Behavioral and Biological Risk Factor Determination of Non-Communicable Disease in Male Persons of Dhaka

A Project Report to be submitted in the Department of Pharmacy for the Partial Fulfillment of the Degree of Bachelor of Pharmacy.

Submitted By

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DECLARATION BY THE RESEARCH CANDIDATE

I, Saumendra Swaskhar Roy, ID: 2012-3-70-018, hereby declare that the dissertation entitled **"Behavioral and Biological Risk Factor Determination of Non-Communicable Disease in Male Persons of Dhaka''** 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 **"Behavioral and Biological Risk Factor Determination of Non-Communicable Disease in Male Persons of Dhaka"** is a bona fide research work done by Saumendra Swaskhar Roy (ID: 2012-3-70-018), in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy under my supervision.

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This is to certify that the dissertation, entitled **"Behavioral and Biological Risk Factor Determination of Non-Communicable Disease in Male Persons of Dhaka"** is a bona fide research work done by Saumendra Swaskhar Roy (ID: 2012-3-70-018), under the guidance of **Nigar Sultana Tithi**, Senior Lecturer, in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy.

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DEDICATION

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CDC	Center for Disease Control
NCD	Non communicable Disease
HHS	Human Health Service

Abstract

Non-communicable diseases (NCDs) creates a new frontier for health professionals globally. Increase in NCD prevalence and death rates can be accounted for by emerging NCD epidemics in developing countries. Bangladesh has been facing a dual burden of existing infectious diseases and escalating rise of NCDs. The aim of the study was to determine the distribution of the risk factors of NCDs, prevalence of NCDs also the study was also done to determine the knowledge or awareness of the population about the risk factors. A total of 310 Male respondents of different spheres of life participated in the study. They responded to structured questionnaires which was setup by following STEPS guideline. Around 23.23% hypertension, 6.45% diabetes mellitus were found to have current medical conditions among the respondents. Within the study population family history of smoking (46.77%) and smokeless (12.56%) tobacco use, hypertension (33.88%), and 26.45% diabetes mellitus (26.45%) were prominent. The major concerning issue was 24.52% of the people having Hypertension 1 and 3.87% had hypertension 2. Of the study population 6.45% were having obese waist circumference which indicates one of the biological risk factor that was alarming including 0.65% had higher risk of obesity. On the other hand 26.45% of the study population were overweight and 2.90% were obese already. Of the study population 45.16% never done physical activity and a majority of the population spent their time by sitting and through sleeping. Regarding the vegetables and fruit intake19.68% and 13.87% and 65.48% respondents takes meal outside. Minority of the respondents added salt or salty sauce in the food but a majority ate processed food high in salt content. Within the study 46% of the respondents used tobacco. The majority of the respondents had knowledge about tobacco use, excess salt intake, physical inactivity and obesity with associated health problems. According to the questionnaire whether they were advised by doctor's to modify their lifestyle or behavioral factors majority portion of the respondents answered in a positive manner. But result showed their lack of willingness. It was seen that major portion of the population were suffering from one risk factor at least and some of them were having more than one risk factor which was alarming. At this point, promoting health awareness programs and increasing awareness about guidelines related to the risk factors of NCDs things might provide a good solution.

Keywords- *Non-communicable disease, Biological Risk factors, Behavioral Risk Factors, Bangladesh, Hypertension, STEPS.*

Chapter 1

Introduction

1.1 Introduction

Noncommunicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression. The 4 main types of noncommunicable diseases are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes.

NCDs already disproportionately affect low- and middle-income countries where nearly three quarters of NCD deaths – 28 million – occur (Lim *et al*., 2010).

1.2 Overview

Chronic, non-communicable diseases (NCDs) are the number one cause of death and disability in the world. The term NCDs refers to a group of conditions that are not mainly caused by an acute infection, result in long-term health consequences and often create a need for long-term treatment and care. These conditions include cancers, cardiovascular disease, diabetes and chronic lung illnesses. Many NCDs can be prevented by reducing common risk factors such as tobacco use, harmful alcohol use, physical inactivity and eating unhealthy diets.

Many other important conditions are also considered NCDs, including injuries and mental health disorders. HHS works with US government and international partners, including the World Health Organization, to address these and other important chronic health conditions (Global Health Topics. 2015).

NCDs share several common, modifiable risk factors — tobacco use, alcohol use, physical inactivity and unhealthy diets. Mitigating the effects of these common risk factors is critical to combat NCDs worldwide (Psi.org, 2016).

Non-communicable diseases are by far the leading cause of death in the world. Of the 57 million global deaths in 2008, 36 million, or 63 percent, were due to NCDs. By 2030, non-communicable diseases will account for 66 percent of the global disease burden's some 80 percent of all NCD deaths occur in low- and middle-income countries. Non-communicable diseases are the most frequent causes of death in all regions of the world except Africa, where such diseases are rising rapidly and are projected to cause almost three quarters as many deaths as communicable, maternal, perinatal and nutritional diseases by 2020 – and to exceed them as the most common

causes of death by 2030. Of the approximately 36 million people who die annually from NCDs, one-quarter are aged less than 60 years, and regarded therefore as premature and largely preventable deaths. As these diseases take lives, the also diminish opportunities. Poverty grinds on. Development stalls. Struggling communities weaken even further. Families are decimated by the loss of loved ones or and potentially catastrophic expenditures for treatment. The rapidly growing magnitude of such diseases is driven in part by population aging, the impact of urbanization and the globalization of trade and marketing. It is fuelled by the persistent increase in noncommunicable disease-related risk factors, namely, tobacco use, an unhealthy diet, lack of physical activity and harmful alcohol use, particularly in low- and middle-income countries.

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. (Note: 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).

The World Health Organization estimates that NCDs account for 60 percent (more than 35 million) deaths annually.

Roughly 80 percent of NCD related deaths occur in low- and middle-income countries, where fragile health systems often struggle to meet the population’s most basic health needs.

WHO estimates that 48 percent of NCD deaths in low- and middle-income countries occur before 70 years old, compared with 26 percent in high income countries.

In 2012, all United Nations member countries committed to achieving a 25 percent reduction in premature mortality from NCDs by 2025 (the 25 x 25 target) (Psi.org, 2016).

1.3 Global Conditions of NCD

Non-communicable diseases have been established as a clear threat not only to human health, but also to development and economic growth. Claiming 63% of all deaths, these diseases are currently the world's main killer. Eighty percent of these deaths now occur in low- and middle-income countries. Half of those who die of chronic non-communicable diseases are in the prime of their productive years, and thus, the disability imposed and the lives lost are also endangering industry competitiveness across borders (Bloom *et al*., 2011).

Noncommunicable diseases are the leading health concerns of the modern era, accounting for two-thirds of global deaths, half of all disability, and rapidly growing costs. To provide a contemporary overview of the burdens caused by noncommunicable diseases, we compiled mortality data reported by authorities in forty-nine countries for atherosclerotic cardiovascular diseases; diabetes; chronic respiratory diseases; and lung, colon, breast, cervical, liver, and stomach cancers. From 1980 to 2012, on average across all countries, mortality for cardiovascular disease, stomach cancer, and cervical cancer declined, while mortality for diabetes, liver cancer, and female chronic respiratory disease and lung cancer increased. In contrast to the relatively steep cardiovascular and cancer mortality declines observed in high-income countries, mortality for cardiovascular disease and chronic respiratory disease was flat in most low- and middle-income countries, which also experienced increasing breast and colon cancer mortality. These divergent mortality patterns likely reflect differences in timing and magnitude of risk exposures, health care, and policies to counteract the diseases. Improving both the coverage and the accuracy of mortality documentation in populous low- and middle-income countries is a priority, as is the need to rigorously evaluate societal-level interventions. Furthermore, given the complex, chronic, and progressive nature of noncommunicable diseases, policies and programs to prevent and control them need to be multifaceted and long-term, as returns on investment accrue with time (Ali, 2015).

The international community is very concerned about the effect of NCDs on families, communities, and nations. From July 10-11, 2014, the United Nations (UN) reviewed and assessed progress made since the 2011 UN General Assembly high-level meeting on NCDs, including on developing voluntary global targets and recommending ways to

work across all of society to prevent and manage NCDs. The meeting also identified gaps and challenges, and laid out actions to enhance work to reduce the burden of non-communicable diseases. In May 2014, the 67th World Health Assembly agreed on a Global Coordination Mechanism to help coordinate activities by governments, civil society and the private sector and support implementation of the 2013 Global Action Plan on NCDs (Global Health Topics. 2015).

In May 2013, the 66th World Health Assembly adopted a set of measures to tackle the global NCDs challenge. They endorsed a new Global Action Plan on NCDs containing suggested actions for WHO, countries, and international partners. These actions included working to improve multi-stakeholder collaboration and adopting the global monitoring framework. The framework lays out 25 indicators of progress and nine voluntary global targets to:

Cut avoidable, premature deaths from the leading NCDs by 25 percent.

Decrease leading behaviors that increase the risk of NCDs, namely tobacco use, harmful alcohol use, physical inactivity, and eating unhealthy diets including consuming excess salt/sodium.

Stop the rise in diabetes and obesity, and reduce population levels of raised blood pressure.

Encourage access to essential medicines and technologies for NCDs and promote appropriate use of drug therapy to reduce heart attacks and strokes

In September 2011, the United Nations (UN) General Assembly held a high-level meeting on NCD prevention and control. UN Member States adopted a political declaration calling on the World Health Organization (WHO) to develop a global monitoring framework and recommend voluntary global targets to prevent and control these diseases. Countries also committed to strengthen their national responses to NCDs and to increase international collaboration, working across government, civil society and the private sector.

HHS contributes in many ways to preventing and controlling NCDs around the world. HHS supports basic, clinical, and applied research that builds knowledge about effective NCD approaches. HHS supports health systems strengthening activities such

as training and workforce development that better equip providers with the skills needed to prevent and manage chronic illnesses. HHS also partners with multilateral institutions to develop, promote, and implement evidence-based health policies. International partners work together toward shared goals of better preventing NCDs and addressing the needs of people living with chronic illness. OGA, under HHS, leads multilateral efforts on global NCD issues. They work with partners including the World Health Organization and the Pan-American Health Organization. OGA also helps facilitate the international work of HHS's divisions and institutes (Global Health Topics, 2015).

1.4 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: Non communicable diseases list

Genetic Diseases	Environmental Diseases
➢ Achondroplasia, ➢ Albinism ➢ Bardet-Biedl syndrome ➢ Bipolar disorder ➢ Canavan disease ➢ Color blindness ➢ Cystic fibrosis ➢ Down's syndrome	➢ Appendicitis ➢ Anorexia nervosa ➢ Arteriosclerosis ➢ Asthma ➢ Carpal tunnel syndrome ➢ Chronic obstructive pulmonary diseases ➢ Emphysema

➢ Fragile X syndrome ➢ Galactosemia ➢ Hemophilia ➢ Krabbe disease ➢ Muscular dystrophy ➢ Neurofibromatosis ➢ Noonan syndrome ➢ 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 ➢ Xeroderma pigmentosum.	➢ Fetal alcohol syndrome ➢ Glaucoma ➢ Fibromyalgia ➢ Hyperthyroidism ➢ Hypothyroidism ➢ Irritable Bowel Syndrome ➢ Liver cirrhosis ➢ Narcolepsy ➢ Osteoporosis ➢ Sudden infant death syndrome (SIDS) ➢ Tick paralysis.

(Wma.net, 2016)

1.5 The Major list of Non-communicable disease that is occurring globally

1.5.1 Diabetes

Diabetes limits the body's ability to process glucose normally. Type 1 diabetes which is present from birth causes the pancreas to be destroyed by the immune system, causing glucose to build up in the bloodstream. Type-2 diabetes is developed over time causing the cells to resist the effects of insulin, causing unhealthy levels of glucose in the bloodstream. Risk factor of Type 2 diabetes is being overweight or obese. Patients with high blood sugar will typically experience polyuria (frequent urination), they will become increasingly thirsty (polydipsia) and hungry (polyphagia) (MacGill, 2016).

1.5.1.1 Type-1 Diabetes

The body does not produce insulin. Some people may refer to this type as insulin-dependent diabetes, juvenile diabetes, or early-onset diabetes. People usually develop type 1 diabetes before their 40th year, often in early adulthood or teenage years. Type 1 diabetes is nowhere near as common as type-2 diabetes. Approximately 10% of all diabetes cases are type 1.

Patients with type 1 diabetes will need to take insulin injections for the rest of their life. They must also ensure proper blood-glucose levels by carrying out regular blood tests and following a special diet.

Between 2001 and 2009, the prevalence of type 1 diabetes among the under 20s in the USA rose 23%, according to *SEARCH for Diabetes in Youth* data issued by the CDC (Centers for Disease Control and Prevention).

In type 1 diabetes, the pancreas is unable to produce any insulin, the hormone that controls blood sugar levels. Insulin production becomes inadequate for the control of blood glucose levels due to the gradual destruction of beta cells in the pancreas. This destruction progresses without notice over time until the mass of these cells decreases to the extent that the amount of insulin produced is insufficient.
Type 1 diabetes typically appears in childhood or adolescence, but its onset is also possible in adulthood.
When it develops later in life, type 1 diabetes can be mistaken initially for type-2 diabetes. Correctly diagnosed, it is known as latent autoimmune diabetes of adulthood (MacGill, 2016).

1.5.1.1.1 Causes of type 1 diabetes

The gradual destruction of beta cells in the pancreas that eventually results in the onset of type 1 diabetes is the result of autoimmune destruction. The immune system turning against the body's own cells is possibly triggered by an environmental factor exposed to people who have a genetic susceptibility.

Although the mechanisms of type 1 diabetes etiology are unclear, they are thought to involve the interaction of multiple factors:

- Susceptibility genes - some of which are carried by over 90% of patients with type 1 diabetes. Some populations - Scandinavians and Sardinians, for example - are more likely to have susceptibility genes
- Autoantigens - proteins thought to be released or exposed during normal pancreas beta cell turnover or injury such as that caused by infection. The autoantigens activate an immune response resulting in beta cell destruction
- Viruses - coxsackievirus, rubella virus, cytomegalovirus, Epstein-Barr virus and retroviruses are among those that have been linked to type 1 diabetes
- Diet - infant exposure to dairy products, high nitrates in drinking water and low vitamin D intake have also been linked to the development of type 1 diabetes. (MacGill, 2016).

1.5.1.2. Type-2 diabetes

The body does not produce enough insulin for proper function, or the cells in the body do not react to insulin (insulin resistance). Approximately 90% of all cases of diabetes worldwide are type 2.

Some people may be able to control their type 2 diabetes symptoms by losing weight, following a healthy diet, doing plenty of exercise, and monitoring their blood glucose levels. However, type 2 diabetes is typically a progressive disease - it gradually gets worse - and the patient will probably end up have to take insulin, usually in tablet form.

Overweight and obese people have a much higher risk of developing type 2 diabetes compared to those with a healthy body weight. People with a lot of visceral fat, also known as central obesity, belly fat, or abdominal obesity, are especially at risk. Being overweight/obese causes the body to release chemicals that can destabilize the body's cardiovascular and metabolic systems (MacGill, 2016).

1.5.1.2.1 Causes of type 2 diabetes

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.

The impairment stimulates the pancreas to make more insulin but eventually the pancreas is unable to make enough to prevent blood sugar levels from rising too high.

Genetics plays a part in type 2 diabetes - relatives of people with the disease are at a higher risk, and the prevalence of the condition is higher in particular among Native Americans, Hispanic and Asian people.

Obesity and weight gain are important factors that lead to insulin resistance and type 2 diabetes, with genetics, diet, exercise and lifestyle all playing a part. Body fat has hormonal effects on the effect of insulin and glucose metabolism.

Once type-2 diabetes has been diagnosed, health care providers can help patients with a program of education and monitoring, including how to spot the signs of hypoglycemia, hyperglycemia and other diabetic complications.

As with other forms of diabetes, nutrition and physical activity and exercise are important elements of the lifestyle management of the condition (MacGill, 2016).

1.5.1.3. Gestational diabetes

This type affects females during pregnancy. Some women have very high levels of glucose in their blood, and their bodies are unable to produce enough insulin to transport all of the glucose into their cells, resulting in progressively rising levels of glucose.

The majority of gestational diabetes patients can control their diabetes with exercise and diet. Between10% to20% of them will need to take some kind of blood-glucose-controlling medications. Undiagnosed or uncontrolled gestational diabetes can raise the risk of complications during childbirth. The baby may be bigger than he/she should be.

Scientists from the National Institutes of Health and Harvard University found that women whose diets before becoming pregnant were high in animal fat and cholesterol had a higher risk for gestational diabetes, compared to their counterparts whose diets were low in cholesterol and animal fats (MacGill, 2016).

1.5.1.4. 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).

1.5.1.5. Prediabetes

The vast majority of patients with type 2 diabetes initially had prediabetes. Their blood glucose levels where higher than normal, but not high enough to merit a diabetes diagnosis. The cells in the body are becoming resistant to insulin. Studies have indicated that even at the prediabetes stage, some damage to the circulatory system and the heart may already have occurred (MacGill, 2016).

1.5.1.6. Symptoms of Diabetes

The most common symptoms are related to hyperglycemia (high blood sugar levels), especially the classic symptoms of diabetes: frequent urination and thirst. Fatigue related to dehydration and eating problems can also be related to high blood sugars.

The International Diabetes Foundation highlights four symptoms that should prompt someone to get checked for diabetes as soon as possible.

- **Frequent urination-**When there is too much glucose (sugar) in blood urination will occur more often. If insulin is ineffective, or not there at all, kidneys cannot filter the glucose back into the blood. The kidneys will take water from blood in order to dilute the glucose - which in turn fills up bladder.
- **Disproportionate thirst** - If urination occurs more than usual, need to replace that lost liquid. Drinking will become more than usual.
- **Intense hunger-** As the insulin in blood is not working properly, or is not there at all, and cells are not getting their energy, body may react by trying to find more energy - food. Induced hunger may occur
- **Unusual weight loss-** This is more common among people with Diabetes Type 1. As your body is not making insulin it will seek out another energy source (the cells aren't getting glucose). Muscle tissue and fat will be broken down for

energy. As Type 1 is of a more sudden onset and Type 2 is much more gradual, weight loss is more noticeable with Type 1.

- **Increased fatigue-** If insulin is not working properly, or is not there at all, glucose will not be entering y cells and providing them with energy. This will make feel tired and listless.
- **Blurred vision-** This can be caused by tissue being pulled from eye lenses. This affects eyes' ability to focus. With proper treatment this can be treated. There are severe cases where blindness or prolonged vision problems can occur.
- **Cuts and bruises don't heal properly or quickly-** When there is more sugar (glucose) in body, its ability to heal can be undermined.
- **More skin and/or yeast infections-** When there is more sugar in body, its ability to recover from infections is affected. Women with diabetes find it especially difficult to recover from bladder and vaginal infections (MacGill, 2016).

