor is more abundant to them and either they have any kind of knowledge about the risk factors of NCDs or not. From that, we can take steps to reduce the possible risk factors and to increase awareness among the people about NCDs.

Aims and Objective of the Study

The main objectives of the study are –

- ✓ To determine prevalence estimation of NCD risk factors of mass people for both male & female respondents of ≥18 years.

- ✓ To determine the Behavioral factors associated with non-communicable disease.

- ✓ To determine the Biological factors associated with non-communicable disease.

- ✓ To determine the knowledge and awareness regarding the Risk factors.

Chapter 3

Methodology

3.1 Type of the Study

It was a survey based study.

3.2 Study Area

The survey was conducted in different areas inside Narayanganj which includes some school & college too.

3.3 Study Population

In this study, a total number of 290 respondents out of mass people were surveyed with a questionnaire in order to assess the awareness and knowledge about behavioral and biological risk factor of non-communicable disease.

3.4 Inclusion Criteria

- Adult respondents (age ≥18)
- Male and Female respondents

3.5 Exclusion Criteria

- Unwilling person

3.6 Questionnaire Development

The pre-tested questionnaire was specially designed to collect the simple background data and the needed information. The questionnaire was written in simple English in order to avoid unnecessary semantic misunderstanding. The questionnaire was tested to ensure it was understandable by the participants. Extra space was however, allowed after some questions for the participants' comments; and in most cases, these were used as qualifying remarks which aided considerably in giving answers to specific questions and in providing additional information which assisted the interviewers in drawing up conclusions.

3.7 Sampling Technique
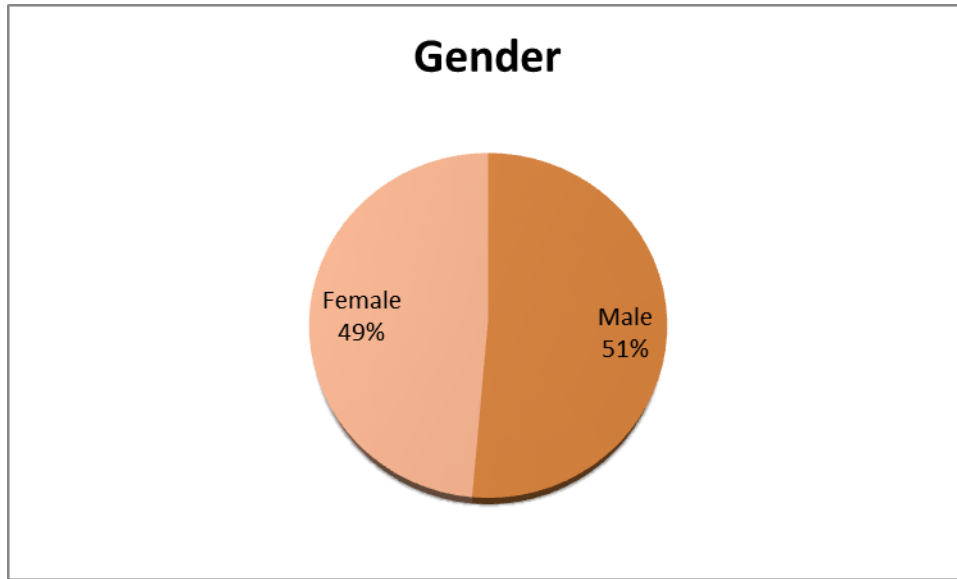
In this study convenient sampling technique was followed.

3.8 Data Analysis

After collecting, the data were checked and analyzed with the help of Microsoft Excel 2010. The result was shown in bar, pie and column chart and calculated the percentage of the awareness and disease.
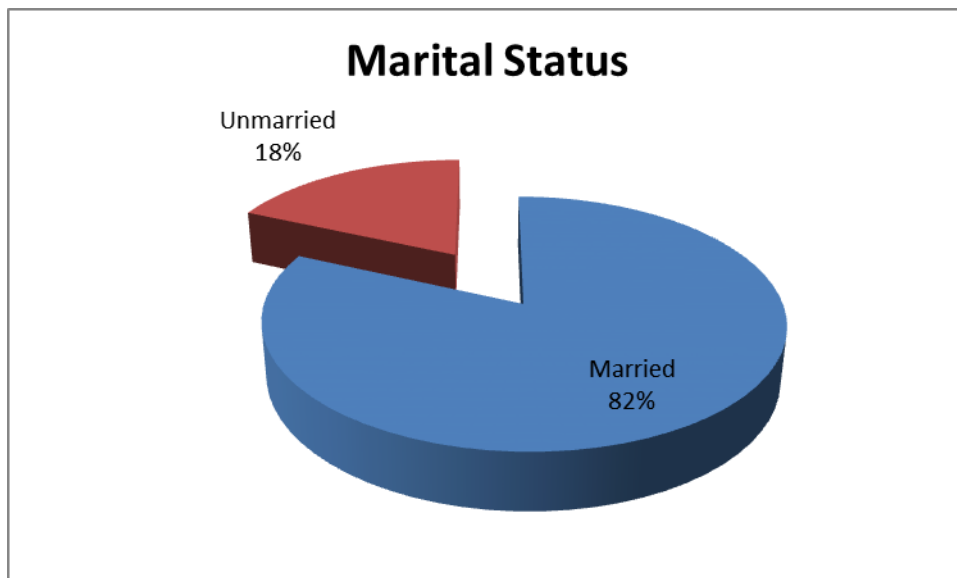
Chapter 4

Results

4.1 Gender Distribution of the Respondents

Figure 4.1: Gender Distribution of the Respondents

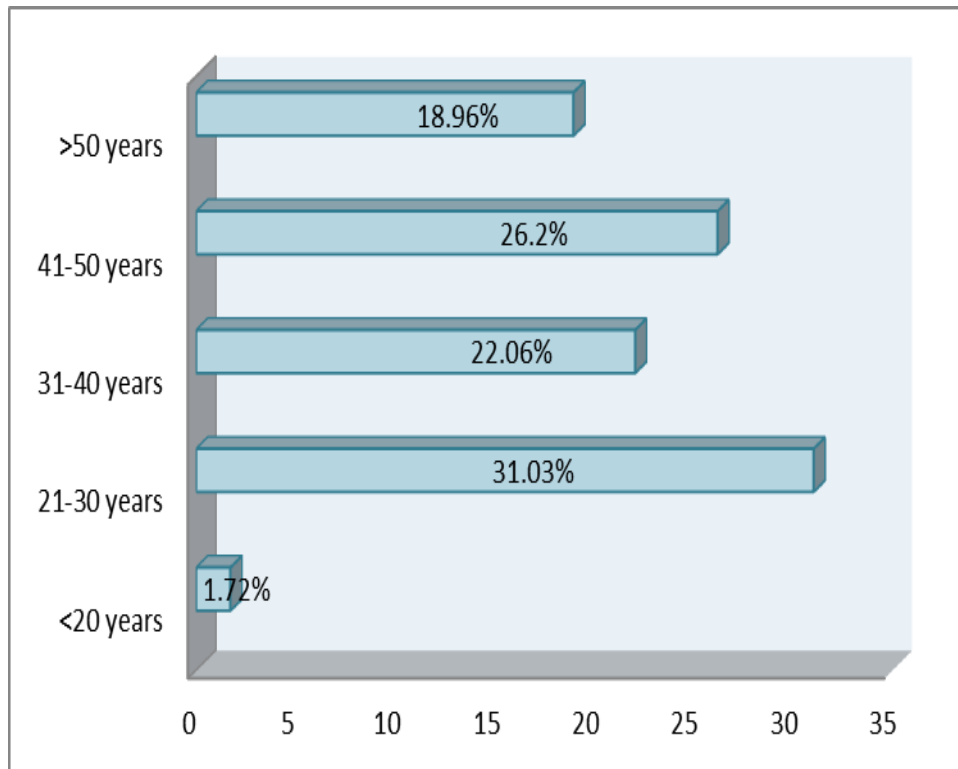In this study, around 51% population were male and 49% were female.

4.2 Marital Status of the Respondents

Figure 4.2: Marital Status of the Respondents

Among the respondents about 81.72% population were unmarried upon which the study was conducted, whereas, 18.28% were married.

