

CHAPTER I

INTRODUCTION

Non- Communicable Diseases are an array of medical conditions that are not transmitted from person to person nor caused by infectious agents. Generally, these diseases have a longer and constantly recurring history and worldwide are a leading cause of death and disability. As per research studies in September 2021, Non-Communicable Diseases (NCD's) have been a significant global health concern and their prevalence has been steadily increasing worldwide. According to estimates from the World Health Organization (WHO), non-communicable diseases account for over 74% of all fatalities worldwide. Each year, non-communicable diseases cause the deaths of over 15 million people between the ages of 30 and 69. Countries, regions, physical conditions, and A number of socioeconomic factors may influence the frequency of non-communicable diseases. (WHO: Geneva, 1995, WHO: Geneva, 2012, and WHO, 2023).

Non- Communicable Diseases were coined as epidemic [Zimmet (2001) and Zimmet and Alberti (2006)] encompass a wide range of cancers, including those affecting the lungs, breast, prostate, colon and other organs. Neurological Disorders like Alzheimer's disease, Parkinson's disease and epilepsy fall under this category. Musculo- skeletal disorders are conditions affecting the bones, joints and muscles, such as arthritis and osteoporosis. Chronic kidney disease is a progressive loss of kidney function over time, leading to reduced filtering and waste removal from the body. Mental Health Disorders like depression, anxiety, bipolar disorder and other conditions affect mental well-being. Obesity and excess body weight are important risk factors for a number of non-communicable diseases, including Cardio Vascular Diseases, Diabetes Mellitus and some cancers. Non-communicable diseases are at risk due to unhealthy lifestyle choices like smoking, binge drinking, eating poorly, not exercising, having a genetic susceptibility, exposure to certain environments, and aging.

Non- Communicable Diseases pose a considerable global health challenge and are responsible for a significant proportion of premature deaths and disability. They have an impact on people individually, but they also cost society and healthcare institutions a great deal of money. Preventive measures to address Non-

Communicable Diseases include promoting healthy lifestyles, early detection and diagnosis, access to essential healthcare services and vaccination programs and implementing policies that target risk factors. Governments, healthcare organizations and communities are working together to develop comprehensive strategies to prevent and manage Non- Communicable Diseases, with a focus on health promotion, education and creating environments that support healthy living.

The Non- Communicable Diseases burden (Schmidt *et al.*, 2011, Upadhyay, 2012) has been drastically rising worldwide over the last two to three decades, with the influence of urbanization and lifestyle changes of the population. Equally, there is a decreasing trend in communicable diseases. Recent research studies have shown that individual components of Metabolic Syndrome (MetS) are the major reason for the increase in NCD's. MetS is variedly explained by different research bodies. The most commonly accepted MetS is the presence of three minimum factors among five of its components namely central obesity, type II diabetes mellitus, hypertension, hypertriglyceridemia, low levels of high-density lipoproteins as specified by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) and the International Diabetic Federation (IDF), (NCEP ATP III , 2001, 2002 and revised in 2005).

The metabolic factors, physiological, clinical and biochemical in total increase the incidence of MetS in individuals. It is important to identify those who are at risk of developing or having Metabolic Syndrome and counsel them on the deleterious effects on their health and educate them on preventive and curative strategies that are necessary. To decrease the worst outcomes of Metabolic Syndrome; it is important to identify those who are having Metabolic Syndrome or at likelihood of Metabolic Syndrome development. Further the contributing factors have to be recognized and preventive and curative steps against Metabolic Syndrome need to be addressed.