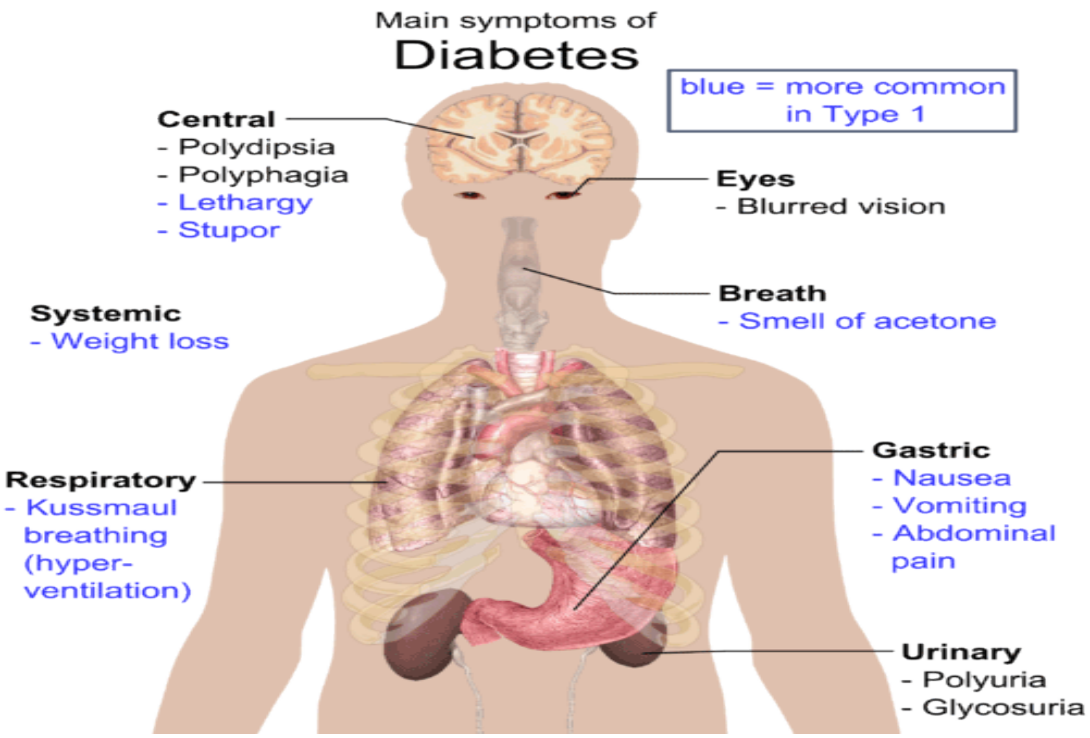

Figure 1.1: Symptoms of Diabetes (MacGill, 2016).

1.5.1.7. Diagnosis of Diabetes

- **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.

- **The A1C test**

  -at least 6.5% means diabetes

  -between 5.7% and 5.99% means prediabetes

  - Less than 5.7% means normal

- **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)

- **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, 2016).

1.5.1.8. Diabetes Treatment and Management

People with diabetes who are overweight need to incorporate weight loss as part of their treatment.

- A combination of healthy diet and exercise – aim to reduce dietary intake of fat, salt, and sugar, increase intake of fruit and vegetables, and consume mainly low glycemic index foods. A minimum of 150 minutes of moderate intensity exercise should be undertaken each week.
- Medication with tablets and/or insulin.
- Managing Blood sugar levels.
- Managing Diabetes By routine Checkups and Annual Checkups.

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).

1.5.2 Hypertension

Blood pressure is the force exerted by the blood against the walls of blood vessels, and the magnitude of this force depends on the cardiac output and the resistance of the blood vessels.

This is caused when an individual consistently has a blood pressure reading over 140/90. This can be caused by diabetes, smoking, excessive salt intake, obesity or kidney disease.

This means the systolic reading (the pressure as the heart pumps blood around the body) is over 140 mmHg (millimeters of mercury) or the diastolic reading (as the heart relaxes and refills with blood) is over 90 mmHg.

While this threshold has been set to define hypertension, it is for clinical convenience and because achieving targets below this level brings benefits for patients.

But rather than being marked by a particular cut-off point, the medical expert committees on the condition actually see high blood pressure as having a continuous relationship to cardiovascular health.

They believe that, to a point (down to levels of 115-110 mmHg systolic, and 75-70 mmHg diastolic) the lower the blood pressure the better (MacGill and Webberley, 2016).

Systolic: The top number, which is also the higher of the two numbers, measures the pressure in the arteries when the heart beats (when the heart muscle contracts).

Diastolic: The bottom number, which is also the lower of the two numbers, measures the pressure in the arteries between heartbeats (when the heart muscle is resting between beats and refilling with blood).

1.5.2.1. 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 #)**
Normal	less than **120**	and	less than **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
Hypertensive Crisis (Emergency care needed)	Higher than **180**	or	Higher than **110**

(American Heart Association, 2014)

1.5.2.2. Risk Factors of High Blood pressure

High blood pressure is a symptomless disease except in its most extreme cases known as hypertensive crisis. Individuals whose blood pressure is higher than 140/90 mm Hg (140 systolic or above OR 90 diastolic or above) often become patients treated for serious cardiovascular problems.

Risk increases even more if you have high blood pressure along with other risk factors:

- Age
- Heredity (including race)
- Gender (male)

- Overweight or obesity
- Smoking
- High cholesterol
- Diabetes
- Physical inactivity (American Heart Association, 2014).

1.5.2.3. 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, 2014).

1.5.2.4. Causes of hypertension

1. **Family history**- Height, hair and eye color runs in families --- so can high blood pressure. If parents or close blood relatives have had HBP, more likely to develop it, too. It might also pass that risk factor on to children. That's why it's important for children as well as adults to have regular blood pressure checks. None can't control heredity, but can take steps to live a healthy life and lower risk factors. Lifestyle choices have allowed many people with a strong family history of HBP to avoid it themselves.
2. **Advanced age**- As we age, we all develop higher risk for high blood pressure and cardiovascular disease. Blood vessels lose flexibility with age which can contribute to increasing pressure throughout the system.
3. **Gender-related risk patterns-** A higher percentage of men than women have HBP until 45 years of age. From ages 45 to 54 and 55 to 64, the percentages of men and women with HBP are similar. After that, a much higher percentage of women have HBP than men.
4. **Lack of physical activity-** Physical activity is good for your heart and circulatory system. An inactive lifestyle increases the chance of high blood pressure, heart disease, blood vessel disease and stroke. Inactivity also makes it easier to become overweight or obese. Give yourself the gift of improved health and lower blood pressure with regular, moderate-to-vigorous physical activity.
5. **Poor diet, especially one that includes too much salt-** To care for our bodies, we all needs good nutrition from a variety of food sources. A diet that's high in calories, fats and sugars and low in essential nutrients contributes directly to poor health as well as to obesity. In addition, there are some problems that can happen from eating too much salt. Some people are "salt sensitive," meaning a high-salt (sodium) diet raises their high blood pressure. Salt keeps excess fluid in the body that can add to the burden on the heart. While too much salt can be dangerous, healthy food choices can actually lower blood pressure. Learn about enjoying a heart-healthy diet.
6. **Overweight and obesity**- Being overweight increases your chances of developing high blood pressure. A body mass index between 25 and 30 is considered overweight. A body mass index over 30 is considered obese. About

two-thirds of U.S. adults are overweight or obese. About one in three U.S. children ages 2 to 19 are overweight or obese. Excess weight increases the strain on the heart, raises blood cholesterol and triglyceride levels, and lowers HDL (good) cholesterol levels. It can also make diabetes more likely to develop. Losing as little as 10 to 20 pounds can help lower blood pressure and heart disease risk. To successfully and healthfully lose weight—and keep it off—most people need to subtract about 500 calories per day from their diet to lose about 1 pound per week. Calculate your body mass index and learn how to manage your weight.

7. **Drinking too much alcohol-** Heavy and regular use of alcohol can increase blood pressure dramatically. It can also cause heart failure, lead to stroke and produce irregular heartbeats. Too much alcohol can contribute to high triglycerides, cancer and other diseases, obesity, alcoholism, suicide and accidents (American Heart Association, 2014).

1.5.2.5. Possible contributing factors:

There is some connection between blood pressure and these factors but science has not proven that they actually cause high blood pressure.

- **Stress-** Being in a stressful situation can temporarily increase your blood pressure, but science has not proven that stress causes high blood pressure. Some scientists have noted a relationship between coronary heart disease risk and stress in a person's life, health behaviors and socioeconomic status. For example, people under stress may overeat or eat a less healthy diet, put off physical activity, drink, smoke or misuse drugs.
- **Smoking and second-hand smoke-** Smoking temporarily raises blood pressure and increases your risk of damaged arteries. The use of tobacco can be devastating for health, especially if already at risk for high blood pressure. Secondhand smoke --- exposure to other people's smoke increases the risk of heart disease for nonsmokers. (American Heart Association, 2014).

1.5.2.6. Specific causes of hypertension

Primary hypertension is unlikely to have a specific cause but multiple factors, including blood plasma volume and activity of the renin-angiotensin system, the hormonal regulator of blood volume and pressure - and primary hypertension are affected by environmental factors, including the lifestyle-related ones above.

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

Common reversible causes are excessive intake of alcohol and use of oral contraceptives, which is a cause a slight rise in blood pressure; hormone therapy for menopause is also a culprit. Other secondary hypertensions are caused by:

- 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) (MacGill and Webberley, 2016).

1.5.2.7. 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, 2014).

1.5.2.8. Symptoms of hypertension

High blood pressure itself is usually experienced by patients without any symptoms at all (asymptomatic). It can do its damage silently.

Hypertension can lead to problems in the organs affected by high blood pressure. Long-term hypertension can lead to the following complications via arteriosclerosis, which causes narrowing of blood vessels by forming plaques:

- An enlarged or weakened heart, to a point where it may fail to pump enough blood (heart failure)
- Aneurysm - an abnormal bulge in the wall of an artery
- Blood vessel narrowing - in the kidneys, leading to possible kidney failure; also in the heart, brain and legs, leading to potential heart attack, stroke or amputation, respectively
- Blood vessels in the eyes my rupture or bleed, leading to vision problems or blindness (hypertensive retinopathies, which can be classified by worsening grades one through four) (MacGill and Webberley, 2016).

1.5.2.9. 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 there 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).

1.5.2.10. 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), which have been a cornerstone of treatment since 1977
- 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).

1.5.2.11. Recent developments on hypertension Treatment:

1. **Vitamin D 'ineffective as treatment for hypertension'**-Supplementation cannot lower blood pressure and should not be used as an antihypertensive agent, study concluded.
2. **Folic acid may reduce risk of first stroke in people with hypertension**-Folic acid supplementation and hypertension medication combined reduced the risk of a first stroke among adults with high blood pressure.
3. **Acupuncture may reduce high blood pressure**-A new study suggests that a form of acupuncture may benefit patients with high blood pressure and lower their risk of stroke and heart disease (MacGill and Webberley, 2016).

1.5.3 Hyperlipidemia

Hyperlipidemia is characterized by elevated concentrations of circulating lipids, increasing the risk of atherosclerosis and other serious conditions. Specific classes of hyperlipidemia include hyperlipoproteinemia, elevated very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) levels, hypercholesterolemia (elevated cholesterol levels), and hypertriglyceridemia (elevated triglyceride levels).

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.

Any excess cholesterol that is not used by the body can negatively affect our arteries over time. This fatty material begins to adhere as plaque to the walls of the arteries.

Like badly rusted plumbing pipes, arteries can become dangerously clogged with plaque, and then blood has a harder time flowing.

These risk factors include an improper diet high in saturated fats and cholesterol, obesity, and inactivity. Medical conditions such as diabetes mellitus, hypothyroidism, kidney disease, liver disease, alcoholism, as well as certain medications, can cause elevated lipid levels. Also, a family history of high cholesterol may mean that a person is genetically at risk for high lipids.

High lipid levels can speed up a process called atherosclerosis, or hardening of the arteries. Your arteries are normally smooth and unobstructed on the inside, but as you age, a sticky substance called plaque forms in the walls of your arteries. Plaque is made of lipids and other materials circulating in your blood. As more plaque builds up, your arteries can narrow and stiffen. Eventually, enough plaque may build up to reduce blood flow through your arteries.

Lifestyle changes like exercising and eating a healthy diet can also lower your lipid levels and are often the first step in treatment.

In general, there are two broad types of cholesterol that can be measured:

1. LDL or the "bad" cholesterol is the fraction of the total cholesterol that forms the plaque that can clog the arteries. Optimal LDL level is less than 130mg per dL, or less than 100 per dL in high risk individuals.
2. HDL or the "good" cholesterol keeps cholesterol from building up in our arteries. Optimal HDL level is greater than 40 mg per dL in men and greater than 50 mg per dL in women (Nutritionmd.org. 2016).

1.5.3.1. 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:

- Family history
- Diets high in total fat, saturated fat, and cholesterol (see Nutritional Considerations)
- Diabetes mellitus and metabolic syndrome: Hyperinsulinemia is associated with low HDL levels and hypertriglyceridemia.
- Chronic renal failure is associated with hypertriglyceridemia.
- Nephrotic syndrome: Decreased vascular oncotic pressure due to proteinuria leads to increased lipoprotein production by the liver.
- Hypothyroidism
- Hypopituitarism.
- Obesity: Obesity is associated with increased total cholesterol, LDL, VLDL, and triglycerides, as well as with decreased levels of HDL.
- Physical inactivity
- Alcoholism
- Steroid use
- Oral contraceptives
- Smoking: Cigarette smoking lowers HDL levels and is an independent risk factor for cardiovascular disease (Nutritionmd.org. 2016).

1.5.3.2. Causes of Hyperlipidemia

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).

1.5.3.3. Signs and symptoms of Hyperlipidemia

With familial hyperlipidemia, a person could show signs of high cholesterol with yellowish fatty growths (xanthomas) around the eyes or the joints. Otherwise, hyperlipidemia has no signs or symptoms, and unless picked up with the fasting lipid profile, the high cholesterol would remain undetected.

An individual could have a heart attack or stroke, and later learn it was precipitated by hyperlipidemia.

Excessive fat in the blood accumulates over time, forming plaques on the walls of the arteries and blood vessels. This will narrow the openings, producing turbulent blood flow through the vessels, and cause the heart to use more force to get the blood through the constricted areas (Robertson, 2009).

1.5.3.4. Buildup of different disease conditions due to Hyperlipidemia

At healthy levels, lipids are involved in important bodily functions, but they can cause problems if they are present in excess. A raised blood lipid level can cause accelerated hardening of the arteries or atherosclerosis.

In healthy individuals, the insides of arteries are smooth and unobstructed, but as we age, plaque accumulates in the artery walls until they narrow and stiffen.

Plaques are composed of lipids and several other materials that circulate in the blood. Eventually, plaque can accumulate enough to reduce the flow of blood through the arteries. This can reduce the amount of oxygen-rich blood that is received by the heart, which increases the risk of vascular events such as stroke and heart attack.

It may be possible for individuals to slow the progression of atherosclerosis if they can bring their blood lipid level down. This involves making lifestyle changes such as exercising and eating healthily as the first treatment approaches, but, depending on a patient's overall risk, medication may be prescribed in combination with these lifestyle changes.

Higher levels of high-density lipoproteins (HDL) or good cholesterol are associated with a reduced risk of heart disease and stroke because HDL "mops up" cholesterol from the arteries, slowing the buildup of plaque.

Low-density lipoprotein (LDL) cholesterol, on the other hand, is considered "bad" cholesterol because it can lead to obstructed arteries. It transports cholesterol around the body and builds up in the artery walls, making the vessels hard and narrow.

Another type of lipoprotein is very-low-density lipoprotein (VLDL), which contains triglycerides, a type of fat that VLDL delivers to bodily tissues. VLDL increases the size of LDL, causing narrowing of the blood vessels (Robertson, 2009).

1.5.3.5. Laboratory Testing

Patients must fast for at least 12 hours before blood sampling, because chylomicron clearance can take up to 10 hours. However, a fasted sample is not required for simple cholesterol screening.

1. **Total cholesterol-** According to NCEP guidelines, total cholesterol concentrations below 200 mg/dL are "desirable." A borderline high concentration is 200 to 239 mg/dL, and hypercholesterolemia is defined as greater than 240 mg/dL. However, epidemiological evidence suggests that stricter standards may be appropriate. Risk of cardiac events decreases as total cholesterol levels fall until plateauing at total cholesterol of approximately 150 mg/dL. For children, total cholesterol should be less than 180 mg/dL.
2. **Triglyceride -** Normal triglyceride concentration is less than 150 mg/dL. Borderline is 150 to 199 mg/dL, and high is 200 to 499 mg/dL. Concentrations of 500 mg/dL or higher are considered very high.
3. **HDL cholesterol** - Concentrations of 60 mg/dL or higher are optimal. In general, an HDL concentration below 40 mg/dL is considered a major risk factor for coronary heart disease (CHD), although women's risk of CHD increases marginally with HDL cholesterol < 50. However, HDL is often interpreted in the context of total cholesterol and LDL concentrations, and may be less significant when LDL is low.
4. **LDL cholesterol-** According to the NCEP, LDL cholesterol concentrations below 100mg/dL are considered optimal. A range of 100 to129 mg/dL is near optimal. Borderline is 130 to 159 mg/dL. High is 160 to189 mg/dL. However, increasing evidence supports stricter standards, including reductions below 70 mg/dL for very high-risk patients. Studies of hunter-gatherer populations and normal neonates have modified the concept of "normal" cholesterol levels. Normal human LDL cholesterol concentration may be as low as 50 to 70 mg/dL, approximately half the US adult population mean. Coronary heart disease risk decreases as LDL cholesterol concentration decreases, reaching a nadir at approximately 40 mg/dL. NCEP classification and treatment guidelines have changed to reflect revised normal values and risk estimates (Nutritionmd.org. 2016).