4.3 Age Distribution of the Respondents

Figure 4.3: Age Distribution of the Respondents

During this study, it was found that about 31.03% population were in between 21 to 30 years, whereas, only 1.72% were within the range of below 20 years. However, 26.2% population were between 41 to 50 years of age and 22.06% population were within the 31-40 years range. Rest of the population which includes 18.96% were above 50 years.
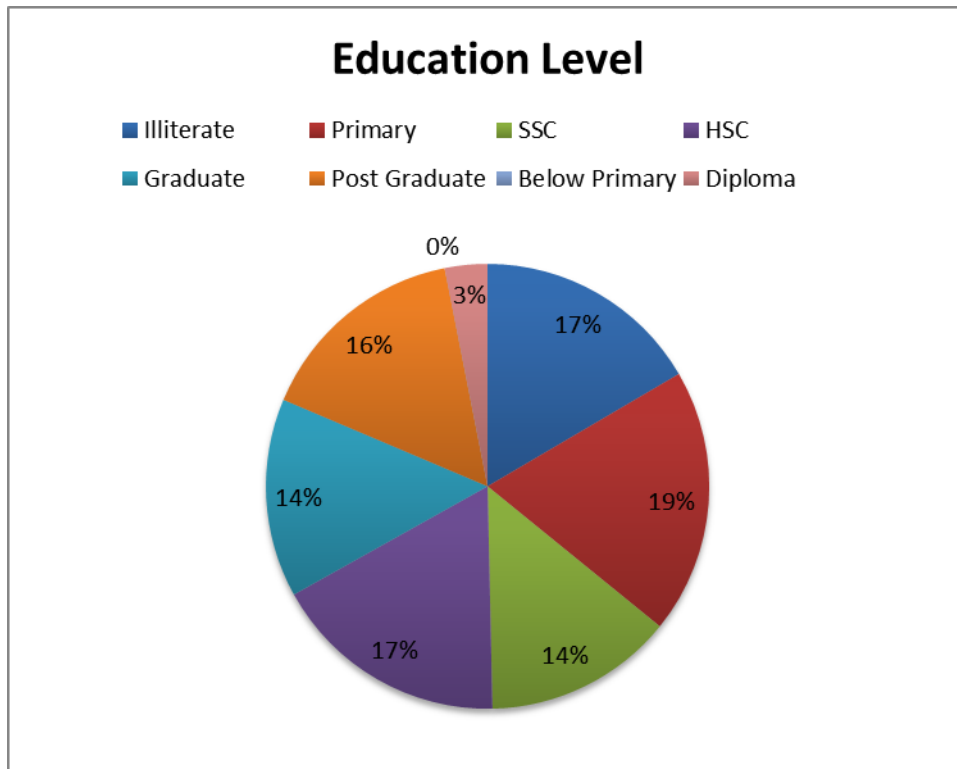
4.4 Residential Status of the Respondents
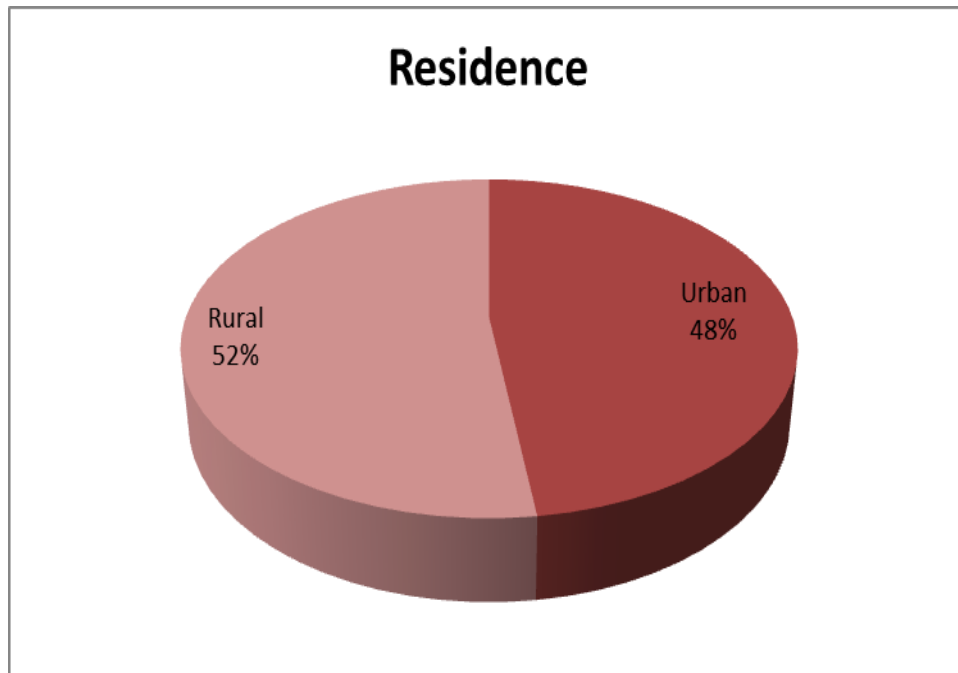
Figure 4.4: Residential Statuses of the Respondents

During this study it was found that about 52% population were living in rural region, the rest of the population were living in the cities or in urban areas includes around 48%.
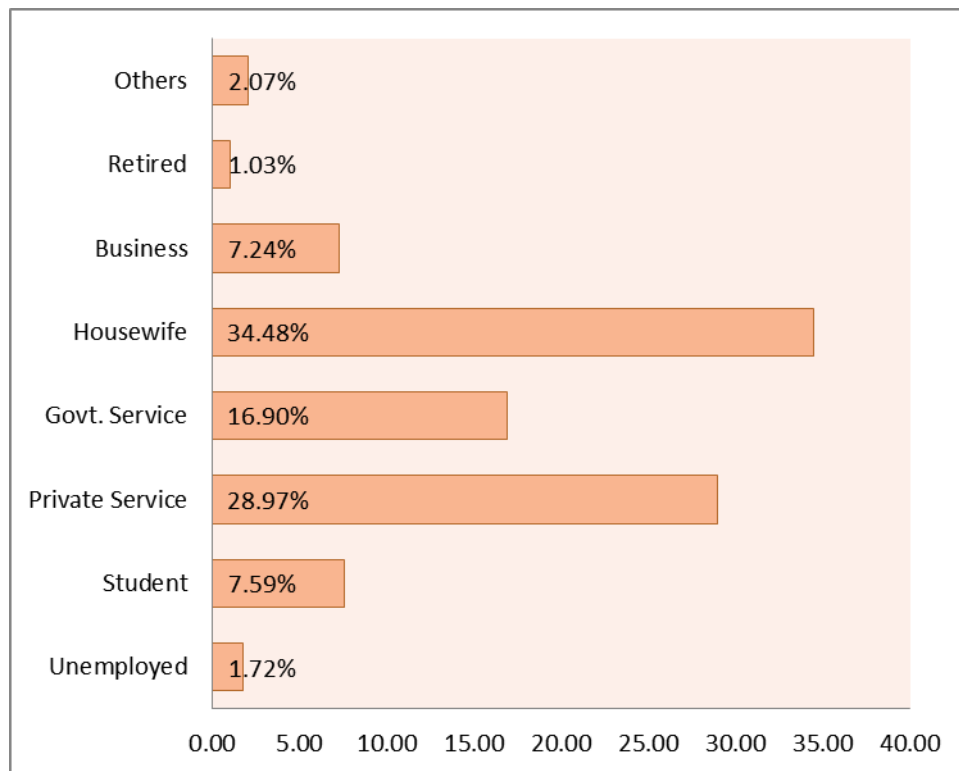
4.5 Educational Qualifications of the Respondents

Figure 4.5: Educational Qualification of the Respondents

During this study it was found that 17.24% of the population passed HSC level, whereas, 14.48% were Graduates and 15.52% of Post graduates people. Around, 13.79% population passed SSC level. 19.31% population also passed Primary education level and rest of the population which includes 16.55% of Illiterate and 3.10% of Diploma people.

## 4.6 Occupational Qualifications of the Respondents

Figure 4.6: Occupational Qualifications of the Respondents

Regarding their occupational qualification status about 34.48% population were housewife, whereas, 28.97% are working in the private sectors. Around, 16.90% population are Govt. Service holders. Around 2.07% population are pursuing others means for living. 7.24% of the population are businessmen. The rest of the population includes 1.03% of the retired people and 1.72% of the Unemployed people.

4.7 Monthly Family incomes of the Respondents
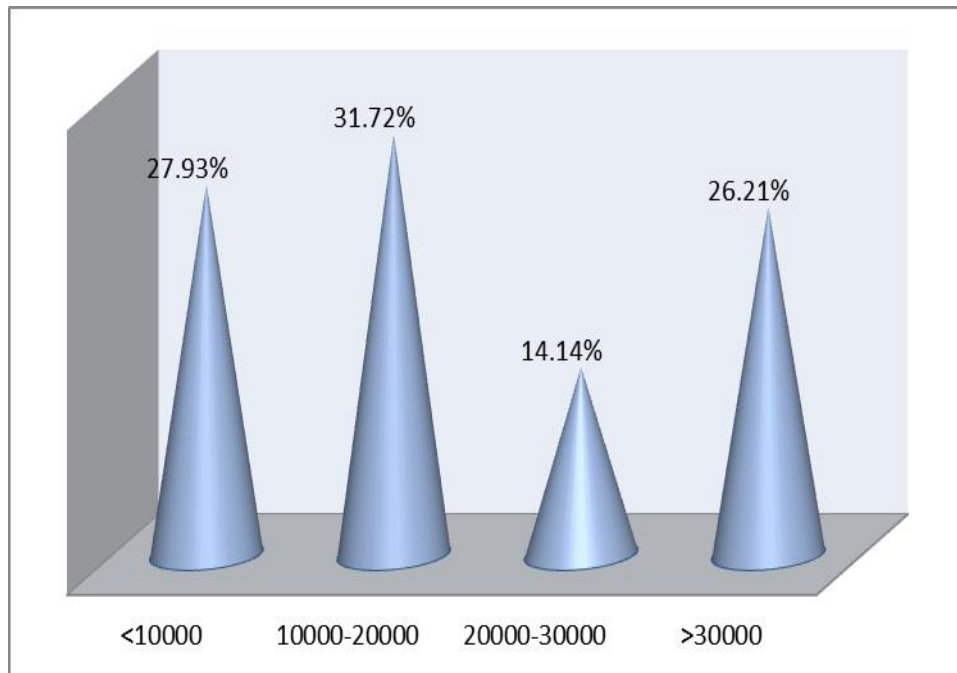
Figure 4.7: Monthly Family incomes of the Respondents

Regarding the respondents monthly family income about 31.72% population had monthly family income within the range of 10000-20000tk, whereas, 27.93% had earnings of <10000tk. Around 26.21% population are earning more than 30000tk. The rest of the population includes 14.14% of the people earning within the range of 20000-30000tk as their family income for a month.

4.8 Body Mass Index (BMI) Status of the Respondents
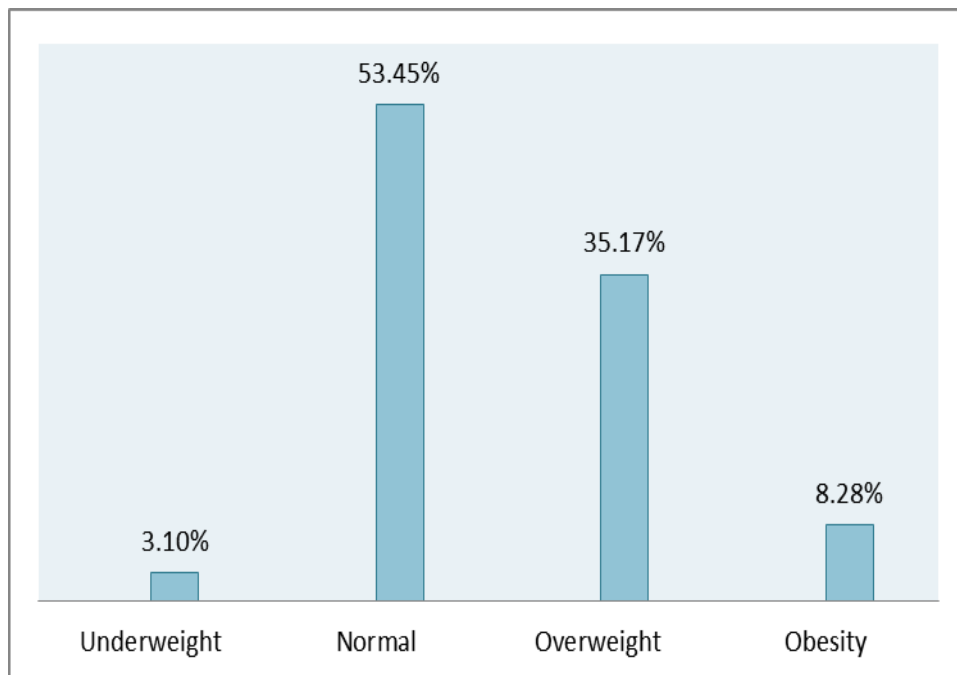
Figure 4.8: Body Mass Index (BMI) Status of the Respondents

Height, Weight and Waist circumference of each of the respondents were taken properly and it was then calculated with the BMI Calculator to signify the obesity in the studied population. From the results, we can see that 53.45% of the population had a normal weight whereas 3.10% of the population were underweight. But it was found that 35.17% of the population were within the range of overweight and had greater risk of obesity in the near future. On the other hand 8.28% of the population were already in the range of obesity so they were in greater risk of suffering from different kinds of non-communicable diseases.
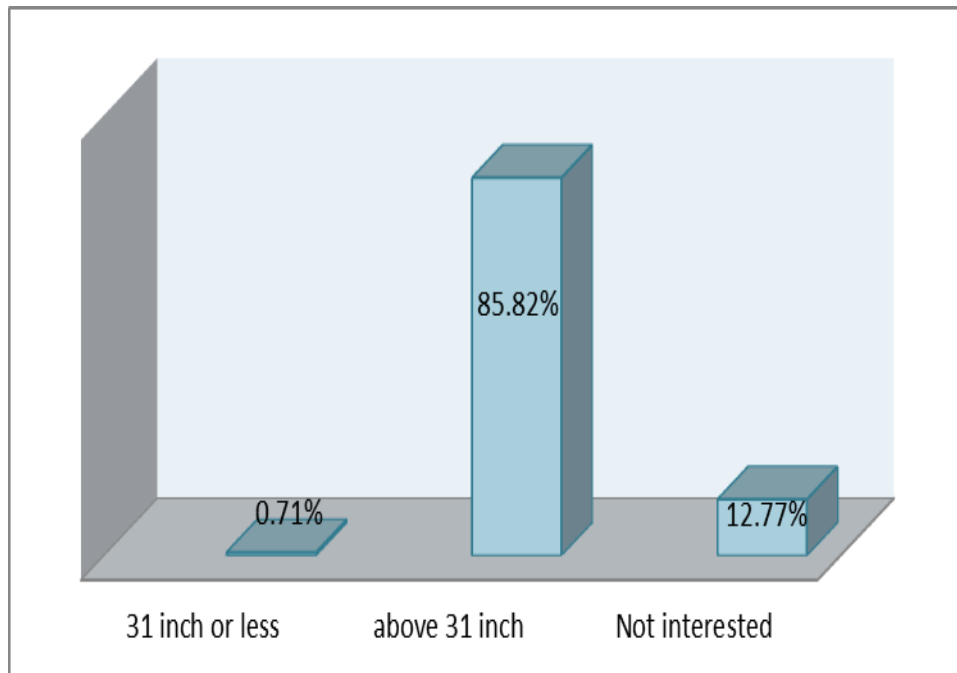
4.9 Waist Circumference Status of the Male Respondents
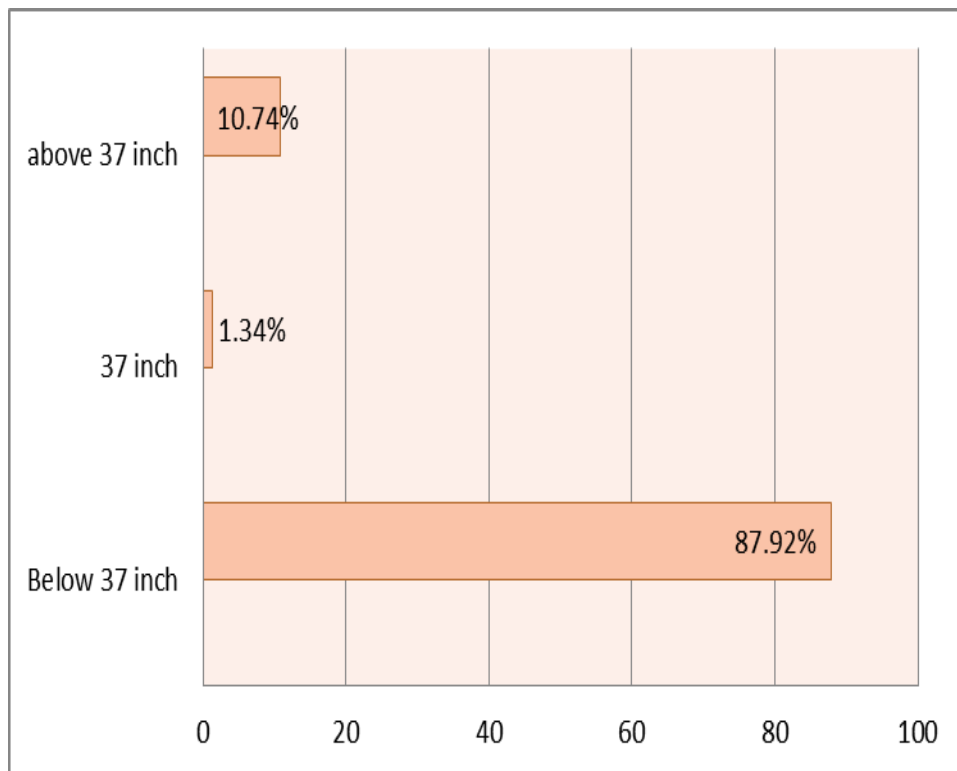
Figure 4.9: Waist Circumference Status of the Male Respondents

During this study it was found that about 87.92% population had waist circumference which was normal as that was normal waist <37 inch. On the other hand 1.34% of the respondents had overweight waist means 37 inch they had increased chance of suffering from obesity in the near future. But the most alarming situation was such that when already 10.74% of the study population were having obese waist circumference which indicates one of the behavioral risk factor that was alarming. The distribution of this risk factor threatens population from suffering from NCDs in the near future.