1.5.3.6. Life Style Modification/Prevention

If a patient is diagnosed with hyperlipidemia, the lifestyle changes they can make and medications they can use to improve their lipid profile are described below**:**

1. **Lose weight-** A body mass index (BMI) of 30 or higher increases the risk of high cholesterol and losing just 5 to 10 pounds can help to lower cholesterol. Being overweight can lower your levels of HDL (good) cholesterol and weight loss can decrease the LDL level. Extra weight around the abdominal area increases the risk of heart disease more than extra weight carried around the thighs, bottom and hips.
2. **Healthy diet-** A diet that is high in cholesterol-rich foods such as full fat dairy and red meat increases the total cholesterol level, whereas a diet that is rich in fiber and contains cholesterol-lowering foods can be as successful as a statin at bringing the cholesterol level down. People trying to lower their cholesterol should ensure that no more than 10% of their daily calories come from saturated fat. Monounsaturated fats found in foods such as canola oils and peanuts are a healthier option. Some types of fish such as halibut and tuna contain less saturated fat and cholesterol than red meat and poultry and herring, salmon and mackerel are rich in omega-3 fatty acids, which can lower triglycerides. Trans-fats, which are found in foods such as margarine and commercially baked cakes, cookies and crackers should be eliminated from the diet because they increase LDL and lower HDL. Certain nutrients found in whole-grain foods such as whole-grain bread, whole-wheat pasta, flour and brown rice promote heart health and fruits and vegetables can help lower cholesterol.
3. **Exercise-**Exercise helps to boost HDL, while it lowers LDL and triglycerides. A lack of exercise can therefore increase the risk of high cholesterol. A doctor may advise walking for at least 30 minutes a day on most days of the week to help reduce cholesterol.
4. **Quitting smoking-**Cigarette smoke can damage vessel walls, making them more susceptible to the accumulation of fatty deposits, hardening and narrowing. Smoking can also lower HDL and people with hyperlipidemia should quit as soon as they are diagnosed (Robertson, 2009)

1.5.3.7. Treatment via Medication

The mainstay of treatment for hyperlipidemia is dietary and lifestyle modification, followed by drug therapy, as necessary. Hyperlipidemia should not be considered refractory to dietary treatment if the therapeutic regimen included animal products or more than minimal amounts of vegetable oils. Such diets do not lower LDL cholesterol concentrations as effectively as high-fiber, low-fat diets that exclude animal products.

Regular exercise can improve lipid concentrations. Low to moderate amounts of physical activity such as walking lower triglyceride concentrations by an average of 10 mg/dL, while raising HDL by 5 mg/dL/ (these numbers are means drawn from large groups). More strenuous activity may have greater effects.[6]

Patients with familial hypercholesterolemia typically require medication starting in early childhood.

HMG CoA reductase inhibitors (statins) decrease cholesterol production in the liver, and are first-line agents in the treatment of elevated LDL cholesterol. Statins also have important effects on cardiovascular risk aside from their ability to reduce lipid concentrations, and may be indicated for high-risk patients even when lipid targets can be achieved without drug therapy. Potential side effects include myopathy and increased liver enzymes. Some statins may also lower HDL to a below-goal level.

Bile acid sequestrants (eg, cholestyramine, colestipol) are second-line agents for the treatment of elevated LDL cholesterol. These medications can produce gastrointestinal distress, constipation, and impaired absorption of other drugs.

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) is a second-line therapy for all lipid disorders. Niacin is often combined with statins, but is also effective as a single agent. Its use is often limited by skin itching or burning. Other side effects include GI distress, hepatotoxicity, hyperglycemia, and gout.

Ezetimibe and colesevelam decrease GI cholesterol absorption, and have emerged as a favored second-line therapy due to their effectiveness, safety, and lack of side effects. They lower LDL and often raise HDL, and are particularly effective when combined with statins (often achieving lipid targets at lower statin doses). Ezetimibe has emerged as the more effective drug (Nutritionmd.org. 2016).

1.5.3.8. Recent developments on Hyperlipidemia treatment

- **Pycnogenol boosts endothelial function in a range of borderline conditions-** Pycnogenol appears to improve endothelial function in individuals with borderline hypertension, hyperglycemia or hyperlipidemia, according to the results of an Italian study reported recently in the *Journal of International Angiology*.
- **FDA advisory panel approves novel cholesterol-lowering drug-**An advisory committee for the Food and Drug Administration has recommended the approval of a novel, injectable cholesterol-lowering drug called alirocumab, though many committee members have noted certain restrictions for its use and have requested further data on the drug's ability to reduce the risk of heart problems (Davis, 2015).

1.5.3.9. Advice

Hyperlipidemia is a common preventable contributor to atherosclerosis. Both cholesterol and triglyceride concentrations can be reduced through restriction of saturated fat, cholesterol, Trans fatty acids, and total fat. Increasing dietary fiber, soy foods, and exercise can make these measures more effective. The patient's family may also be at risk for hyperlipidemia and other cardiovascular diseases. Their adoption of the same diet and lifestyle changes being made by the patient, including smoking cessation, will encourage patient adherence and improve family members' health (Nutritionmd.org. 2016).

1.5.4 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/m^2).

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 (World Health Organization. 2016).

1.5.4.1. 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 (World Health Organization. 2016).

1.5.4.2. Consequences of overweight and obesity

Raised BMI is a major risk factor for noncommunicable diseases such as:

- cardiovascular diseases (mainly heart disease and stroke), which were the leading cause of death in 2012;
- diabetes;

- musculoskeletal disorders (especially osteoarthritis - a highly disabling degenerative disease of the joints);
- Some cancers (endometrial, breast, and colon).

The risk for these noncommunicable diseases increases, with an increase in BMI. Childhood obesity is associated with a higher chance of obesity, premature death and disability in adulthood. But in addition to increased future risks, obese children experience breathing difficulties, increased risk of fractures, hypertension, and early markers of cardiovascular disease, insulin resistance and psychological effects (World Health Organization. 2016).

1.5.4.3. 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 (World Health Organization. 2016).

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. 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 Risk Factors of NCD (Non- communicable Disease)

All age groups and all regions are affected by NCDs. NCDs are often associated with older age groups, but evidence shows that 16 million of all deaths attributed to noncommunicable diseases (NCDs) occur before the age of 70. Of these "premature" deaths, 82% occurred in low- and middle-income countries. Children, adults and the elderly are all vulnerable to the risk factors that contribute to noncommunicable diseases, whether from unhealthy diets, physical inactivity, exposure to tobacco smoke or the effects of the harmful use of alcohol.

These diseases are driven by forces that include ageing, rapid unplanned urbanization, and the globalization of unhealthy lifestyles. For example, globalization of unhealthy

lifestyles like unhealthy diets may show up in individuals as raised blood pressure, increased blood glucose, elevated blood lipids, and obesity. These are called 'intermediate risk factors' which can lead to cardiovascular disease, a NCD (Lim, 2010).

1.7.1 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).

1.7.2 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).

1.8 Socioeconomic Impacts of NCDs

NCDs threaten progress towards the UN Millennium Development Goals and post-2015 development agenda. Poverty is closely linked with NCDs. The rapid rise in

NCDs is predicted to impede poverty reduction initiatives in low-income countries, particularly by increasing household costs associated with health care. Vulnerable and socially disadvantaged people get sicker and die sooner than people of higher social positions, especially because they are at greater risk of being exposed to harmful products, such as tobacco or unhealthy food, and have limited access to health services.

In low-resource settings, health-care costs for cardiovascular diseases, cancers, diabetes or chronic lung diseases can quickly drain household resources, driving families into poverty. The exorbitant costs of NCDs, including often lengthy and expensive treatment and loss of breadwinners, are forcing millions of people into poverty annually, stifling development.

In many countries, harmful drinking and unhealthy diet and lifestyles occur both in higher and lower income groups. However, high-income groups can access services and products that protect them from the greatest risks while lower-income groups can often not afford such products and services (Mozaffarian, 2014).

1.9 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 noncommunicable 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).

1.10 WHO Response

Under the leadership of the WHO more than 190 countries agreed in 2011 on global mechanisms to reduce the avoidable NCD burden including a *Global action plan for the prevention and control of NCDs 2013-2020*. This plan aims to reduce the number of premature deaths from NCDs by 25% by 2025 through nine voluntary global targets. The nine targets focus in part by addressing factors such as tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity that increase people's risk of developing these diseases.

The plan offers a menu of “best buy” or cost-effective, high-impact interventions for meeting the nine voluntary global targets such as banning all forms of tobacco and alcohol advertising, replacing trans fats with polyunsaturated fats, promoting and protecting breastfeeding, and preventing cervical cancer through screening.

In 2015, countries will begin to set national targets and measure progress on the 2010 baselines reported in the *Global status report on noncommunicable diseases 2014*. The UN General Assembly will convene a third high-level meeting on NCDs in 2018 to take stock of national progress in attaining the voluntary global targets by 2025 (Mozaffarian and Lim, 2014).

Chapter 2

Literature Review

2.1 Non communicable disease risk factors in Iran

Non-communicable disease, especially cardiovascular disease (CVDS), as a public health problem became evident in developed and developing countries in this century. The majority of deaths (59%) is from noncommunicable diseases. Six out of ten leading risk factors to all deaths in the world relate to diet and physical activity. Approximately 80% of the NCD burden is found in developing countries. Iran is an example of countries in the eastern Mediterranean region undergoing a nutritional transition. Methods and materials: This article reviews 3 national surveys: "National health and disease", in 1999, "National Food consumption", in 1995, and "Analytical report on edible oils situation", in 2002. Results: The results show that 34.8% of deaths were due to CVD in 2000. Hypertension affected 10.2% of the total population. This rate reached to 27% and 41.4% in 45-69 and +70 age groups respectively. In addition Hyperlipidemia prevalence (> 200mg/dl) was 25.7%. Diabetes prevalence based on personal given history was 1.5%. The prevalence of overweight and obesity was as high as 50% among men and 66% among women in 40-69 age groups. Fat and carbohydrate consumption were 30% and 40% more than recommended amounts respectively. 80-90% of edible oils were hydrogenated oil. Mean elaidic acid levels (Tran's fatty acid) in hydrogenated oils were 30%, 23.8% and 27.2% in 1999-2001. This rate was reported 38.3% in 2002. Mean tran fatty acid intake (15.6-30gr/day) was far away from recommended amount (< 5gr/day). The population's sedentary life style was also becoming as a public health problem, with 70-80% being physically inactive. Conclusion: Non-communicable diseases and their related morbidity and mortality are becoming a significant serious public health problem in Iran. Development and implementation of national policies to modify food consumption patterns is highly recommended to decrease the risks of NCDs (Sheikholeslam *et al*., 2004).

2.2 Non-communicable diseases in sub-Saharan Africa: What we know now

Sub-Saharan Africa (SSA) has a disproportionate burden of both infectious and chronic diseases compared with other world regions. Current disease estimates for SSA are based on sparse data, but projections indicate increases in non-communicable diseases (NCDs) caused by demographic and epidemiologic transitions. Surveyor reviewed the literature on NCDs in SSA and summarize data from the World Health Organization

and International Agency for Research on Cancer on the prevalence and incidence of cardiovascular diseases, diabetes mellitus Type 2, cancer and their risk factors.

It was searched the PubMed database for studies on each condition, and included those that were community based, conducted in any SSA country and reported on disease or risk factor prevalence, incidence or mortality.

They found few community-based studies and some countries (such as South Africa) were over-represented. The prevalence of NCDs and risk factors varied considerably between countries, urban/rural location and other sub-populations. The prevalence of stroke ranged from 0.07 to 0.3%, diabetes mellitus from 0 to 16%, hypertension from 6 to 48%, obesity from 0.4 to 43% and current smoking from 0.4 to 71%. Hypertension prevalence was consistently similar among men and women, whereas women were more frequently obese and men were more frequently current smokers.

The prevalence of NCDs and their risk factors is high in some SSA settings. With the lack of vital statistics systems, epidemiologic studies with a variety of designs (cross-sectional, longitudinal and interventional) capable of in-depth analyses of risk factors could provide a better understanding of NCDs in SSA, and inform health-care policy to mitigate the oncoming NCD epidemic (Dalal *et al*., 2011).

2.3 Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases1, 2, and 3

Global energy imbalances and related obesity levels are rapidly increasing. The world is rapidly shifting from a dietary period in which the higher-income countries are dominated by patterns of degenerative diseases (whereas the lower- and middle-income countries are dominated by receding famine) to one in which the world is increasingly being dominated by degenerative diseases. This article documents the high levels of overweight and obesity found across higher- and lower-income countries and the global shift of this burden toward the poor and toward urban and rural populations. Dietary changes appear to be shifting universally toward a diet dominated by higher intakes of animal and partially hydrogenated fats and lower intakes of fiber. Activity patterns at work, at leisure, during travel, and in the home are equally shifting rapidly toward reduced energy expenditure. Large-scale decreases in food prices (eg, beef prices) have

increased access to supermarkets, and the urbanization of both urban and rural areas is a key underlying factor. Limited documentation of the extent of the increased effects of the fast food and bottled soft drink industries on this nutrition shift is available, but some examples of the heterogeneity of the underlying changes are presented. The challenge to global health is clear (Popkin, 2006).

2.4 Prevention of non-communicable disease in a population in nutrition transition: Tehran Lipid and Glucose Study phase II

The Tehran Lipid and Glucose Study (TLGS) is a long term integrated community-based program for prevention of non-communicable disorders (NCD) by development of a healthy lifestyle and reduction of NCD risk factors. The study begun in 1999, is ongoing, to be continued for at least 20 years. A primary survey was done to collect baseline data in 15005 individuals, over 3 years of age, selected from cohorts of three medical heath centers. A questionnaire for past medical history and data was completed during interviews; blood pressure, pulse rate, and anthropometrical measurements and a limited physical examination were performed and lipid profiles, fasting blood sugar and 2-hours-postload-glucose challenge were measured. A DNA bank was also collected. For those subjects aged over 30 years, Rose questionnaire was completed and an electrocardiogram was taken. Data collected were directly stored in computers as database software- computer assisted system. The aim of this study is to evaluate the feasibility and effectiveness of lifestyle modification in preventing or postponing the development of NCD risk factors and outcomes in the TLGS population.

In phase II of the TLGS, lifestyle interventions were implemented in 5630 people and 9375 individuals served as controls. Primary, secondary and tertiary interventions were designed based on specific target groups including schoolchildren, housewives, and high-risk persons. Officials of various sectors such as health, education, municipality, police, media, traders and community leaders were actively engaged as decision makers and collaborators. Interventional strategies were based on lifestyle modifications in diet, smoking and physical activity through face-to-face education, leaflets & brochures, school program alterations, training volunteers as health team and treating patients with NCD risk factors. Collection of demographic, clinical and laboratory data

will be repeated every 3 years to assess the effects of different interventions in the intervention group as compared to control group.

This controlled community intervention will test the possibility of preventing or delaying the onset of non-communicable risk factors and disorders in a population in nutrition transition (Azizi *et al*., 2009).

2.5 Developmental origins of non-communicable disease: Implications for research and public health

This White Paper highlights the developmental period as a plastic phase, which allows the organism to adapt to changes in the environment to maintain or improve reproductive capability in part through sustained health. Plasticity is more prominent prenatally and during early postnatal life, i.e., during the time of cell differentiation and specific tissue formation. These developmental periods are highly sensitive to environmental factors, such as nutrients, environmental chemicals, drugs, infections and other stressors. Nutrient and toxicant effects share many of the same characteristics and reflect two sides of the same coin. In both cases, alterations in physiological functions can be induced and may lead to the development of non-communicable conditions. Many of the major diseases – and dysfunctions – that have increased substantially in prevalence over the last 40 years seem to be related in part to developmental factors associated with either nutritional imbalance or exposures to environmental chemicals. The Developmental Origins of Health and Disease (DOHaD) concept provides significant insight into new strategies for research and disease prevention and is sufficiently robust and repeatable across species, including humans, to require a policy and public health response. This White Paper therefore concludes that, as early development (in utero and during the first years of postnatal life) is particularly sensitive to developmental disruption by nutritional factors or environmental chemical exposures, with potentially adverse consequences for health later in life, both research and disease prevention strategies should focus more on these vulnerable life stages (Barouki *et al*., 2012).

2.6 Systems medicine and integrated care to combat chronic noncommunicable diseases

We propose an innovative, integrated, cost-effective health system to combat major non-communicable diseases (NCDs), including cardiovascular, chronic respiratory, metabolic, rheumatologic and neurologic disorders and cancers, which together are the predominant health problem of the 21st century. This proposed holistic strategy involves comprehensive patient-centered integrated care and multi-scale, multi-modal and multi-level systems approaches to tackle NCDs as a common group of diseases. Rather than studying each disease individually, it will take into account their intertwined gene-environment, socio-economic interactions and co-morbidities that lead to individual-specific complex phenotypes. It will implement a road map for predictive, preventive, personalized and participatory (P4) medicine based on a robust and extensive knowledge management infrastructure that contains individual patient information. It will be supported by strategic partnerships involving all stakeholders, including general practitioners associated with patient-centered care. This systems medicine strategy, which will take a holistic approach to disease, is designed to allow the results to be used globally, taking into account the needs and specificities of local economies and health systems (Bousquet *et al*., 2011).

2.7 Obesity-related non-communicable diseases: South Asians vs White Caucasians

South Asians are at higher risk than White Caucasians for the development of obesity and obesity-related non-communicable diseases (OR-NCDs), including insulin resistance, the metabolic syndrome, type 2 diabetes mellitus (T2DM) and coronary heart disease (CHD). Rapid nutrition and lifestyle transitions have contributed to acceleration of OR-NCDs in South Asians. Differences in determinants and associated factors for OR-NCDs between South Asians and White Caucasians include body phenotype (high body fat, high truncal, subcutaneous and intra-abdominal fat, and low muscle mass), biochemical parameters (hyperinsulinemia, hyperglycemia, dyslipidemia, hyperleptinemia, low levels of adiponectin and high levels of C-reactive protein), procoagulant state and endothelial dysfunction. Higher prevalence, earlier onset and increased complications of T2DM and CHD are often seen at lower levels of

body mass index (BMI) and waist circumference (WC) in South Asians than White Caucasians. In view of these data, lower cut-offs for obesity and abdominal obesity have been advocated for Asian Indians (BMI; overweight >23 to 24.9 kg m−2 and obesity greater than or equal to25 kg m−2; and WC; men greater than or equal to 90 cm and women greater than or equal to80 cm, respectively). Imbalanced nutrition, physical inactivity, perinatal adverse events and genetic differences are also important contributory factors. Other differences between South Asians and White Caucasians include lower disease awareness and health-seeking behavior, delayed diagnosis due to atypical presentation and language barriers, and religious and sociocultural factors. All these factors result in poorer prevention, less aggressive therapy, poorer response to medical and surgical interventions, and higher morbidity and mortality in the former. Finally, differences in response to pharmacological agents may exist between South Asians and White Caucasians, although these have been inadequately studied. In view of these data, prevention and management strategies should be more aggressive for South Asians for more positive health outcomes. Finally, lower cut-offs of obesity and abdominal obesity for South Asians are expected to help physicians in better and more effective prevention of OR-NCDs (Mishra and Khurana, 2010).

2.8 Prevalence of Diabetes and Impaired Fasting Glucose in the Adult Population of Iran (National Survey of Risk Factors for Non-Communicable Diseases of Iran)

Despite concerns regarding a diabetes epidemic in the Middle East, internationally published data on national estimates of prevalent type 2 diabetes in Iran do not exist. With this article, we document a dramatically high prevalence of diabetes in Iran.