4.10 Waist Circumference Status of the Female Respondents

Figure 4.10: Waist Circumference Status of the Female Respondents

During this study it was found that about 85.82% population were waist circumference had overweight waist means above 31 inch they had increased chance of suffering from obesity in the near future. On the other hand 0.71% of the respondents had had waist circumference which was normal as that was normal waist 31 inch or less. Around 12.77% of the respondents were not interested to this study.

4.11 Sleeping Habit of the Respondents
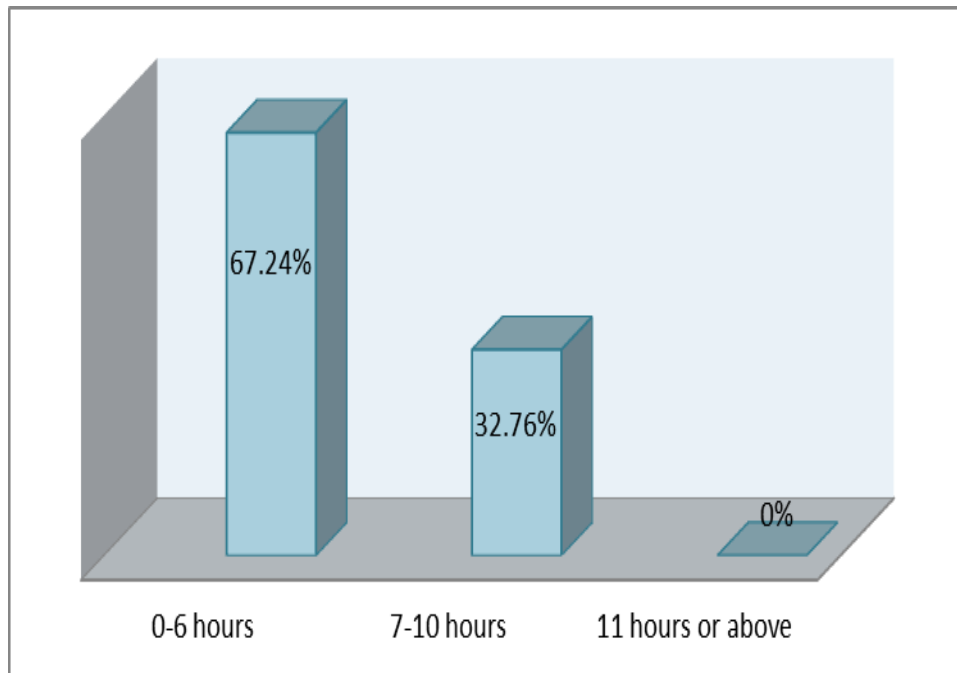
Figure 4.11: Sleeping Habit of the Respondents

During this study when respondents were asked about their sleeping habit 67.24% population had a sleeping habit of 0-6 hours a day. Around 32.76% of the population had a sleeping duration of 7-10 hours a day which is considered as the normal sleeping habit.

4.12 Blood Pressure Status of the Respondents
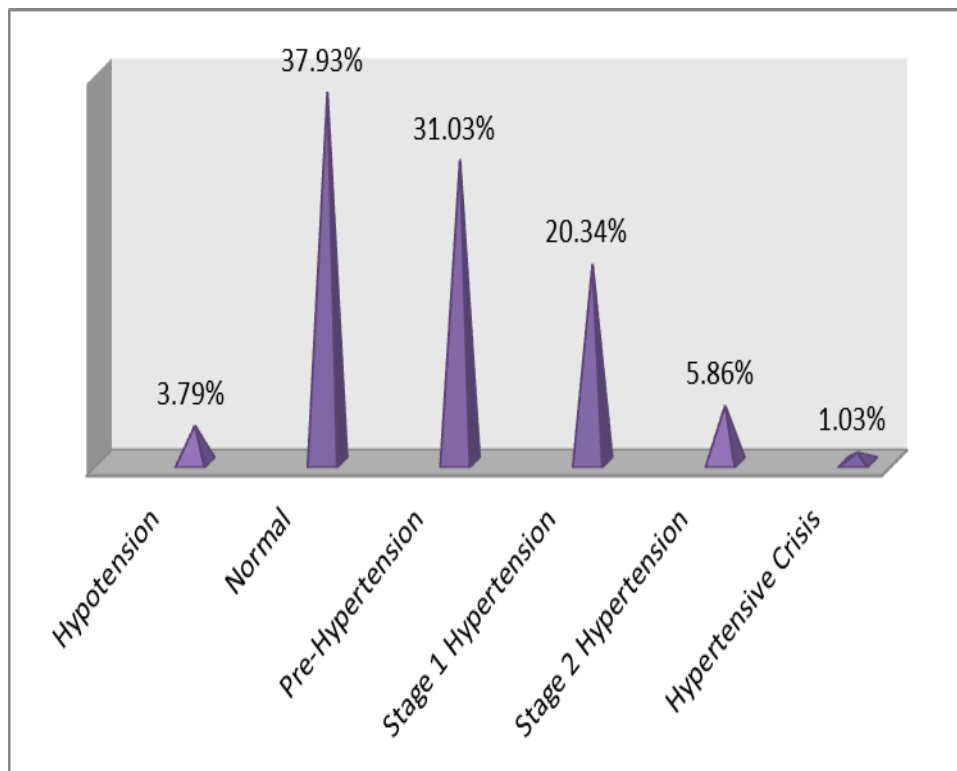
Figure 4.12: Blood Pressure Status of the Respondents

During this study, when the pressure of each of the respondents were measured it was seen through analysis that 37.93% of the respondent had normal blood pressure conditions and 31.03% of the people had pre-hypertension. But the major concerning issue was that 20.34% of the people having stage1 hypertension and 5.86% of the population had stage2 hypertension which may lead to further complications. Besides 3.79% of the respondents had hypotension and 1.03% are suffering hypertensive crisis.

4.13 Status of Respondents Current Medical Condition
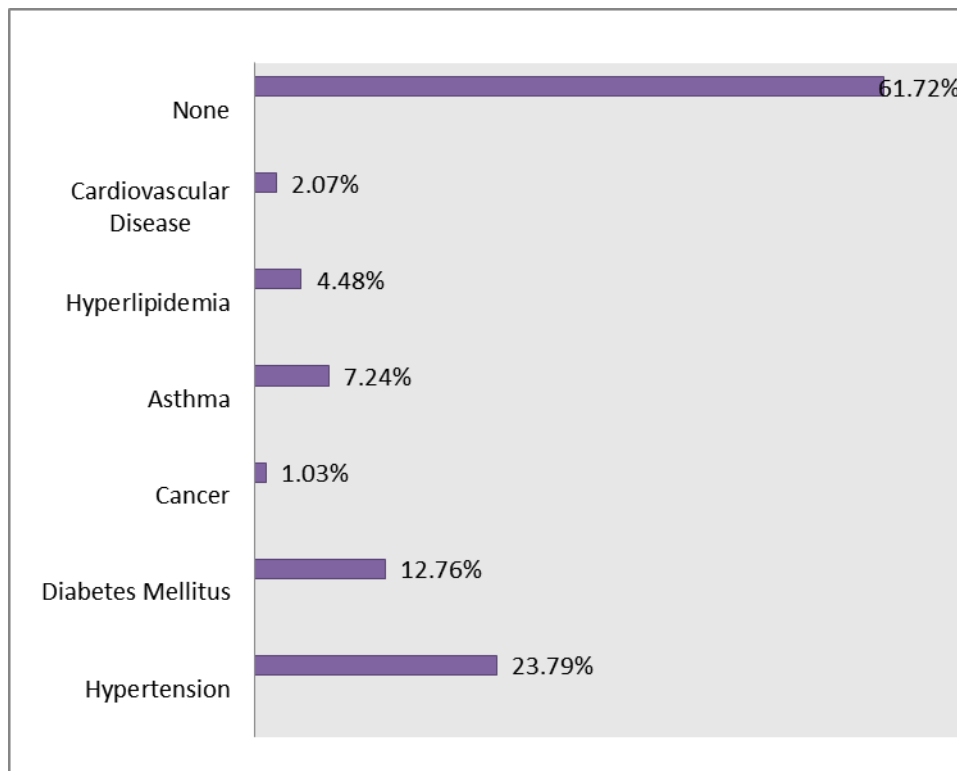
Figure 4.13: Status of Respondents Current Medical Condition

When the respondents were asked whether they are suffering from any of the medical conditions than 23.79% of the people answered that they are suffering from hypertension. Other respondents included 12.76% having Diabetes mellitus, 7.24% from asthma, 4.48% from hyperlipidemia, 2.07% from cardiovascular diseases and 1.03% from cancer. But 61.72% of the populations were not suffering from any of the conditions out of 290 respondents.

**4.14 Status of Respondents Suffered from Any Disease Conditions**
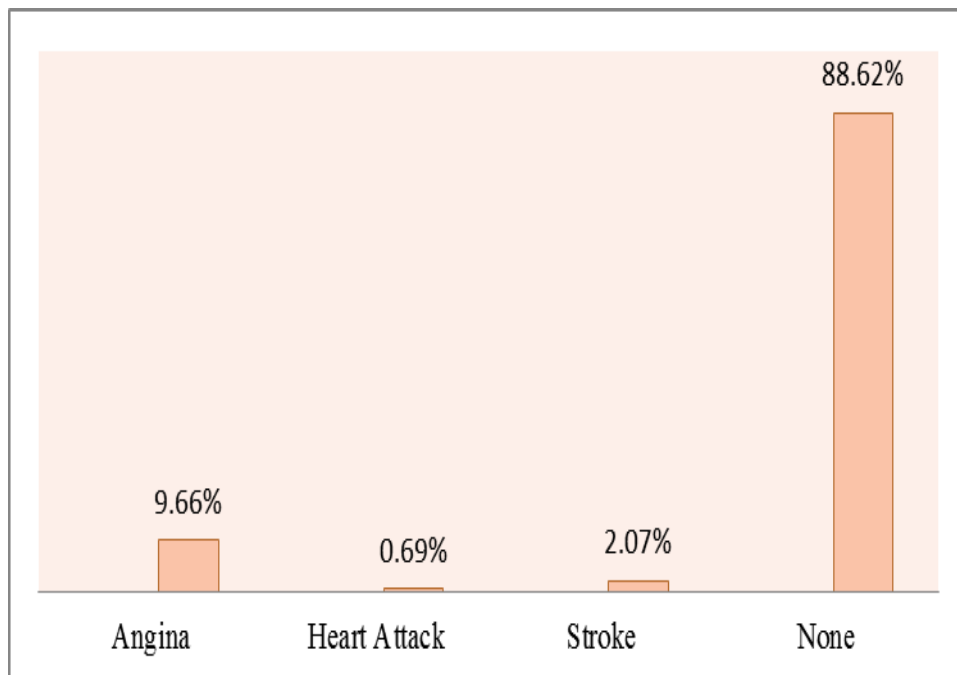
Figure 4.14: Status of Respondents Suffered from Any Disease Conditions

During this study, it was found that 88.62% of the study populations were not suffered from any disease conditions regarding NCDs. Around 9.66% were suffered from angina, 0.69% were suffered from heart attack, 2.07% were suffered from stroke at least once in their lifetime.

4.15 Status of Respondents about Family History of the Disease Conditions
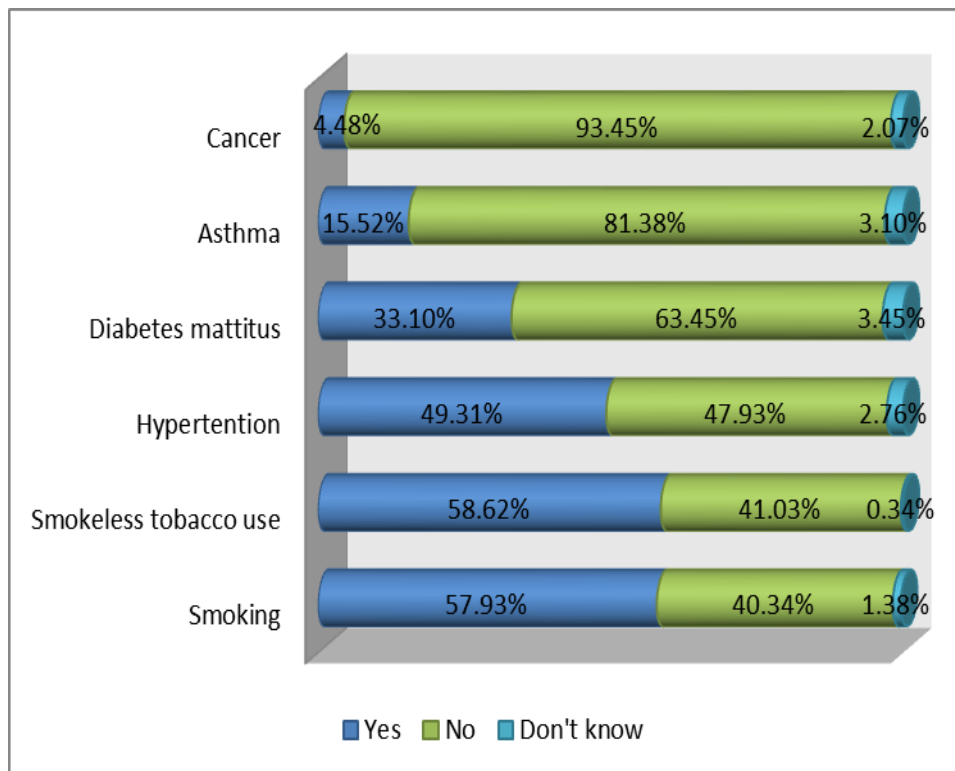
Figure 4.15: Status of Respondents about Family History of the Disease Conditions

Whether the respondents of the study had any sort of family history regarding the disease conditions or behavioral conditions they answered that there were 57.93% of the people have family history of smoking. But 40.34% had no family history and 1.38% knew nothing about it. So the people having history are at greater risk also the people who have no idea about the family history. About smokeless tobacco use 58.62% said about their family history but 41.03% had nothing and 0.34% knew nothing about it. In case of hypertension 49.31% had family history but 47.93% had no history and 2.76% didn't know about it. 33.10% of the respondents had family history in diabetes mellitus but 63.45% had no history and 3.45 knew nothing. The rest of the conditions regarding asthma and cancer 15.52% and 4.48% provided affirmative answers about family history. But 81.38% and 93.45% correspondingly gave negative answers. The rest 3.10% and 2.07% knew nothing about their family history.

4.16 Knowledge about Factors Causing Health Problems
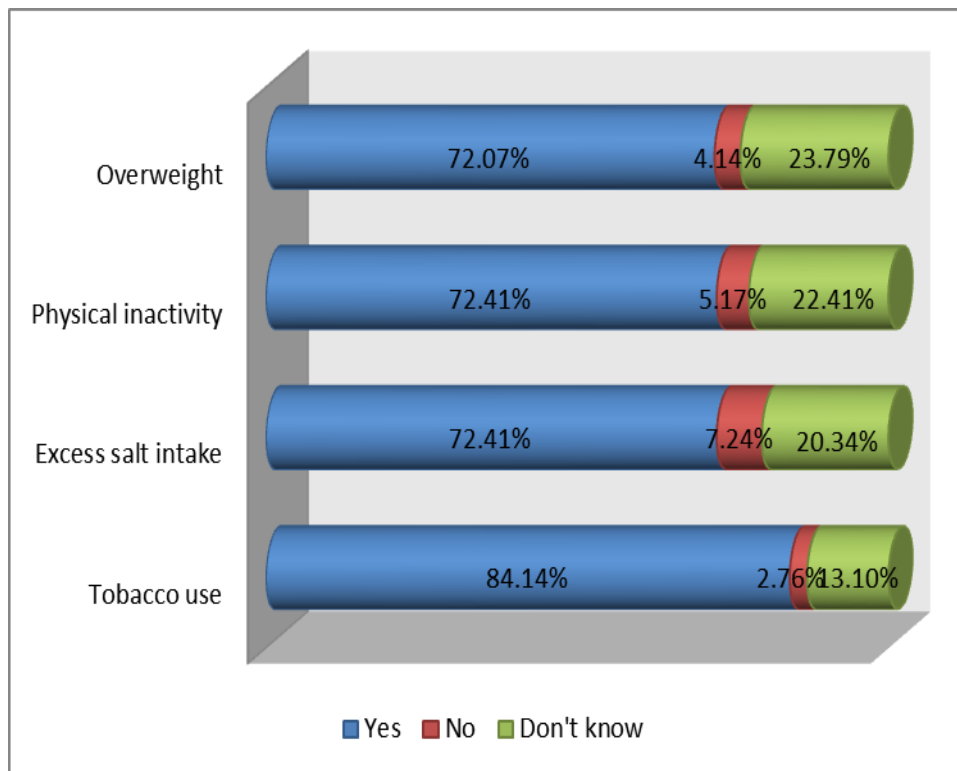
Figure 4.16: Knowledge about Factors Causing Health Problems

When the respondents were asked whether tobacco use, excess salt intake, physical inactivity and obesity cause health problem then about 84.14%, 72.41% , 72.41% and 72.07% of the respondents respectively knew that these can cause health problem. About 13.10%, 20.34%, 22.41% and 23.79% of the people had no idea that these risk factors could cause any sort of health problem in a person. Rest of the study people thought these risk factors didn't cause any sort of health problem.