Their data were based on the results of the first Survey of Risk Factors of Non-Communicable Diseases of Iran, 2005. In this national cross-sectional survey, 70,981 Iranian citizens aged 25–64 years were recruiting.

They found that 7.7% of adults aged 25–64 years, or 2 million adults, have diabetes, among which one-half are undiagnosed. An additional 16.8%, or 4.4 million, of Iranian adults have impaired fasting glucose.

The high prevalence of diabetes in working-age adults is an ominous sign for this developing nation. As the relatively young Iranian population ages in the future and

urbanization continues or accelerates, the prevalence of diabetes will likely escalate (Esteghamati *et al*., 2007).

Significance of the study

Non-communicable diseases are by far the leading cause of death in the world. Of the 57 million global deaths in 2008, 36 million, or 63 percent, were due to NCDs. By 2030, non-communicable diseases will account for 66 percent of the global disease burden's some 80 percent of all NCD deaths occur in low- and middle-income countries. Non-communicable diseases are the most frequent causes of death in all regions of the world except Africa, where such diseases are rising rapidly and are projected to cause almost three quarters as many deaths as communicable, maternal, perinatal and nutritional diseases by 2020 – and to exceed them as the most common causes of death by 2030 (Hunter and Reddy, 2013).

Roughly 80 percent of NCD related deaths occur in low- and middle-income countries, where fragile health systems often struggle to meet the population's most basic health needs. WHO estimates that 48 percent of NCD deaths in low- and middle-income countries occur before 70 years old, compared with 26 percent in high income countries (Psi.org, 2016).

NCDs already disproportionately affect low- and middle-income countries where nearly three quarters of NCD deaths – 28 million – occur (Mozaffarian *et al*., 2014).

The underlying cause of NCD epidemic is the increase in lifestyle related risk factors resulting from social and economic changes. In many countries the increasing impact of globalization has given momentum to this process. Currently neighboring India is also experiencing an epidemic of NCDs attributed to lifestyle changes resulting from urbanization (Bangladesh Society of Medicine, 2011).

Among the modifiable risk factors unhealthy diet, physical inactivity, alcohol and tobacco use are categorized into primary risk factors and overweight, raised blood pressure, raised total cholesterol levels and raised blood glucose are categorized as intermediate risk factors. Most population has been experiencing an increased prevalence of both primary and intermediate risk factors (Bangladesh Society of Medicine, 2011).

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. In addition, one third of all cancers could be prevented by eating healthy food, maintaining normal weight and being physically active throughout the lifespan (Bangladesh Society of Medicine, 2011).

Major non-communicable diseases (NCDs) such as cardiovascular diseases, cancer, diabetes, or chronic respiratory disease have already become major public health problems in Bangladesh. According to the Global Status Report on NCDs 2014 of the World Health Organization (WHO), the estimated probability of premature deaths between ages 30 and 70 from any of the aforesaid NCDs is 17.5 %. The total number of deaths in 2012 was 277,500 due to NCDs giving rise to a death rate of 564.1 per 100,000 in males and 531.9 per 100,000 in females. Nearly half (49 %) of deaths were due to NCDs (Bangladesh Society of Medicine, 2011).

To respond to the increased burden of NCDs, WHO put due emphasis on gathering information on NCDs and their risk factors, as they are necessary for designing prevention and control program with specific goal and measurable outcome. Population specific data on risk factors are essential in order to set priorities, develop targeted programs on NCDs. Anticipating the NCD epidemic, WHO has initiated the worldwide STEP wise approach to Surveillance (STEPS) of risk factors for NCDs. STEPS focuses on the periodic collection of data on key risk factors associated with major NCDs which is indispensable for designing community based interventions to reduce risk factors in the population (Bangladesh Society of Medicine, 2011).

The emerging pandemic of non-communicable diseases (NCDs) creates a new frontier for health professionals globally. Most of the forecasted increase in NCD prevalence and death rates can be accounted for by emerging NCD epidemics in developing countries. Bangladesh has been facing a dual burden of existing infectious diseases and escalating rise of NCDs like diabetes, heart disease, stroke, cancer, chronic respiratory disease, etc. For getting prepared for the challenge of these diseases, information regarding their distribution and determinants is indispensable. Their control could well be addressed through their common risk factors A few studies have so far reported prevalence of individual risk factors such as hypertension, smoking and dietary habit,

from urban and rural populations. However few of them are done recently and showed a significantly increasing gradient in NCD prevalence. The study was done in order to determine the knowledge, awareness of the people regarding the NCD. It was also done to see the clustering of risk factor regarding NCD as a thorough study had not been done in Bangladesh on this topic for some time to measure the biological and behavioral risk factors of people on non-communicable disease was done.

Therefore it is of prime importance to conduct a survey on NCD risk factors taking into account of national representatives.

This study is designed to have a nationally representative prevalence estimate of NCD risk factors of mass people for male respondents of >18 years and above following WHO STEPS. The significance of the study is -To determine the distribution of the risk factors such as tobacco use, fruit and vegetables intake, physical activity, dietary habit, obesity, hypertension, family history of any NCDs, any current medical conditions of NCDs. The study was also done to determine the knowledge or awareness of the population about the risk factors (Biological and Behavioral markers means lifestyles)

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 male respondents of ≥18 years following STEPS guidelines.
- ✓ 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 Dhaka City which includes Luxmibazar, Sutrapur, Chankharpul, Polashi, Wari, Shanarpar and some university areas too.

3.3 Study Population

In this study, a total number of 310 male 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. Informed consent was obtained from the eligible participants before interviewed and participants who agreed to join the study provided the required information for the studies.

3.4 Study Period

The duration of the study was about six months starting from January to May, 2016.

3.5 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 pilot 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.

3.6 Sampling Technique

In this study purposive sampling technique was followed.

3.7 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 regarding eye disease among the students.

Chapter 4

Results

4.1. Age Distribution of the Respondents

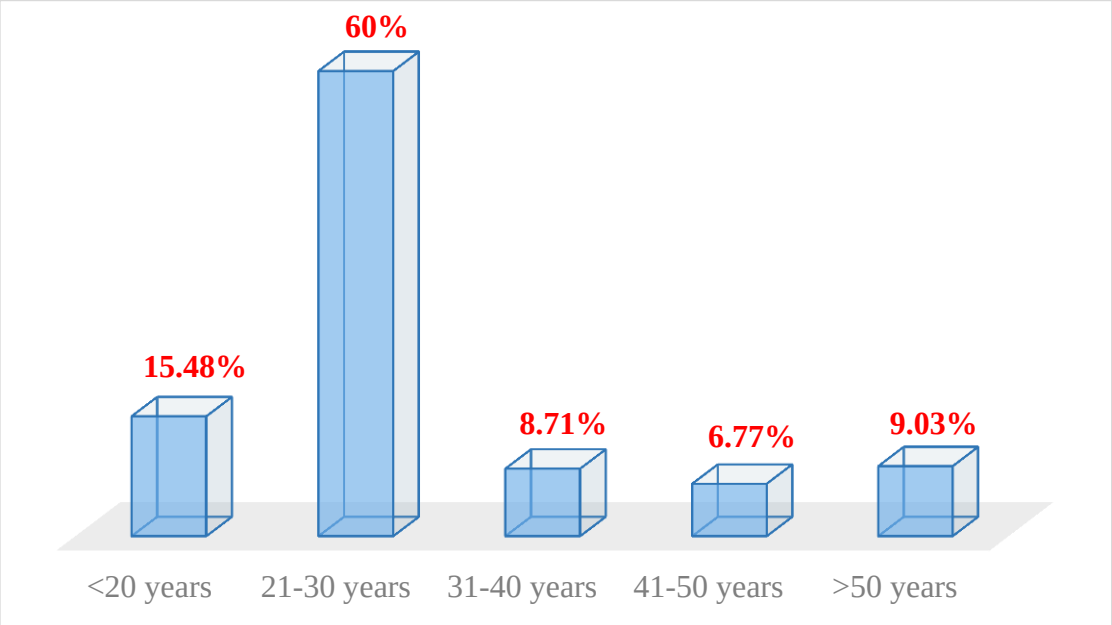

Figure 4.1: Age Distribution of the Respondents

During this study it was found that about 60% population were in between 21 to 30 years, whereas, 15.48% were within the range of below 20 years. However, only 6.77 % population were between 41 to 50 years of age. Around 8.71% population were within the 31-40 years range and rest of the population which includes 9.03% were > 50 years.

4.2. Educational Qualifications of the Respondents

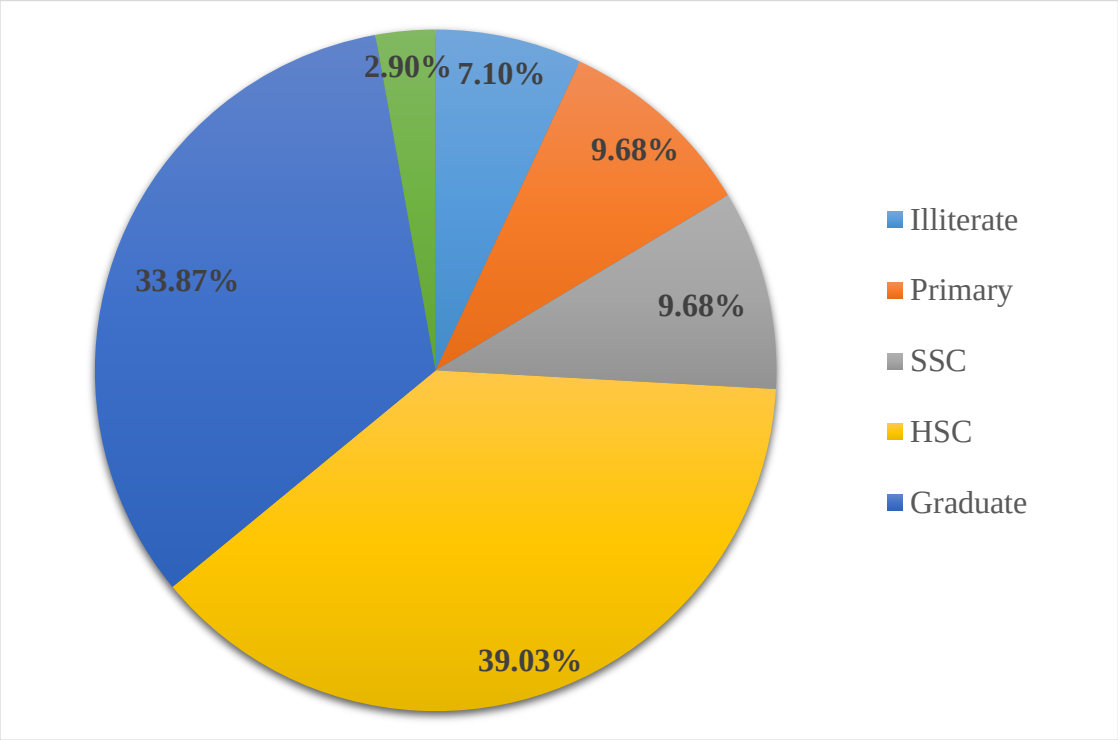

Figure 4.2: Educational Qualification of the Respondents

Regarding their educational status about 39.03% of the population passed HSC level, whereas, 33.87% were Graduates. Around, 9.68% population passed SSC level. 9.68% population also passed Primary education level and rest of the population which includes 7.10% of Illiterate and 2.90% of Post graduates people.

4.3 Occupational Qualifications of the Respondents

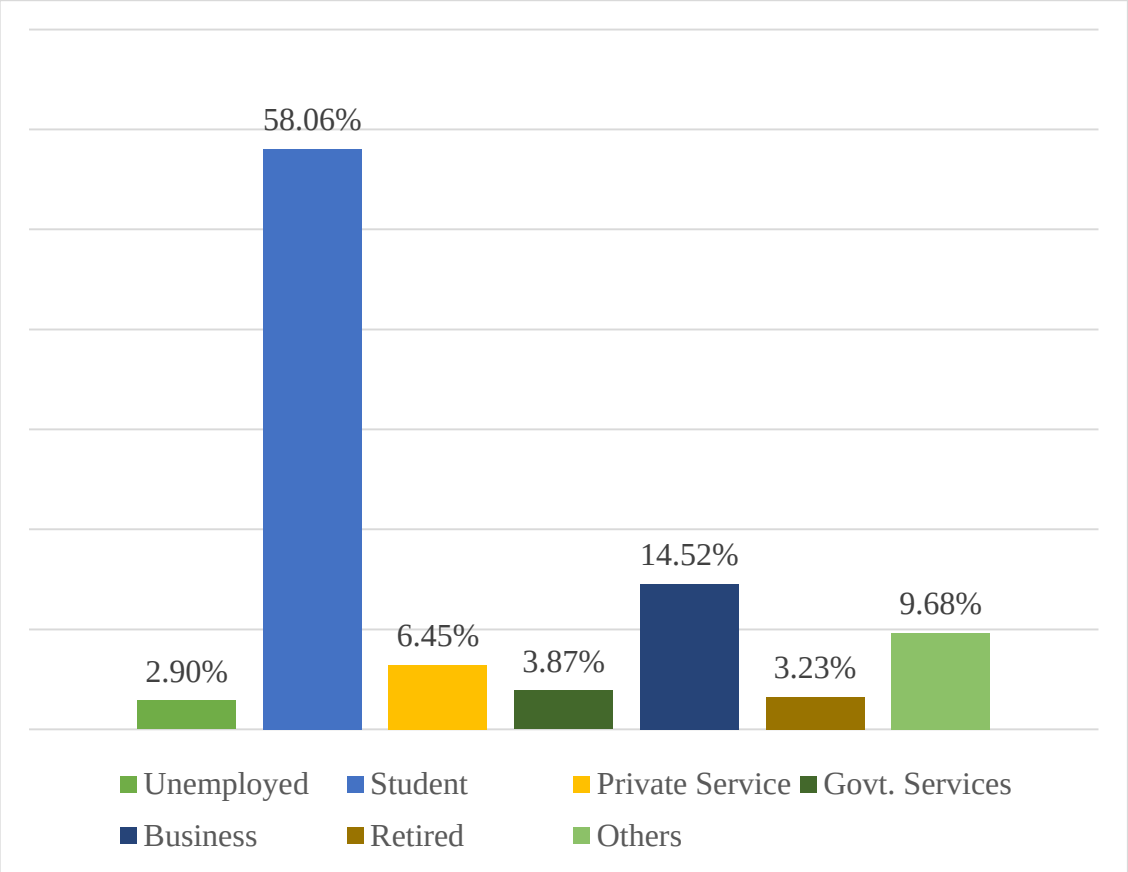

Figure 4.3: Occupational Qualifications of the Respondents

During this study it was found that about 58.06% population were students, whereas, 14.52% were businessmen. Around, 6.45% population are working in the private sectors. Around 9.68% population are pursuing others means for living. 3.23% of the population are Govt. Service holders. The rest of the population includes 3.23% of the retired people and 2.90% of the Unemployed people.

4.4 Marital Status of the Respondents

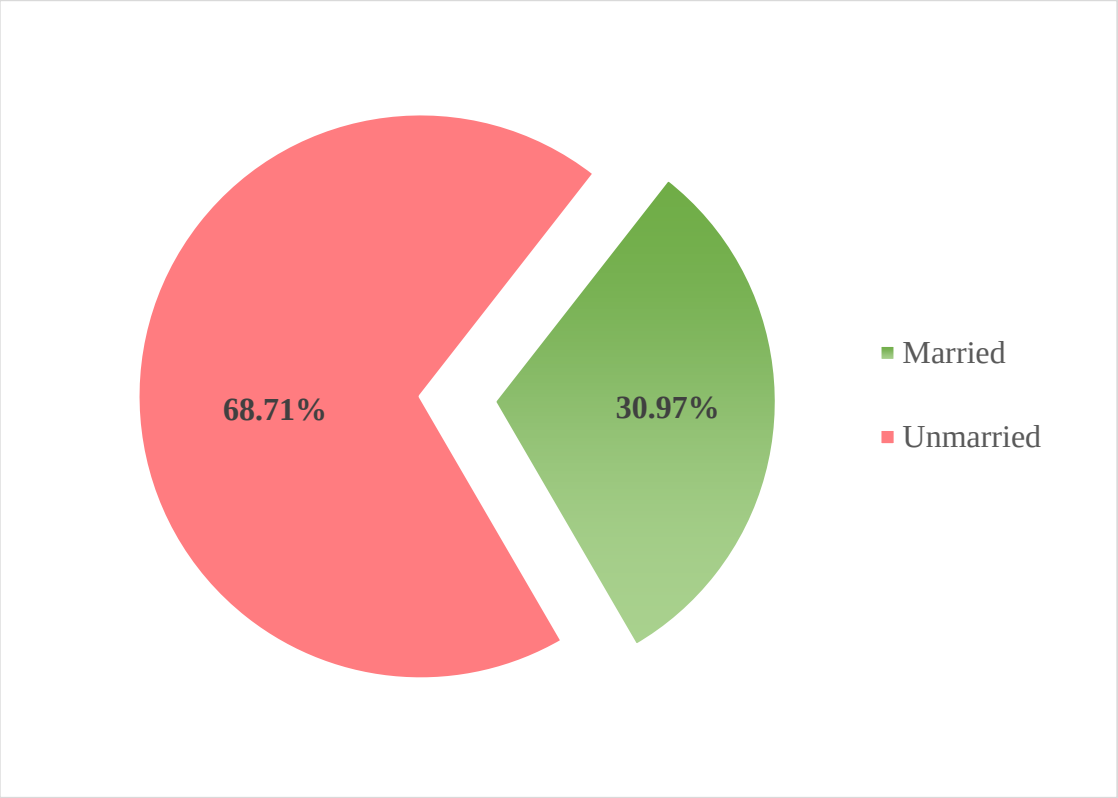

Figure 4.4: Marital Status of the Respondents

Among the respondents about 68.71% population were unmarried upon which the study was conducted, whereas, 30.97% were married.