4.17 Status of Respondents Tobacco Product Use
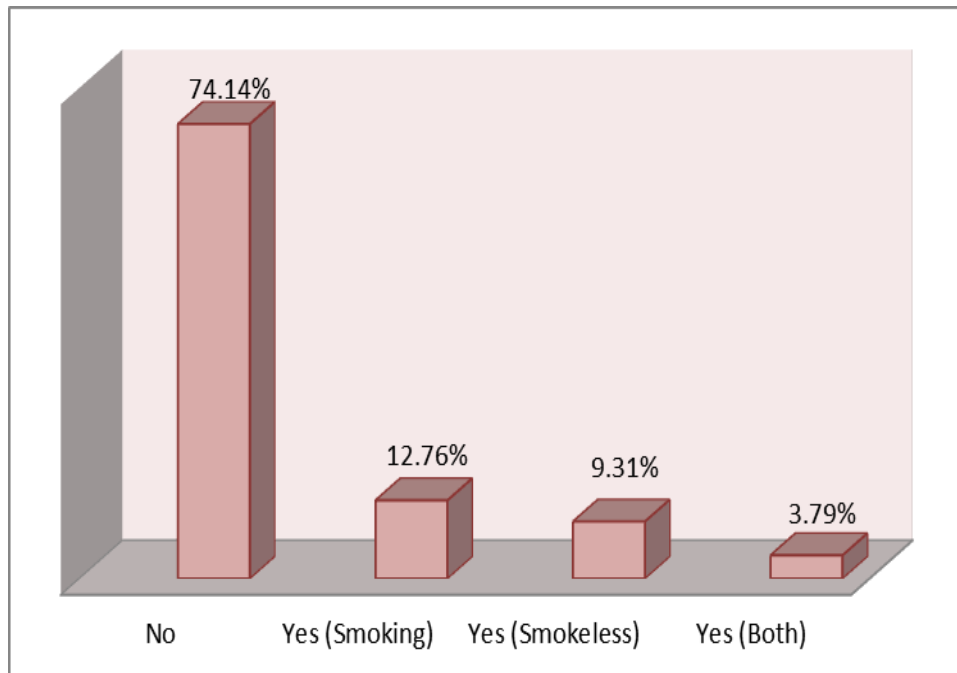
Figure 4.17: Status of Respondents Tobacco product use

When asked whether the respondents have taken any sort of smoking products within last 30 days 74.14% people provided a negative answer and rest of the respondents give affirmative answer including 12.76% used smoking (cigarettes, pipes, biri), 9.31% said they used smokeless (Chewing, snuff, gul, jorda, pan-masala) & 3.79% said they used both (smoking & smokeless tobacco).

4.18 Status of Dietary Habit of the Respondents
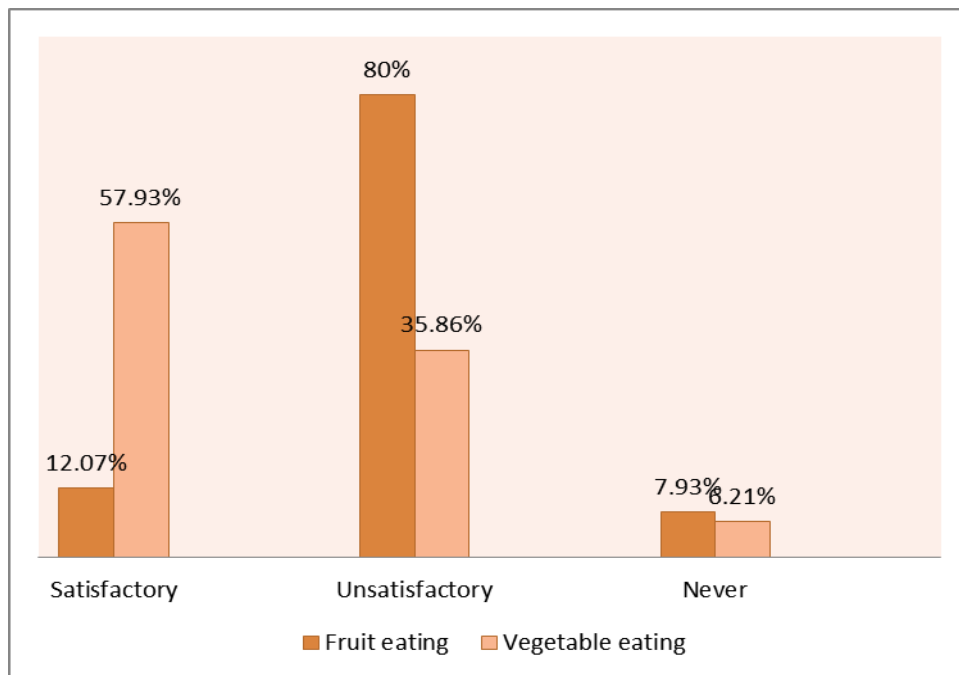
Figure 4.18: Status of Dietary Habit of the Respondents

During this study the dietary habit of the respondents were also judged it included their habit of taking fruits and vegetables. The ideal way is to take fruits and vegetables 5days a week. On that standard 12.71% and 57.93% of the respondent follow this habit. But 80% and 35.86% of the respondents takes fruits and vegetables but doesn't comply with the standard. Again 7.93% and 6.21% of the respondent do not take fruits and vegetables at all. So the respondents who are not following the dietary standard has a greater risk of suffering from the non-communicable diseases.

4.19 Dietary Habit of the Respondents Eating Meal
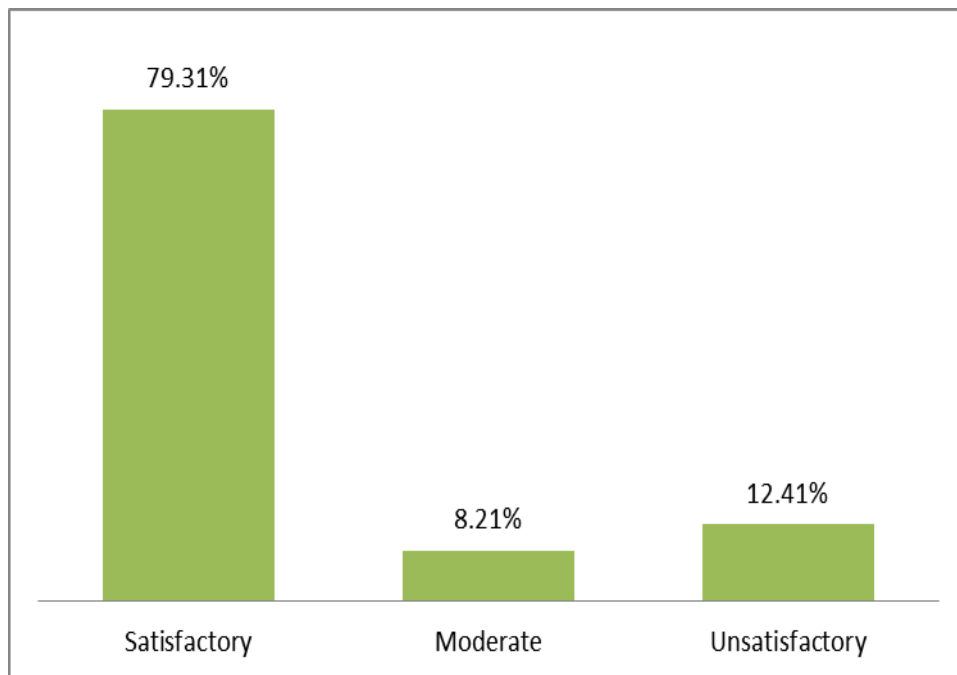
Figure 4.19: Dietary Habit of the Respondents Eating Meals

Habit of eating meals also played as an important parameter in the study. The eating habits of the study population were analyzed about how many meals they take within home and how many they take outside. On the basis of that it was found that 79.53% of the people didn't take a single meal outside which is satisfactory in nature. On the other hand 8.21% of the people took meal outside of home at least 3-4 days a week. The rest of the population 12.41% took at least a meal prepared outside home. The major portion of the people took meals inside of home which is not supposed to be threat for non-communicable diseases occurrence.

4.20 Habit of adding Salt or Salty Sauce in the Food
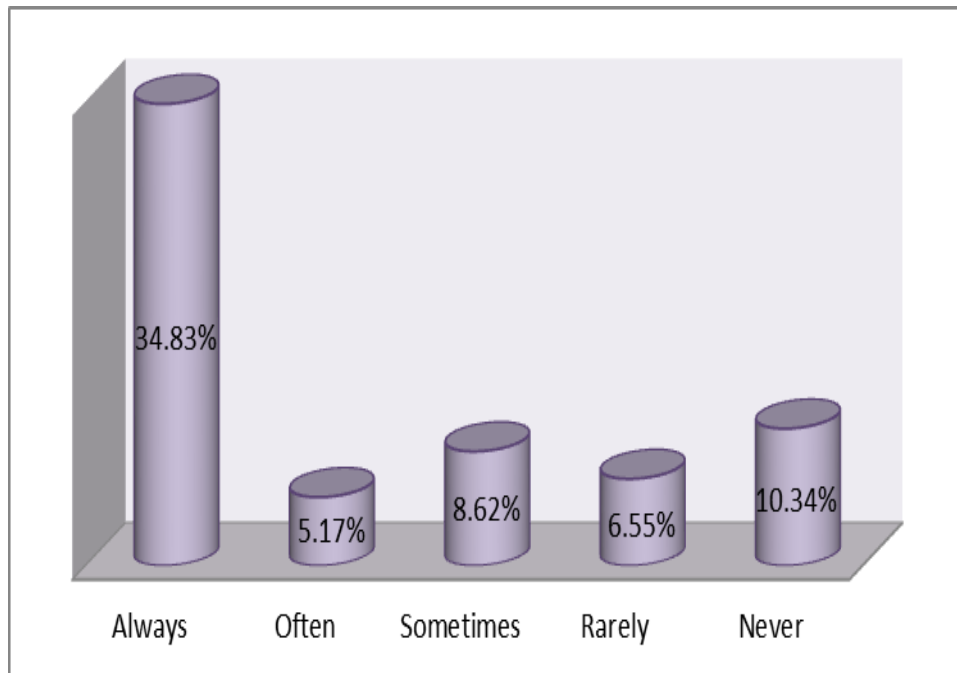
Figure 4.20: Habit of adding Salt or Salty Sauce in the Food

When the respondents were asked about if they take additional salt or salty sauce in the food 34.83% gave affirmative answer. On the other hand 5.17% of the people often added it and 8.62% of the sometimes added salt or salty sauce in their food. Out of the 290 respondents 6.55% rarely and 10.34% never added salt or salty sauce in their food. Upon analyzing it can be easily said that major portion of the study population used to add additional salt and will be easily subjected to non-communicable diseases.

4.21 Habit of Eating Processed Food High in Salt
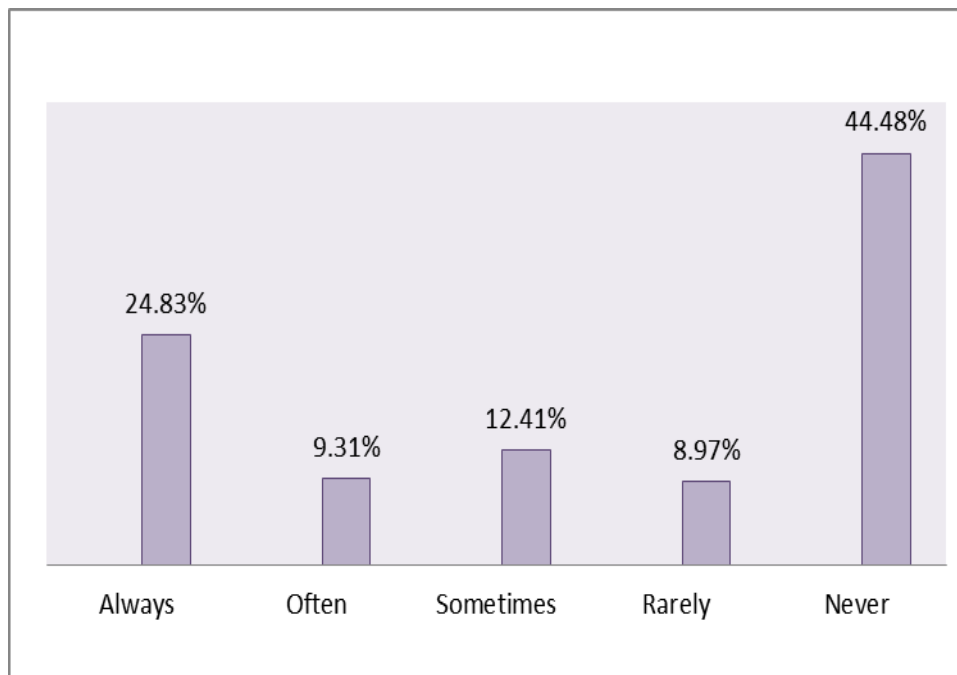
Figure 4.21: Habit of Eating Processed Food High in Salt

When the respondents were asked about if they eat processed food high in salt content 24.83% gave affirmative answer. On the other hand 9.31% of the people often ate processed food high in salt content and 12.41% of the sometimes ate this type of food. Out of the 290 respondents 8.97% rarely and 44.48% never ate processed food high in salt content. Upon analyzing it can be easily said that major portion of the study population sometimes eats such kind of food which increases the risk of suffering from non-communicable diseases.

4.22 Physical Activity status of the Respondents
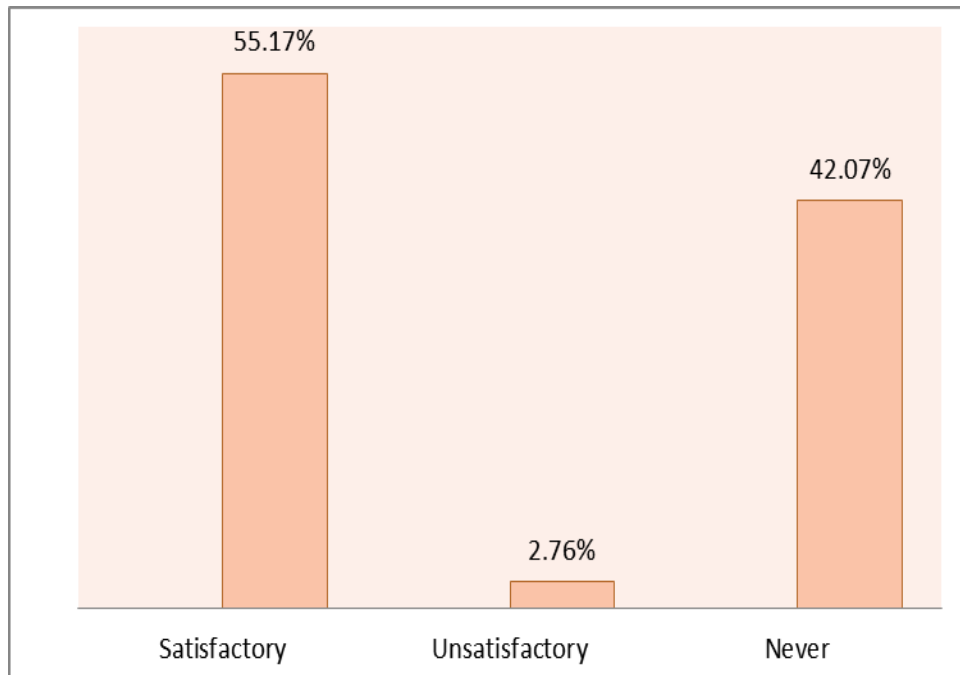
Figure 4.22: Physical Activity Status of the Respondents

Out of the 290 respondents when asked about their physical activity including exercise, walking at home or at work (carrying or lifting loads, digging, construction work, walking) or during travelling (walking or cycling) 55.17 % followed the standard of physical activity which is 150 minutes a week. On the other hand 42.07% of the people never and 2.76% of the people in a not satisfactory manner avoid the physical activity. Almost half of the study populations do not comply with the physical activity standard which increases their chances for suffering from non-communicable diseases.

4.23 Doctors' Advice to the Respondents
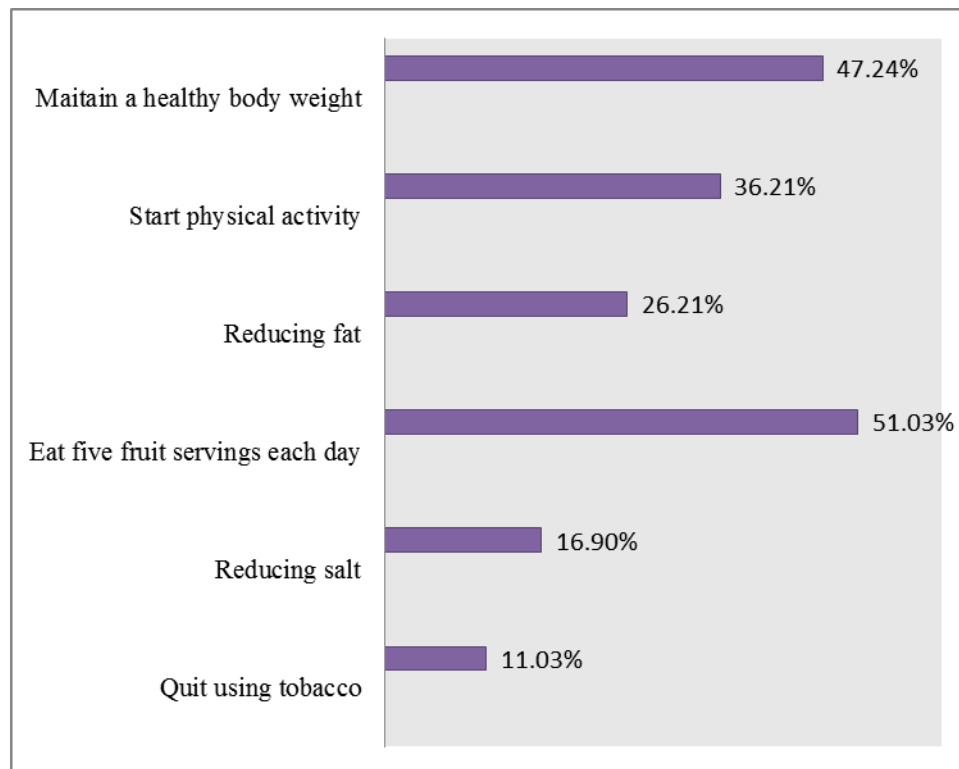
Figure 4.23: Doctors' Advice to the Respondents

When the respondents were asked about whether their doctors ever gave them any advices regarding their behavioral modifications on lifestyles out of 290 respondents regarding healthy body weight or lose weight 47.24% gave affirmative answer. For starting or doing more physical exercise 36.21% were suggested. 26.21% of the respondents were advised to reduce fat in the diet. About 51.03% of the populations were advised to take five servings of fruits/vegetables each. Reducing salt is also important, 16.90% of the population was asked to do it. Finally, for quitting tobacco use 11.03% were advised. From the above analysis we can easily see that majority of the study population are suggested to change their life style.