4.5 Residential Status of the Respondents

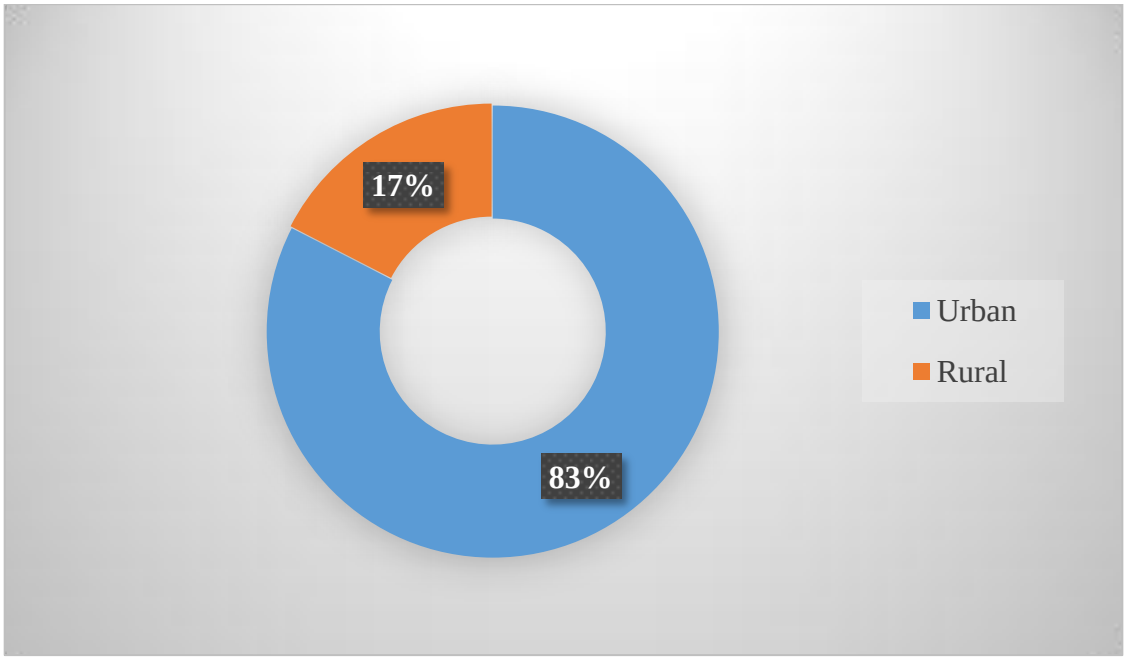

Figure 4.5 Residential Statuses of the Respondents

During this study it was found that about 83% population were living in the cities or in urban areas upon which the study was conducted, the rest of the population were living in rural region includes around 17%.

4.6 Monthly Family incomes of the Respondents

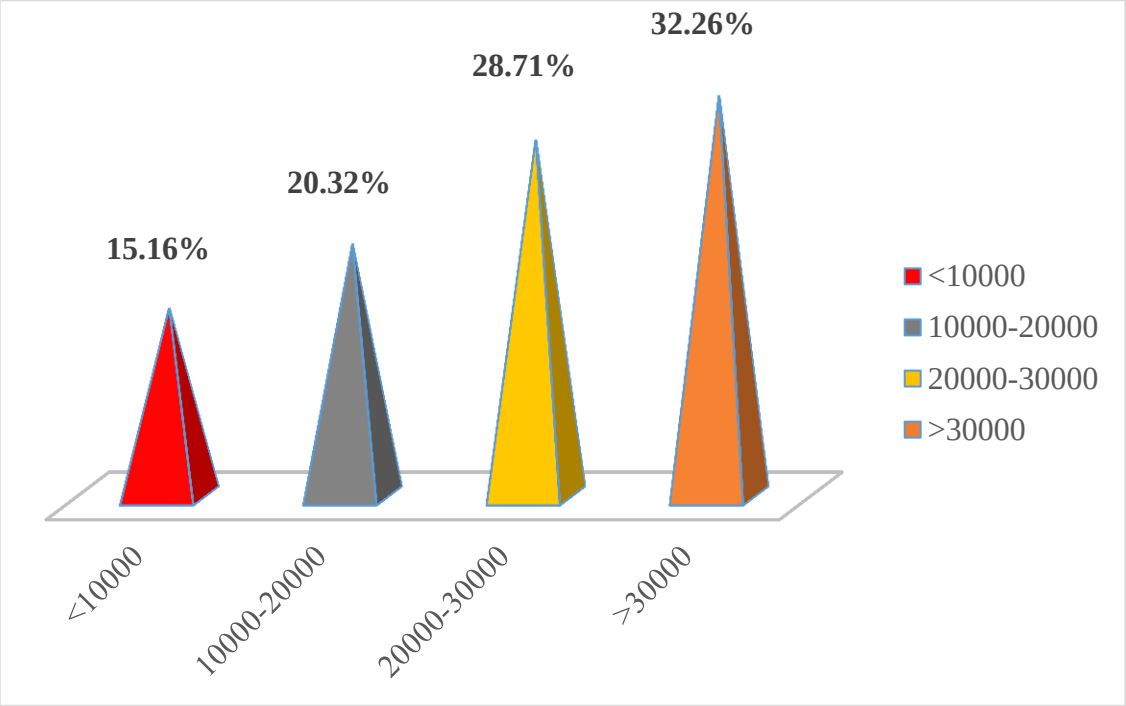

Figure 4.6 Monthly Family incomes of the Respondents

During this study it was found that about 32.26% population had monthly family income >30000tk, whereas, 28.71% had earnings of 20000-30000tk.Around 20.32% population are earning within the range of 10000-20000tk.The rest of the population includes 15.16% of the people earning <10000tk as their family income for a month.

4.7 Body Mass Index (BMI) Status of the Respondents

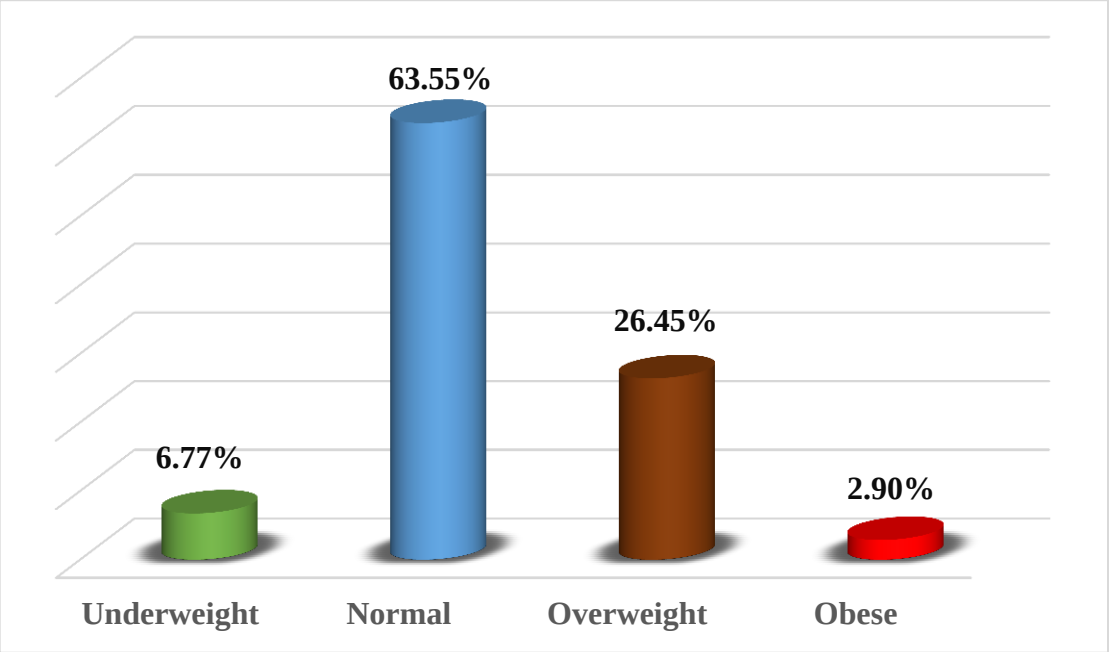

Figure 4.7 Body Mass Index (BMI) Status of the Respondents

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 63.55% of the population had a normal weight whereas 6.77% of the population were underweight. But it was found that 26.45% of the population were within the range of overweight and had greater risk of obesity in the near future. On the other hand 2.90% 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.

4.8 Waist Circumference Status of the Respondents

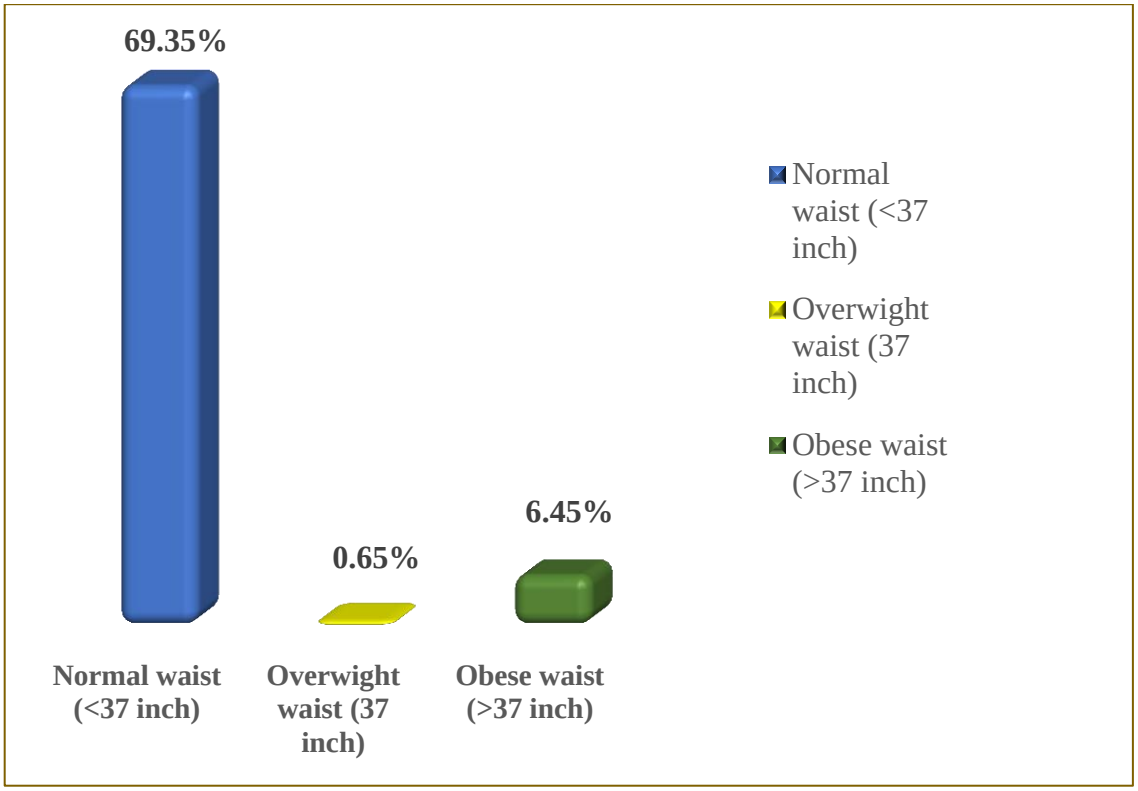

Figure 4.8: Waist Circumference Status of the Respondents

During this study it was found that about 69.35% population were waist circumference which was normal as that was normal waist <37 inch. On the other hand 0.65% of the respondents had overweight waist means 37inch they had increased chance of suffering from obesity in the near future. But the most alarming situation was such that when already 6.45% of the study population were having obese waist circumference which indicates one of the behavioural risk factor that was alarming. The distribution of this risk factor threatens population from suffering from NCDs in the near future.

4.9 Sleeping Habit of the Respondents

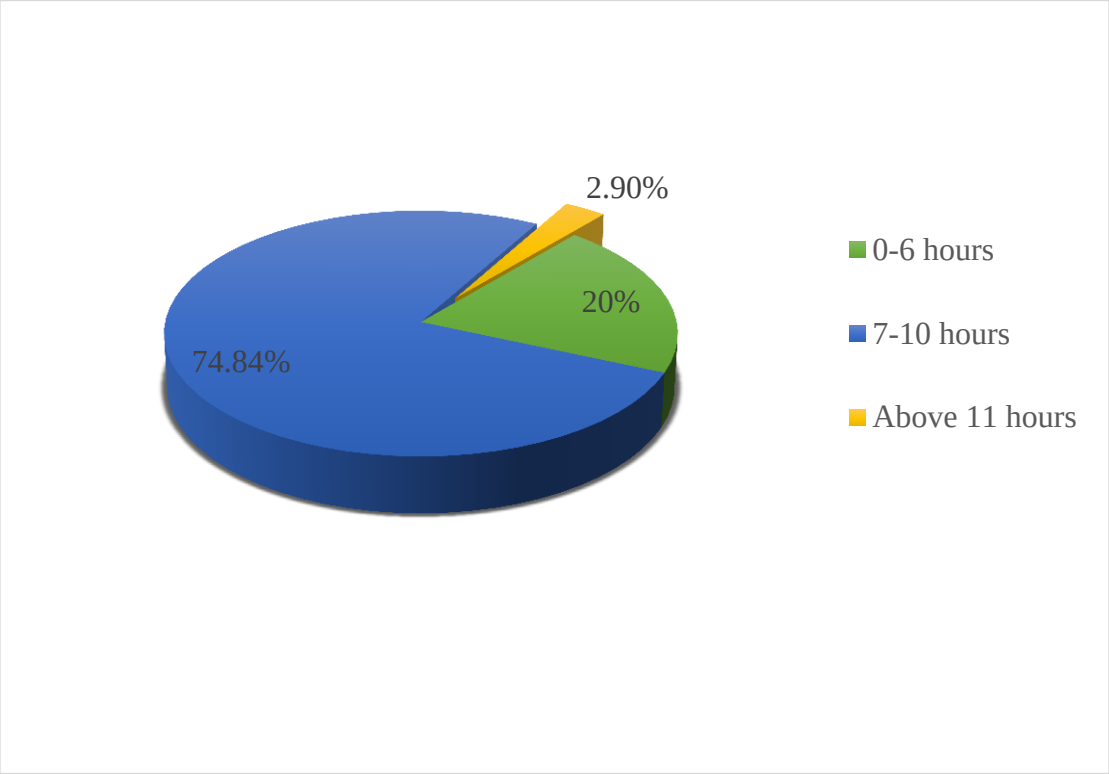

Figure 4.9: Sleeping Habit of the Respondents

During this study when respondents were asked about their sleeping habit 74.84% population had a sleeping habit of 7-10 hours a day. Around 20% of the population had a sleeping duration of 0-6 hours a day. The rest of the population which includes 2.90% of the people had a sleeping duration of above 11 hours a day.

4.10 Blood Pressure Status of the Respondents

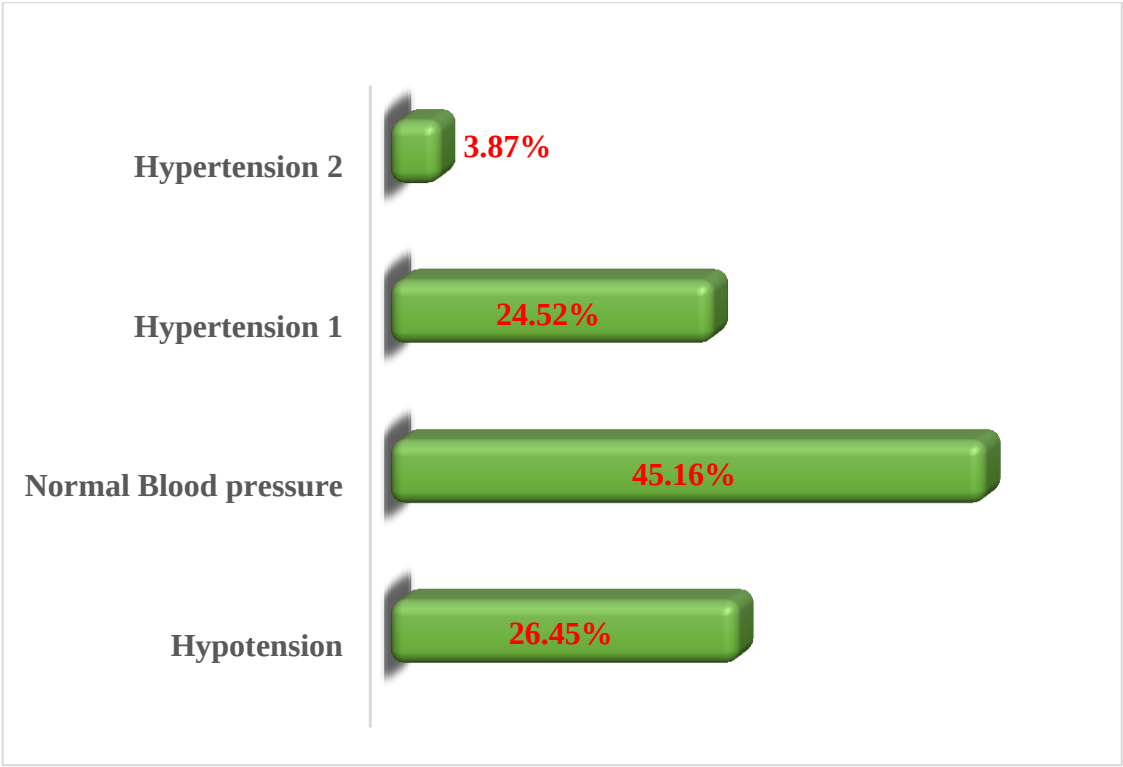

Figure 4.10: Blood Pressure Status of the Respondents

Blood pressure played an important role in the study. During this, when the pressure of each of the respondents were measured it was seen through analysis that 26.45% of the respondent had hypotension and 45.16% of the people had normal blood pressure conditions. But the major concerning issue was that 24.52% of the people having Hypertension 1 and rest of the population had 3.87% hypertension 2 which may lead to further complications.

4.11 Status of Respondents Current Medical Condition

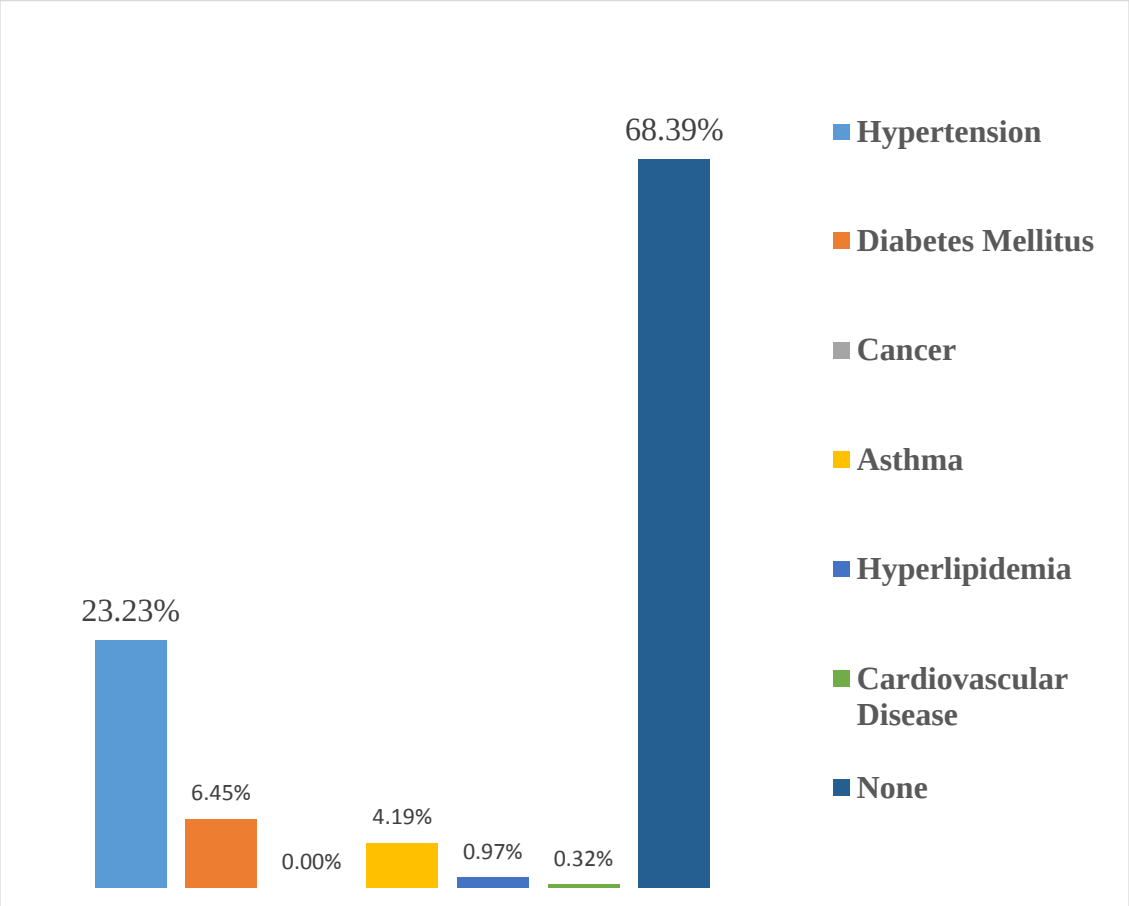

Figure 4.11: Status of Respondents Current Medical Condition

When the respondents were asked whether they are suffering from any of the medical conditions than 23.23% of the people answered that they are suffering from hypertension. Other respondents included 6.45% having Diabetes mellitus, 4.19% from asthma, 0.97% from hyperlipidemia and 0.32% from cardiovascular diseases. But 68.39% of the populations were not suffering from any of the conditions out of 310 respondents.

4.12 Status of Respondents about Family history of the disease conditions

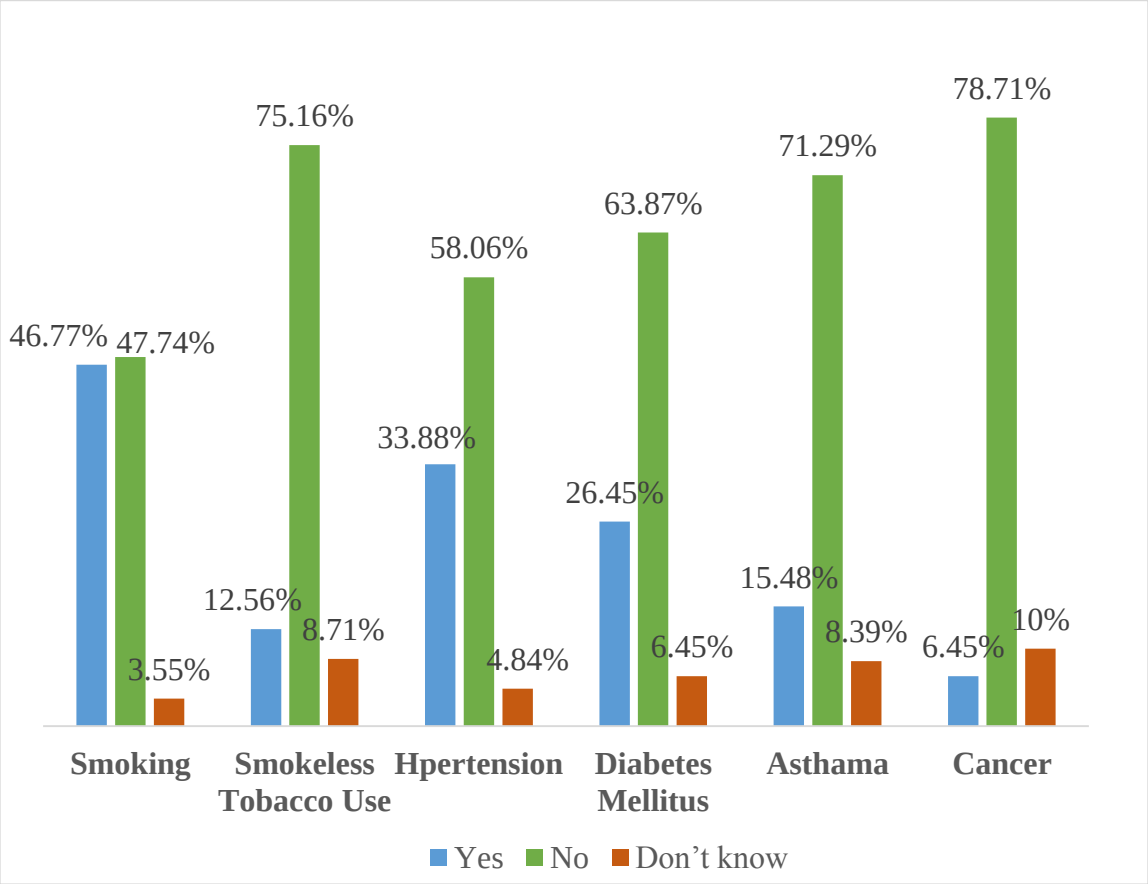

Figure 4.12: Status of Respondents about Family history of the disease conditions

Whether the respondents of the study had any sort of family history or not regarding the disease conditions or behavioral conditions they answered that there were 46.77% of the people have family history of smoking. But 47.74% had no family history and 3.55% 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 12.56% said about their family history but 75.16% had nothing and 8.71% knew nothing about it. In case of hypertension 33.88% had family history but 58.06% had no history and 4.84% didn't know about it. 26.45% of the respondents had family history in diabetes mellitus but 63.87% had no history and 6.45 knew nothing. The rest of the conditions regarding asthma and cancer 15.48% and 6.45% provided affirmative answers about family history. But 71.29% and 78.71% correspondingly gave negative

answers. The rest 8.39% and 10% knew nothing about their family history. From this analysis it is affirmative that respondents with family history had a greater chance of suffering from this disease conditions as they are biological markers.

4.13 Knowledge about factors causing health problems

4.13.1 Knowledge regarding Tobacco Use

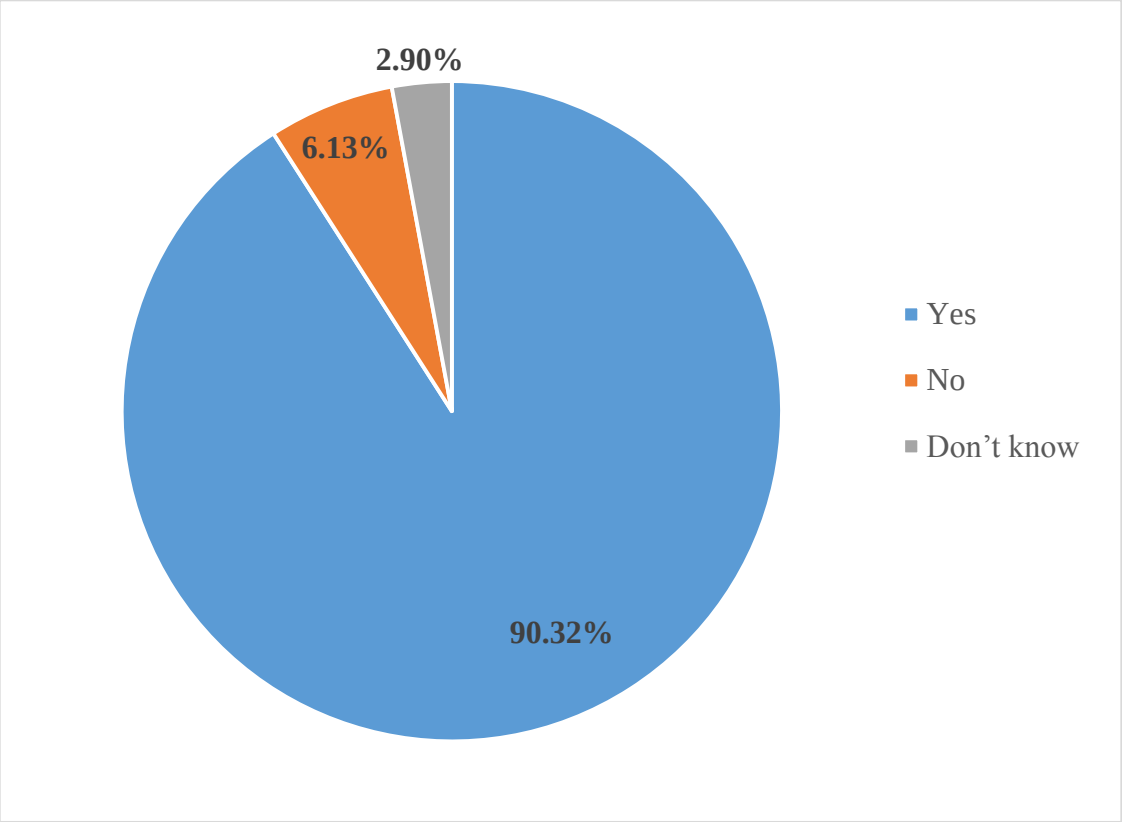

Figure 4.13: Knowledge regarding Tobacco Use

When the respondents were asked whether Tobacco use causes health problem then about 90.32% of the population knew that tobacco use can cause health problem. Around 6.13% of the population thought that tobacco use didn't cause any sort of health problem. The rest of the population which includes 2.90% of the people had no idea that tobacco use could cause any sort of health problem in a person.

4.13.2 Knowledge regarding Excess Salt Intake

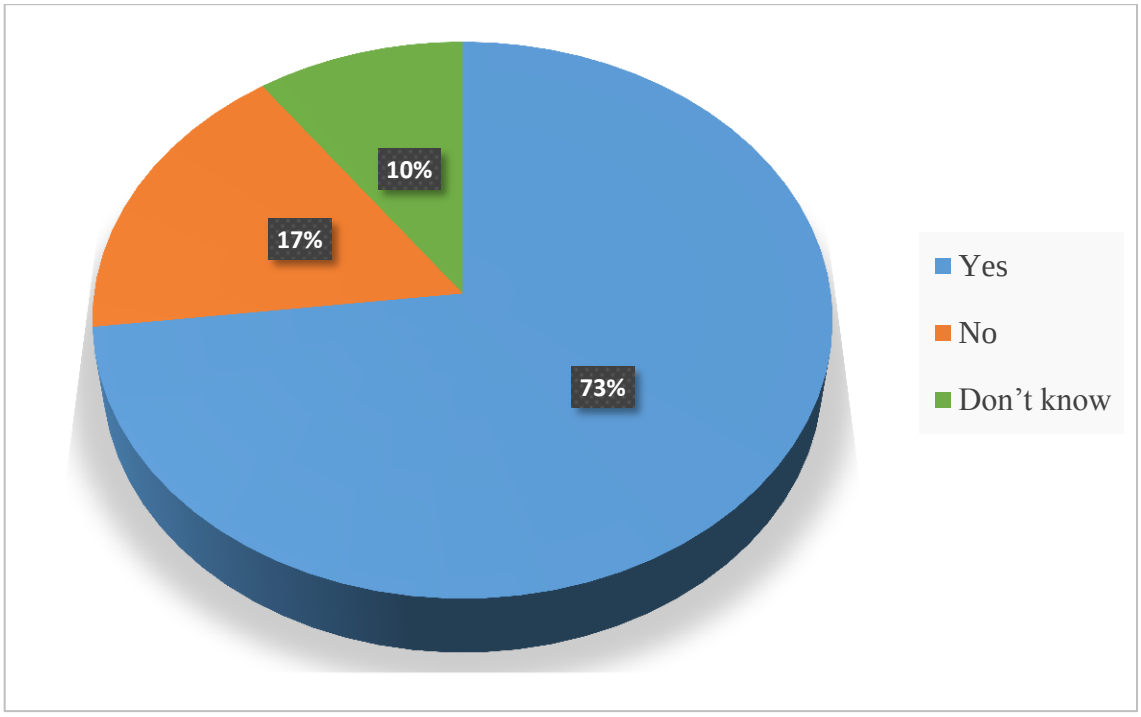

Figure 4.14: Knowledge regarding Excess Salt Intake

When the respondents were asked whether Excess salt intake causes health problem about 73% of the population knew that excess salt intake can cause health problem. Around 17% of the population thought that excess salt intake didn't cause any sort of health problem. The rest of the population which includes 10% of the people had no idea that excess salt intake could cause any sort of health problem in a person.

4.13.3 Knowledge regarding Physical Inactivity

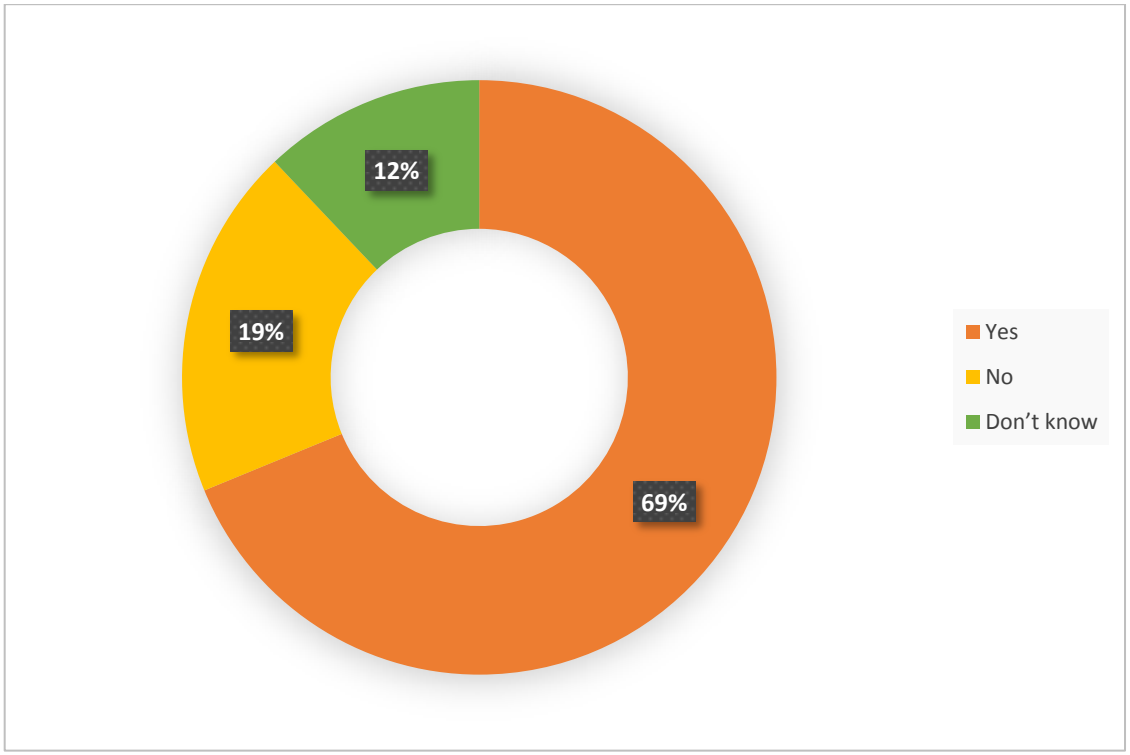

Figure 4.15: Knowledge regarding Physical Inactivity

When the respondents were asked whether Physical Inactivity causes health problem about 69% of the population knew that physical inactivity can cause health problem. Around 19% of the population thought that physical inactivity didn't cause any sort of health problem. The rest of the population which includes 12% of the people had no idea that physical inactivity could cause any sort of health problem in a person.

4.13.4 Knowledge of the Respondents regarding Obesity

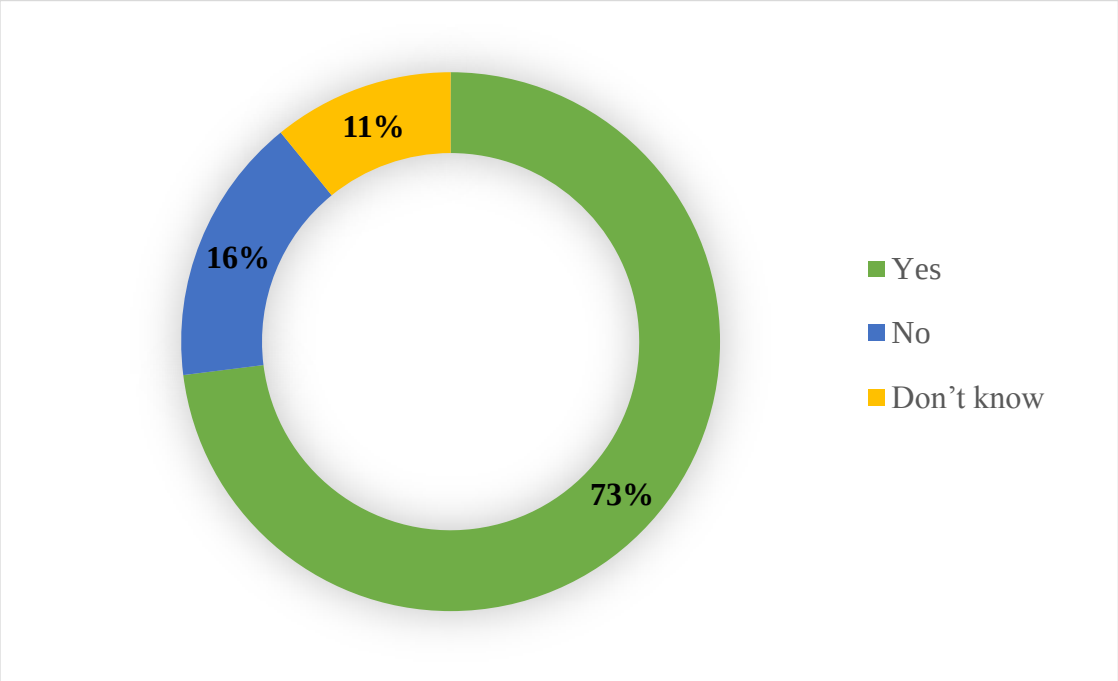

Figure 4.16: Knowledge of the Respondents regarding Obesity

When the respondents were asked whether Obesity causes health problem about 73% of the population knew that obesity can cause health problem. Around 16% of the population thought that obesity didn't cause any sort of health problem. The rest of the population which includes 11% of the people had no idea that obesity could cause any sort of health problem in a person.