Chapter 5

Discussion & Conclusion

Discussion

The aim of the study was to determine the distribution of the risk factors of NCDs, prevalence of NCDs and the knowledge or awareness of the population about the risk factors. The study was conducted on 290 adult respondents of which 51% were male and 49% were female. However, 52% population were living in rural region, the rest of the population were living in the cities or in urban areas.

It was found that about 31.03% population were in between 21 to 30 years, whereas, only 26.2% population were between 41 to 50 years of age. However, 22.06% population were within the 31-40 years range and rest of the population which includes 18.96% were above 50 years.

Regarding their educational qualification about 17.24% of the population passed HSC level, whereas, 14.48% were graduates and 15.52% of post-graduates people. Around, 13.79% population passed SSC level. 19.31% population also passed primary education level and rest of the population which includes 16.55% of illiterate. In case of occupation, 34.48% population were housewife, whereas, 28.97% are working in the private sectors. Around, 16.90% population are Govt. Service holders.

As defined by history of current medication, age standardized prevalence of hypertension and diabetes was 3.7% and 1.0% respectively in rural area (Banik *et al*., 2017). As our study was performed in both areas, 23.79% of the people answered that they are taking medications for hypertension. 12.76% respondents were taking for diabetes mellitus, 14.82% for the rest of the diseases.

Prevalence of high blood pressure (systolic blood pressure e"140 mmHg or diastolic pressure e" 90 mm Hg) was 16.7% (Ahemd *et al*., 2017). In this study, when blood pressure was measured 37.93% of the respondent had normal blood pressure condition, 31.03% of the people had pre-hypertension. But the major concerning issue was that 27.23% of the people having hypertension including different stages of hypertension.

Family history of the study respondents provided that 57.93% of the people had family history of smoking and 58.62% said about their family history in smokeless tobacco use. In case of hypertension 49.31% had family history and 33.10% of the respondents had family history in diabetes mellitus. The rest of the conditions regarding asthma and cancer 15.52% and 4.48% provided affirmative answers about family history. From

analysis it is to be mentioned that 22.41% people are bearing the influence of passive smoking in terms of hypertension.

In a study 54% of the respondents used tobacco in some form. Prevalence of smokeless tobacco use was 36.3% (26.8% in men and 47.2 % in women). Tobacco use is a major threat to health. The overall prevalence of smoking (31.0%) observed is quite high than STEPS survey 2010 (27%) and STEPS survey 2013(17%) done in Bangladesh. Documented diabetes was found in 4% of the participants. Overall, 21% people had hypertension (blood pressure $\geq$140/90 mmHg or medication). NCD prevention through risk factor control, and early detection and treatment of hypertension and diabetes are warranted (Ahmed *et al*; 2017).

It was found that 53.45% of the population had a normal weight whereas 35.17% of the population were within the range of overweight and had greater risk of obesity in the near future. 8.28% of the population were already in the range of obesity so they were in greater risk of suffering from different kinds of non-communicable diseases. Regarding physical activity 55.17 % followed the standard of physical activity which is 150 minutes a week. On the other hand 42.07% of the people never and 2.76% of the people in a not satisfactory manner.

Obesity has been growing in Bangladesh. It was found that 17% were overweight [body mass index (BMI) $\geq$25 kg/m ^{2} and 21% had abdominal obesity (men $\geq$94, women $\geq$80 cm) About one in five of our subjects have central obesity. The age adjusted prevalence is higher in women (16.3%) compared to men (7.3%). 35% had low physical activity level (<600 metabolic equivalent (MET) min per week). It is noteworthy that the central obesity is a peculiar characteristic of South Asian people that predispose them to metabolic syndrome and diabetes (Ahmed *et al*., 2017).

In Ahmed et al., 2017; average waist circumference (as a measure of central obesity) was 73 cm and 71.7 cm in men and women respectively. Overall, 18.8% had central obesity. Women had a higher prevalence of central obesity (16.3 % versus 7.3 %) than men. In our study, around 85.82% female respondents had central obesity by means of waist circumference above 78.74 cm, and 12.08% of male respondents had waist circumference 94 cm or above which leads to central obesity.

In this study when the respondents were asked whether they realize that tobacco utilize, excess salt intake, physical inactivity or obesity plays a part in creating medical issue

than 84.14% for tobacco utilize, 72.41% for abundance salt admission, 72.41% for physical inactivity and 72.07% for obesity implies majority of the populace gave positive answer. Whatever remains of the populace think or don't have the foggiest idea about that these parameters could create any health problems. So the people who don't know or don't believe that tobacco utilize, overabundance salt admission, physical idleness or obesity could bring about health problem they have higher possibility of suffering from NCD.

According to STEPS taking fruits and vegetables 5 Servings a day is standardized. But during this study they didn't use this parameter rather they opted for if a respondent takes fruits or vegetables 5 days a week is quite satisfactory. In our study, 12.71% and 57.93% of the respondent follow this habit. But 80% and 35.86% of the respondents takes fruits and vegetables but doesn't comply with the standard. Again 7.93% and 6.21% of the respondent do not take fruits and vegetables at all. Low consumption of fruits and vegetables probably could be due to the lack of awareness, especially in rural area. WHO attributes approximately three million deaths a year from NCDs to inadequate consumption of fruit and vegetables. Consumption of adequate fruits and vegetables not only prevents nutrient deficiency disorders but also reduces the risk of cardiovascular diseases. Increased consumption of fruits and vegetables is associated with a 16% lower risk of cardiovascular disease in Indian subcontinent. 92% did not consume adequate fruit and vegetables (five servings or more) (Ahmed *et al*; 2017).

When the respondents were asked about if they take additional salt or salty sauce in the food 34.83% gave affirmative answer. On the other hand 5.17% of the people often added it. 10.34% never added salt or salty sauce in their food. Upon analyzing it can be easily said that major portion of the study population used to add additional salt and will be easily subjected to non-communicable diseases.

It was found that more than 85% of the people use extra salt during meal. High intake of sodium is one of the important contributing factors for high blood pressure (Ahmed *et al*; 2017).

For behavioral alterations on ways of life, the specialists prompted 47.24% respondents with respect to solid body weight or get more fit. For accomplishing more physical exercise 36.21% were proposed. 26.21% of the respondents were encouraged to decrease fat in the eating regimen. Around 51.03% of the populaces were informed to take five

servings concerning natural fruits or vegetables each. Diminishing salt is additionally imperative, 16.90% of the populace was made a request to do it. In conclusion, for stopping tobacco utilize 11.03% were advised. From the above analysis we can easily see that majority of the study population are asked to change their life style or behavioral modifications are required.

Conclusion

Regarding the present conditions and after analyzing all the parameters of the respondents it can be concluded that knowledge about the detrimental effect of tobacco use, excess salt intake, overweight and physical inactivity among the respondents is quite satisfactory. Most of the people have the knowledge about their family history regarding risk factors of non-communicable diseases too. But, in case of the prevalence of NCDs, hypertension and diabetes are in the leading position where it can be assumed that significant amount of hypertensive people are influenced by tobacco uses both active and passive way. Even excess salt intake also plays a major role to raise the percentage of hypertension. Almost half of the respondents are within the range of overweight and physical activity are not in a satisfactory manner which leads to different types of NCDs. Majority of the respondents take fruits and vegetables but doesn't comply with the standard. Prominent portion of the study population are also advised by doctors to change their life style or behavioral modifications are required. It is to be mentioned that this is a single district study along with very little amount of respondents. This study could not measure the diabetes status of the respondents which is very important and commonly used in many other NCDs studies. So, to get the complete knowledge regarding the prevalence and knowledge of NCDs risk factors further study on a large scale on different areas of Bangladesh is recommended.

Chapter 6

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