4.14 Status of Respondents Tobacco product use

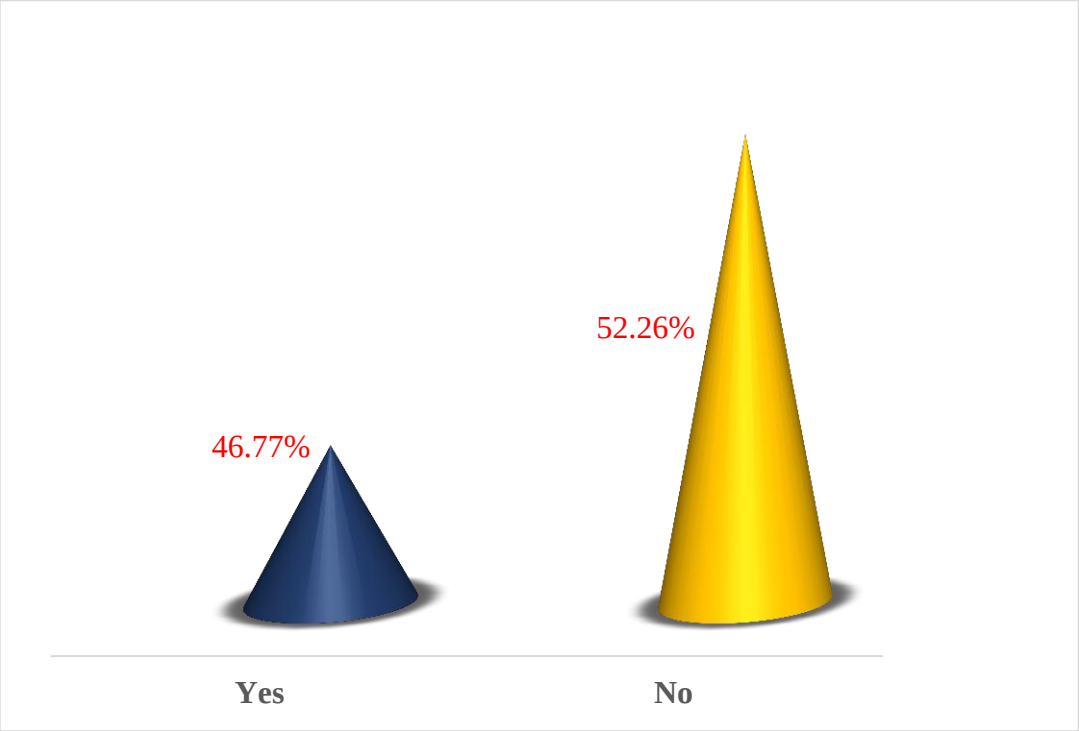

Figure 4.17: Status of Respondents Tobacco product use

When asked whether the respondents have taken any sort of smoking products within last 30 days 46% of the people answered in an affirmative manner and 52.26% people provided a negative answer.

4.14.1 Type of Tobacco product used by Respondents

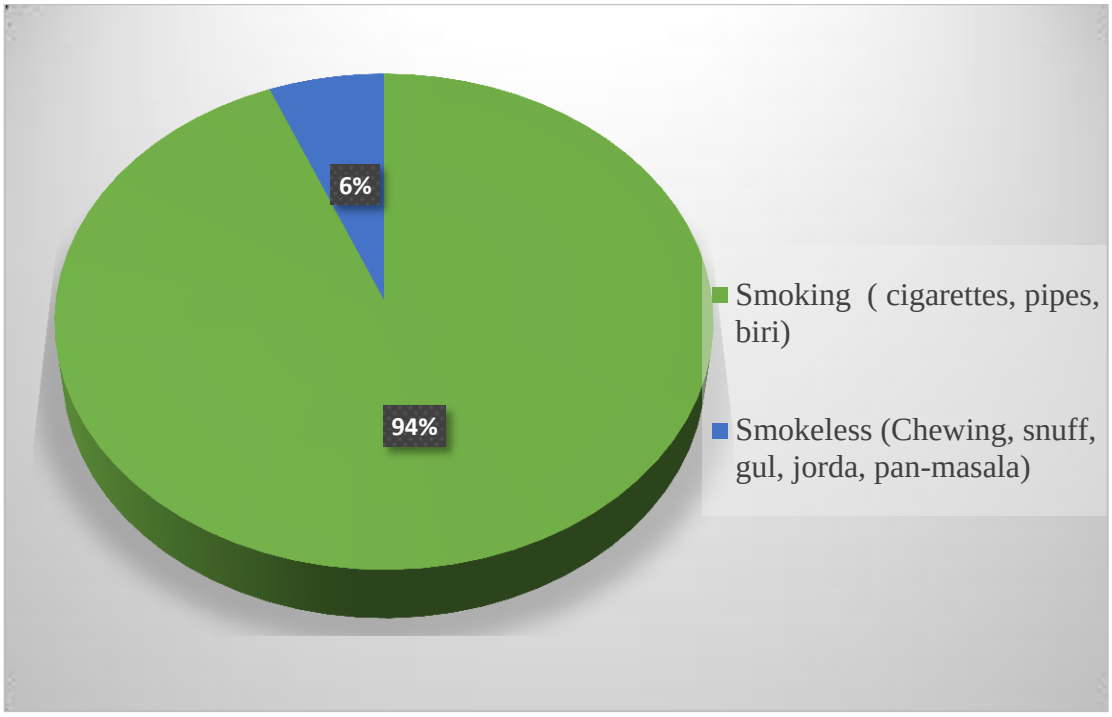

Figure 4.18: Type of Tobacco product used by Respondents

After the respondents were asked about their tobacco use within 30 days if the answer was affirmative then which type of tobacco product they actually used were also asked and 94% of the respondents said they used smoking (cigarettes, pipes, biri).the rest of the people said they used smokeless (Chewing, snuff, gul, jorda, pan-masala).

4.15 Stats of Dietary Habit of the Respondents

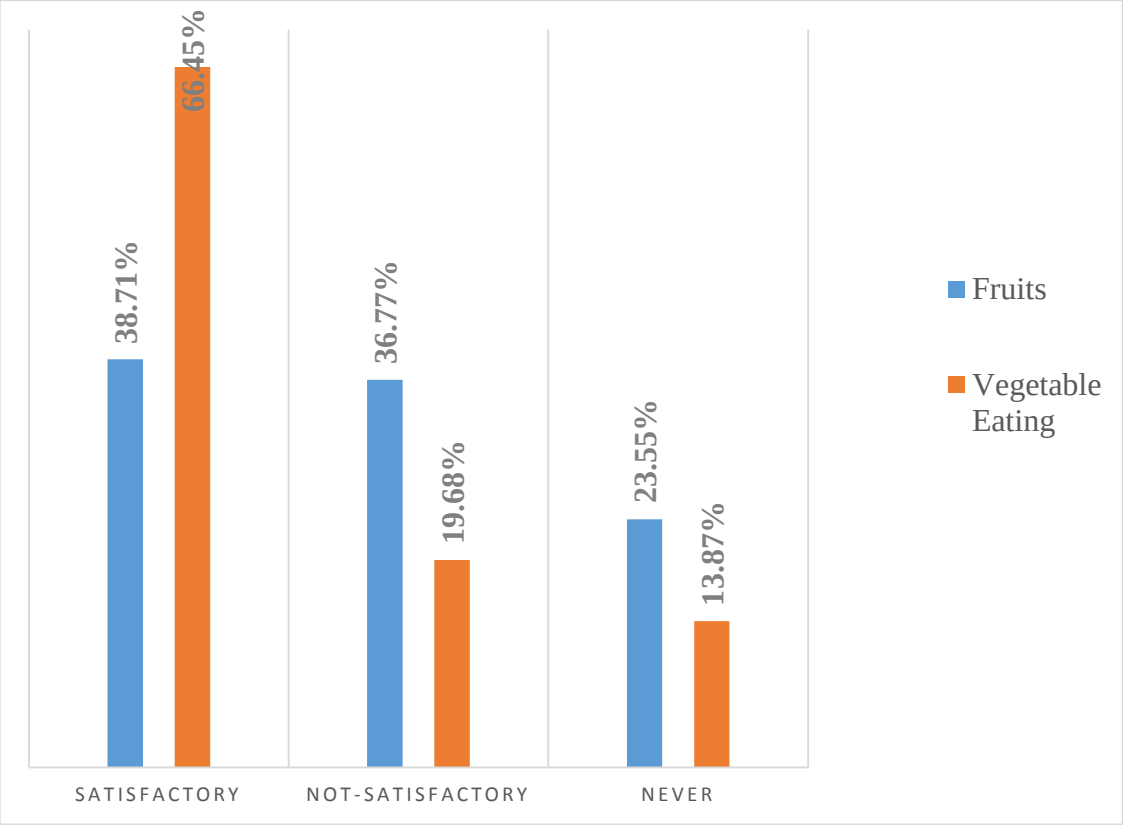

Figure 4.19: Stats of Dietary Habit of the respondents

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 38.71% and 66.45% of the respondent follow this habit. But 36.77% and 19.68% of the respondents takes fruits and vegetables but doesn't comply with the standard. Again 23.55% and 13.87% 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.

4.15.1 Stats of Dietary Habit of the respondents eating meals

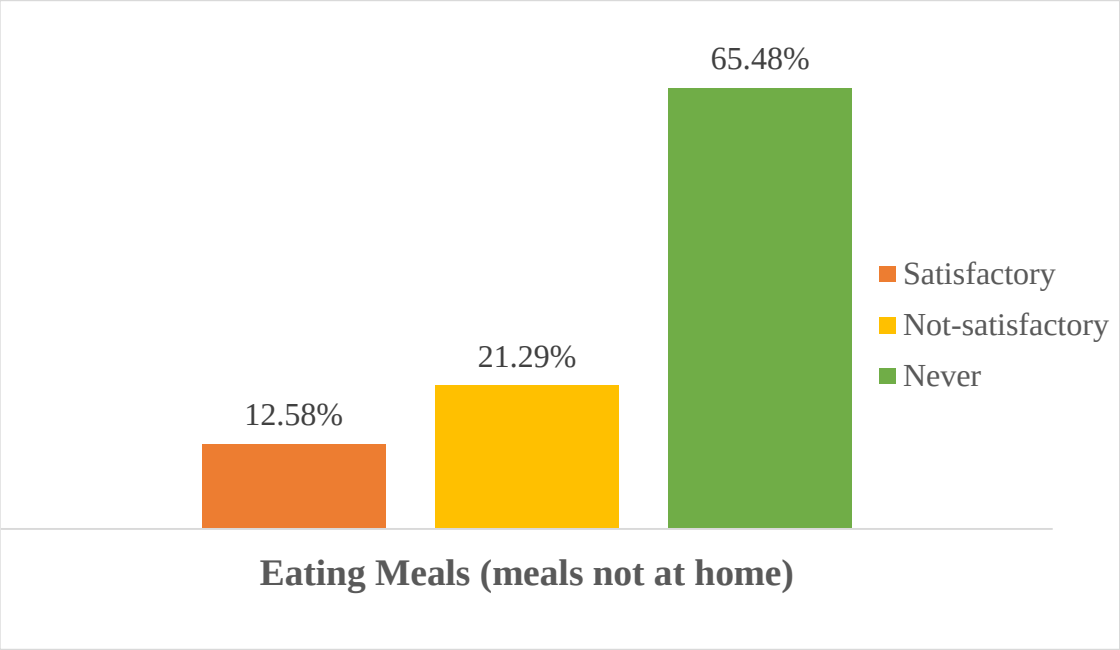

Figure 4.20: Stats of Dietary Habit of the respondents eating meals

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 12.58% of the people didn't take a single meal outside which is satisfactory in nature. On the other hand 21.29% of the people took meal outside of home at least 3-4 days a week. The rest of the population 65.48% took at least a meal prepared outside home. The major portion of the people took meals outside of home which increases a greater threat for non-communicable diseases occurrence.

4.16 Habit of adding Salt or Salty Sauce in the Food

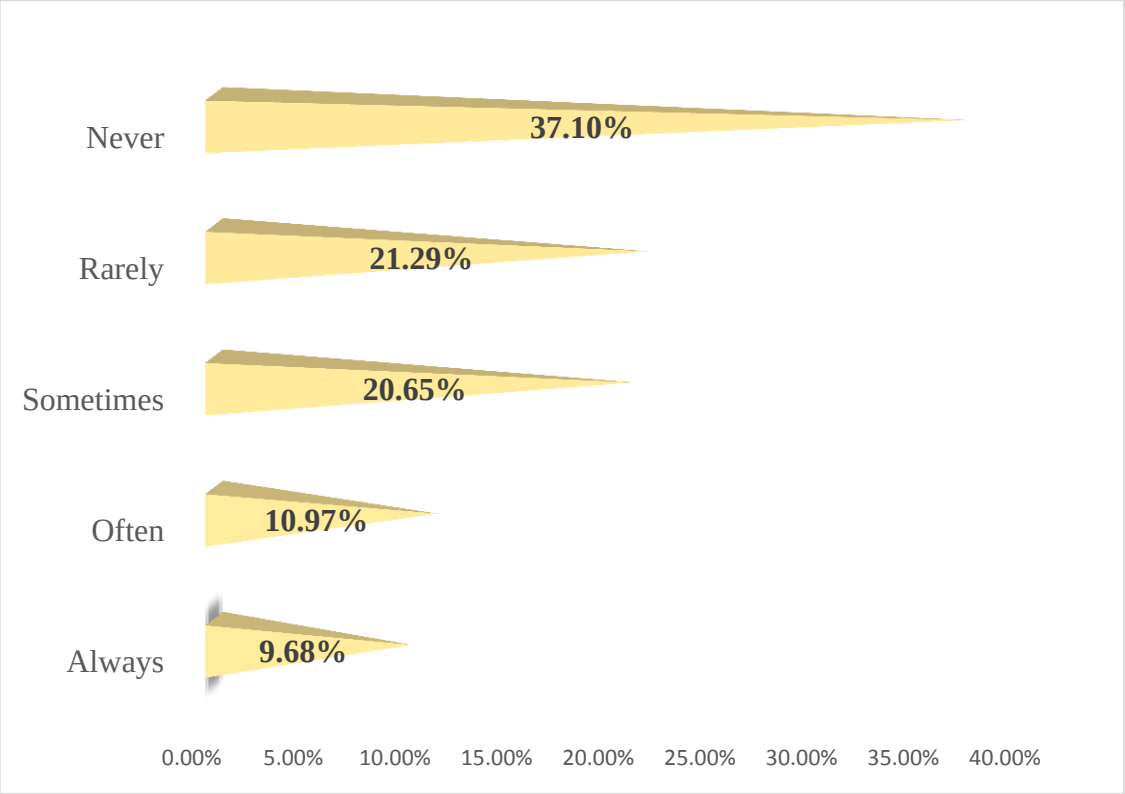

Figure 4.21: Habit of adding Salt or Salty Sauce in the Food

When the respondents were asked about if they take additional salt or salty sauce in the food 9.68% gave affirmative answer. On the other hand 10.97% of the people often added it and 20.65% of the sometimes added salt or salty sauce in their food. Out of the 310 respondents 21.29% rarely and 37.10% never added salt or salty sauce in their food. Upon analyzing it can be easily said that major portion of the study population maintains quite a good habit and will not be easily subjected to non-communicable diseases.

4.17 Habit of eating processed food High in Salt

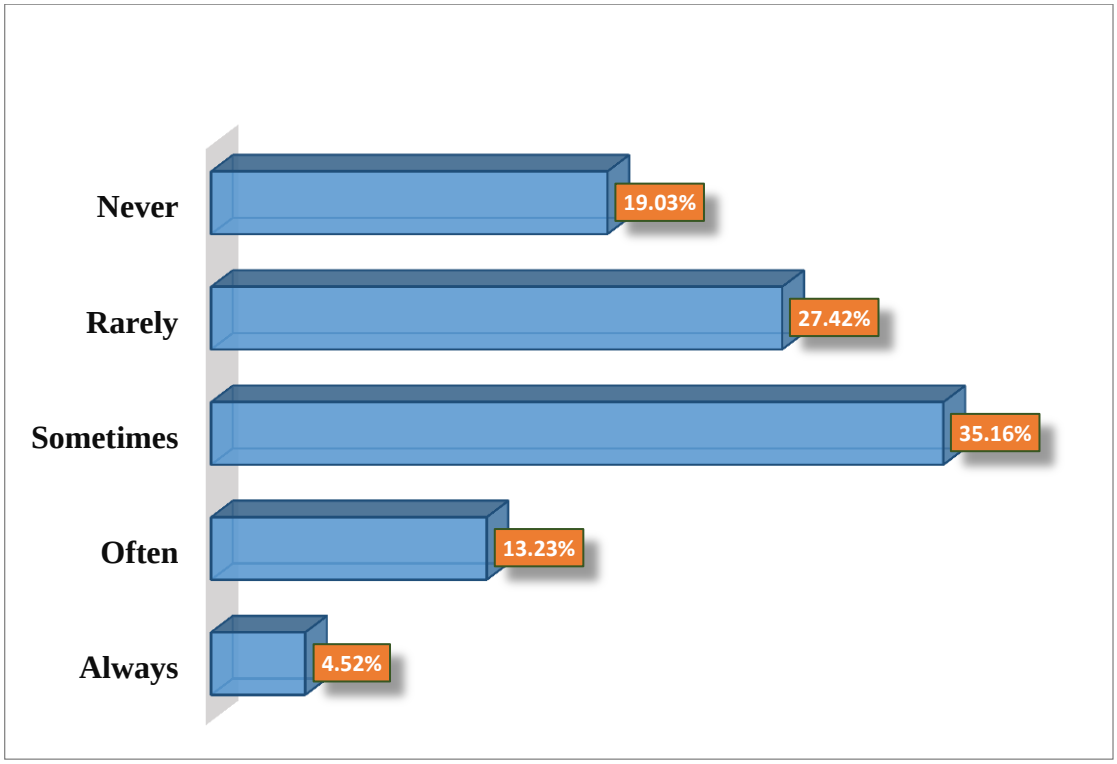

Figure 4.22: Habit of eating processed food High in Salt

When the respondents were asked about if they eat processed food high in salt content 4.52% gave affirmative answer. On the other hand 13.23% of the people often ate processed food high in salt content and 35.16% of the sometimes ate this type of food. Out of the 310 respondents 27.42% rarely and 19.03% 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.

4.18 Physical Activity stats of the Respondents

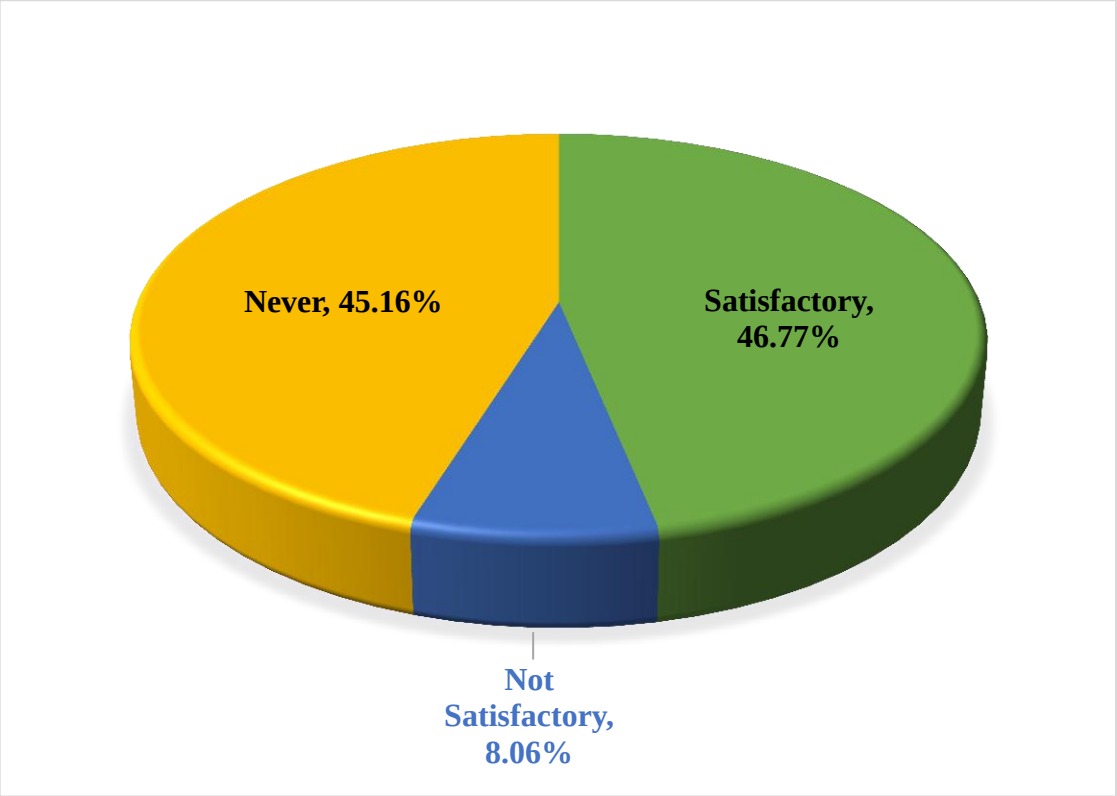

Figure 4.23: Physical Activity stats of the Respondents

Out of the 310 respondents when asked about their physical activity including exercise, walking at home or at work (carrying r lifting loads, digging, construction work, walking) or during travelling (walking or cycling) 46.77% followed the standard of physical activity which is 150 minutes a week. On the other hand 45.16% of the people never and 8.06% of the people in a not satisfactory manner avoid the physical activity. The majority of the study population do not comply with the physical activity standard which increases their chances for suffering from non-communicable diseases.

4.19 Duration of Sitting or Reclining of the Respondents

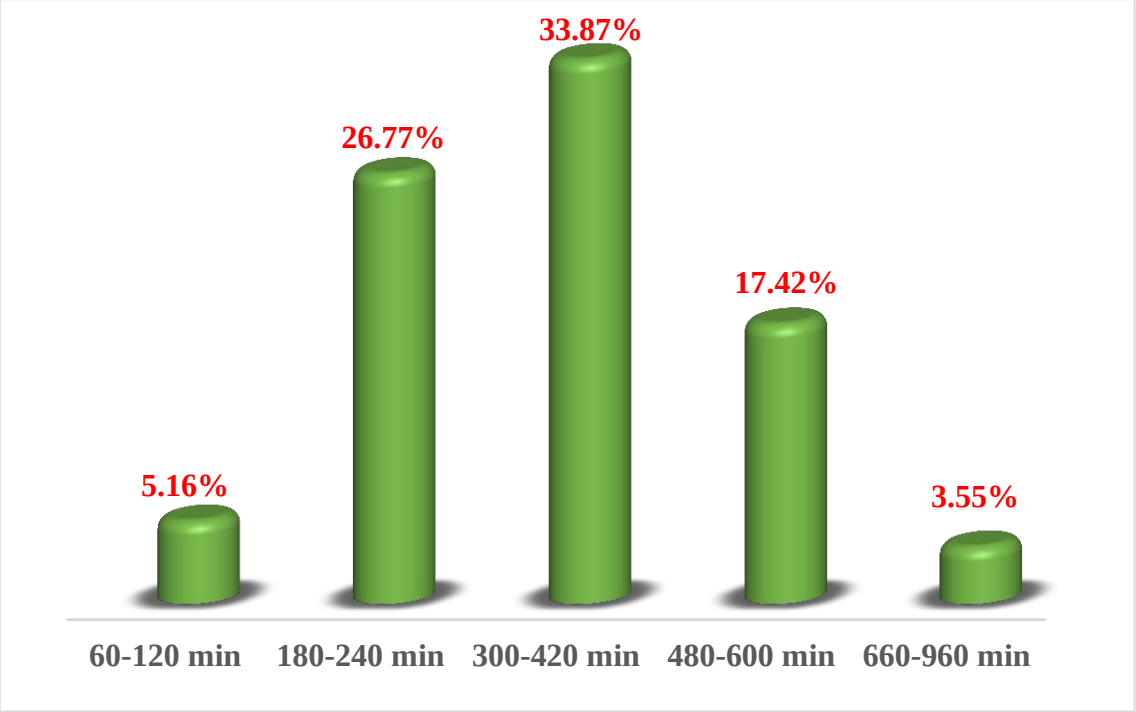

Figure 4.24: Duration of Sitting or Reclining of the Respondents

One of the parameters included about the respondents sitting or reclining time when studied this parameter out of 310 respondents 33.87% of the people said they remain idle for 300-420min. 26.7% of the people recline for 180-240 min and 17.42% recline for 480-600min. The rest of the people recline or sit idle for include 5.16% for 60-120min and 3.55%for 600-960 min. From the analysis it is evident that majority of the study population passing a greater deal of time through sitting or reclining which increases their risk against NCD.

4.20 Doctors' Advice to the Respondents

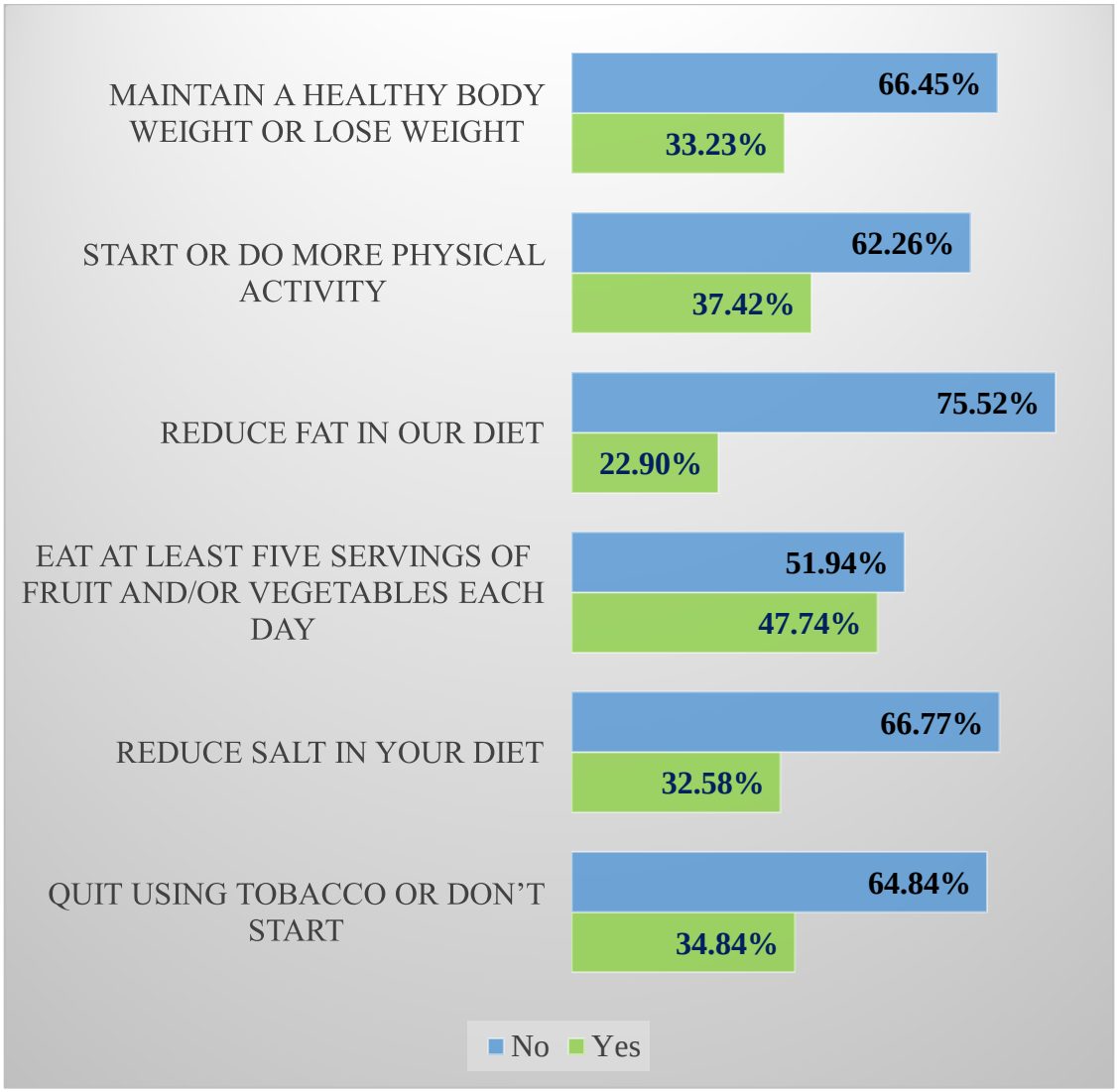

Figure 4.25: Doctors' Advice to the Respondents

When the respondents were asked about whether their doctors ever gave them any advices regarding their behavioral modifications on lifestyles out of 310 respondents regarding healthy body weight or lose weight 66.45% gave affirmative answer and 33.23% gave negative answer. For starting or doing more physical exercise 62.26% were suggested and 37.42% people were not suggested. 75.52% of the respondents were advised to reduce fat in the diet but 22.90% were not advised. About 51.94% of the populations were advised to take five servings of fruits/vegetables each day but 47.74% had no advice regarding this. Reducing salt is also important, 66.77% of the

population was asked to do it but 32.58% were not. Lastly for quitting tobacco use 64.84% were advised but 34.84%of the population were not 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. Else they are within greater danger of suffering from NCD due to their lifestyle or behavioral markers.

Chapter 5

Discussion

&

Conclusion

Discussion

Bangladesh has been facing a dual burden of existing infectious diseases and escalating rise of NCDs. The aim of the study was to determine the distribution of the risk factors of NCDs, prevalence of NCDs also the study was also done to determine the knowledge or awareness of the population about the risk factors.The study was conducted on 310 male respondents of which 60% population were in between 21 to 30 years, whereas, 15.48% were within the range of below 20 years. However, only 6.77 % population were between 41 to 50 years of age. Around 8.71% population were within the 31-40 years range and rest of the population which includes 9.03% were > 50 years and the respondents were male.

Regarding their educational status about 39.03% of the population passed HSC level, whereas, 33.87% were Graduates. The rest of the population included SSC, primary, post-graduates and illiterate people.

A similar study was conducted among of 4073 respondents of the survey 1812 were men and 2261 were women. Mean age was 41 years.11.4% of men were students. In men farmers made up 18.4%, 27.5% were businessmen, 17.2% were day labourer, 21.5% salaried staff and 3.9% were homemakers (Zaman *et al*., 2015).

The major portion of the respondents 68.39% of the populations were not suffering from any of the current medical conditions out of 310 respondents. But 23.23% of the people were suffering from hypertension, 6.45% having Diabetes mellitus, 4.19% from asthma, 0.97% from hyperlipidemia and 0.32% from cardiovascular diseases.

Family history of the study population provided that there were 46.77% of the people have family history of smoking. But 47.74% had no family history and 3.55% 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 12.56% said about their family history but 75.16% had nothing and 8.71% knew nothing about it. In case of hypertension 33.88% had family history but 58.06% had no history and 4.84% didn’t know about it. 26.45% of the respondents had family history in diabetes mellitus but 63.87% had no history and 6.45 knew nothing. The rest of the conditions regarding asthma and cancer 15.48% and 6.45% provided affirmative answers about family history. But 71.29% and 78.71% correspondingly gave negative answers. The rest

8.39% and 10% knew nothing about their family history. From this analysis it is affirmative that respondents with family history had a greater chance of suffering from this non-communicable disease conditions as they are biological markers.

A study Zaman *et al*., 2015 showed 20.7% of the survey population was having hypertension (blood pressure >_140/90 mmHg) excluding medication. The results were quite similar to our study as 26.45% of the respondent had hypotension and 45.16% of the people had normal blood pressure conditions. But the major concerning issue was that 24.52% of the people having Hypertension 1 and rest of the population had 3.87% hypertension 2.

A study showed 5.4% of the survey population was having diabetes mellitus which was documented by Zaman *et al*., 2015and it was quite similar to our study that 6.45% of the respondents were suffering from diabetes also as current medical conditions.

69.35% population had waist circumference which was normal as that was within normal waist range <37 inch. On the other hand 0.65% 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 6.45% of the study population were having obese waist circumference which indicates one of the behavioural risk factor that was alarming.

Based on body mass index (weight in Kg divided by height in meter squared) we can see that 63.55% of the population had a normal weight whereas 6.77% of the population were underweight. But it was found that 26.45% of the population were within the range of overweight and had greater risk of obesity in the near future. On the other hand 2.90% 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. Our results were quite similar with a study 19.6% were overweight and 4.1% of the population were in obese range (Zaman *et al*., 2015).

The physical activity including exercise, walking at home or at work or during travelling 46.77% followed the standard of physical activity which is 150 minutes a week. On the other hand 45.16% of the people never and 8.06% of the people followed

it in an unsatisfactory manner which is not similar because the study showed 34.2% of the subjects fell into low physical activity (Zaman *et al*., 2015).

One of the parameters included about the respondents sitting or reclining time when studied this parameter out of 310 respondents 33.87% of the people said they remain idle for 300-420min. 26.7% of the people recline for 180-240 min and 17.42% recline for 480-600min. The rest of the people recline or sit idle for include 5.16% for 60-120min and 3.55%for 600-960 min. So it results that major portion of the study population remain physically inactive for a greater duration of time.

During this study when respondents were asked about their sleeping habit 74.84% population had a sleeping habit of 7-10 hours a day. Around 20% of the population had a sleeping duration of 0-6 hours a day. The rest of the population which includes 2.90% of the people had a sleeping duration of above 11 hours a day. The respondents were inactive for most of the time of a day.

According to STEPS taking fruits and vegetables 5 Servings a day is standardized. But during our study we didn't use this parameter rather we opted for if a respondent takes fruits or vegetables 5 days a week is quite satisfactory. On that standard 38.71% and 66.45% of the respondent follow this habit. But 36.77% and 19.68% of the respondents takes fruits and vegetables but doesn't comply with the standard. Again 23.55% and 13.87% of the respondent do not take fruits and vegetables at all. The result was found similar to the study clustering of non-communicable diseases risk factors in Bangladeshi adults, 2013 where in spite of a satisfactory frequency, neither fruit nor was vegetables consumption adequate in quantity. Considering the minimum recommended amount, 92.4% did not consume adequate fruit or vegetables on an average day (Zaman *et al*., 2015).

Habit of taking meals outside plays an important role. On that contrary 12.58% of the people didn't take a single meal outside which is satisfactory in nature. On the other hand 21.29% of the people took meal outside of home at least 3-4 days a week. The rest of the population 65.48% took at least a meal prepared outside home. The major portion of the people took meals outside of home which increases a greater threat for non-communicable diseases occurrence.

Out of the 310 respondents 21.29% rarely and 37.10% never added salt or salty sauce in their food and 27.42% rarely and 19.03% never ate processed food high in salt content. As majority of the study population doesn't add salt or salty sauce there is lower risk of NCD. On the other hand there is higher number of people who takes processed food high in salt sometimes for which there are chances for them to suffer from NCD.

Regarding the Tobacco use whether the respondents have taken any sort of smoking products within last 30 days 46% of the people answered in an affirmative manner which means they are current smokers. The result was found quite similar as 58.3% were daily smoker. Again 94% of the respondents said they used smoking (cigarettes, pipes, biri) the rest of the people said they used smokeless (Chewing, snuff, gul, jorda, pan-masala) which includes 6% of the population. The result was found quite similar in case of most smokers 33.2% used manufactured cigarette and overall consumption of smokeless tobacco was 28.5% in higher age group (Zaman *et al*., 2015).
In this study when the respondents were asked whether they know that tobacco use, excess salt intake, physical inactivity or obesity does play a role in causing health problem than 90.32% for tobacco use, 73% for excess salt intake, 69% for physical inactivity and 73% for obesity means majority of the population gave affirmative answer. The rest of the population think or don't know that these parameters could cause any health problems. So the persons who don't know or don't think that tobacco use, excess salt intake, physical inactivity or obesity could cause health problem they have higher chance of suffering from NCD.

For behavioral modifications on lifestyles the doctors advised 66.45% respondents regarding healthy body weight or lose weight. For starting or doing more physical exercise 62.26% were suggested. 75.52% of the respondents were advised to reduce fat in the diet. About 51.94% of the populations were advised to take five servings of fruits/vegetables each day. Reducing salt is also important, 66.77% of the population was asked to do it. Lastly for quitting tobacco use 64.84% 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. If they don't follow the advice they may suffer from NCD.

Conclusion

Based on all the facts, it can be concluded that knowledge and awareness about distribution of the risk factors such as tobacco use, fruit and vegetables intake, physical activity, dietary habit, obesity, hypertension, family history of any NCDs, any current medical conditions of NCDs are quite good among the study population. Most of the respondents knew about it and what can be the consequences if they do not pay heed. But they were not up to the mark in case of following up the guidelines. They do not follow the standard guideline for maintaining the good health conditions. They also have knowledge about their family history in case of risk factors of non-communicable diseases. But do not know how to contain the biological markers. The majority portion knew that which are the risk factors and what complications it may do. The majority of the respondents were advised by the doctor to maintain their health conditions according to the guidelines. But result showed that they do not know how or don't want to follow the instructions or do the behavioral modifications. Because after the analysis it was seen that major portion of the population were suffering from one risk factor at least. There was clustering of the risk factors means some of the respondents of the population were having more than one risk factor which was alarming. At this point, the only way to remedy is to promote health awareness programs and much other awareness guidelines related to the risk factors of NCDs things. It is however need to mention that this research was conducted on randomly chosen population and in a very small scale so it doesn't reflect the whole idea. Therefore it is suggested that if a conclusive result about the awareness of distribution of the risk factors of Non-communicable diseases is desired, further large scale researches should be conducted.

Chapter 6

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