The prevalence percentage as per research studies (2003- 2016) identifying metabolic syndrome with NCEP ATP III conducted worldwide and India were pooled by Kaur *et al.*, (2017). The prevalence of metabolic syndrome worldwide and in India was $28.68 \pm 5.8 \%$ and $28.85 \pm 11.8\%$ respectively. Few other prevalence studies conducted in the United States of America showed 22.9% of Metabolic Syndrome (Ford *et al.*, 2002). Various studies from 2004- 2015 conducted in India showed the

prevalence of Metabolic Syndrome between 10- 30%. Indian Urban studies conducted between 2006- 10 showed a 35% Metabolic Syndrome prevalence (Krishnamoorthy et al., 2020). Ramachandran *et al.*, (2003) stated NCEP ATP III is better for identifying metabolic syndrome. According to Grundy (2008), metabolic syndrome is a pandemic. Using NCEP ATP III criteria, Ravikiran et al. (2010) demonstrated that 35.8% of Asian Indians had metabolic syndrome. The major contributing factor behind this prevalence may be the lifestyle of the urban population. Almost 1/3rd of the Indian population dwells in urban areas and 40% of them are of the age group 30- 70 years (Mohan *et al.*, 2006). This makes it even more important to identify and prevent Metabolic Syndrome at earliest to lower the risk of CVDs and type II diabetes mellitus.

Ministries of health, agriculture, education, finance and sports together have to function to alter the socio-economic causes that are behind Metabolic Syndrome. There is an urgent need to address the ways and means of prevention, but the community has been very slow to react to the problem of the NCD epidemic. Steven and Heinrich (2003) stated about the epidemic state of obesity and metabolic syndrome. More funding for health services is required to address the rising number of Asians suffering from obesity-related non-communicable diseases, and research is needed to provide accessible therapies.

If the World Health Organization (WHO) and other international organizations need to redefine the Asian populations BMI, they will require consolidated data. As per various research studies, Non- Communicable Diseases in India are increasing day by day. In developed countries, Non- Communicable Diseases are typically observed in more than 55 years people. However, in India, NCD's are observed among the 45+ year age group itself (Indrayan and Abhaya 2005; Siegel *et al.*, 2014). The underlying reasons for this might be various chronic causes but many might remain undiagnosed due to lack of awareness or sometimes insufficient access to health care.

Few research studies showed that individuals have more than one NonCommunicable Disease which is indirectly increasing the burden of Metabolic Syndrome and the risk is similar in both urban and rural areas. Primary and secondary preventive strategies are to be developed to help lower the risk and treat the metabolic syndrome.

The Non- Communicable Diseases that are a result of lifestyle-specific factors are rapidly increasing across the globe. The morbidity and mortality risk increase with

these lifestyle-specific CVD's, Type II DM of NCD's. There were 10.4 million deaths and 218 million approx. Disability-Adjusted Life Years (DALY's) were observed in 2017 due to metabolic risk factors. As this burden was increasing, there rose a need for more research to identify, create awareness and work towards preventive or curative factors [Samira and Soma (2010), Global Burden of Disease, (2013), Marie (2014)]. Karageorgi (2013) in his study concluded that with the help of advanced methods, future studies and surveys are required to evaluate the contributing elements of epidemic obesity and address them to avoid future health risks.

Non-communicable diseases account for two thirds of mortality in India and Southeast Asia (WHO, 2014). One of the biggest states in Southern India is Karnataka, where there is a significant prevalence of non-communicable diseases. (Jayanna *et al.*, 2019). For this reason, there is a requirement for integration at the preliminary level of the national health programs for the prevention of diseases, promoting health and giving the proper treatment/ care necessary. Both public and private should partner and identify the need and means by which Non- Communicable Diseases can be prevented or cured. Additionally, concentrate on lowering the rates of hypertension and diabetes mellitus.

Metabolic syndrome is more prevalent and age-related among Asian Indians. Metabolic syndrome is a cluster (Joshi, 2003, Swarup *et al.*, 2022) of interrelated health conditions that occur together and increase the possibility of getting Type II diabetes, Cardio Vascular Disease, and other chronic illnesses. Although metabolic syndrome is not an illness in and of itself, it is a collection of risk factors that can significantly impact an individual's health. One of the risks is being obese in the abdomen. Among the primary characteristics of metabolic syndrome is having excess fat around the waist (waist circumference larger than 35 inches for women and 40 inches for males).

A persistent blood pressure reading of 130/85 mmHg or above is linked to metabolic syndrome. Heart disease and stroke risk are elevated by hypertension. High fasting blood glucose levels (often more than 100 mg/dL) are indicative of diabetes, insulin resistance, triglycerides, a kind of blood fat, are elevated above 150 mg/dL and are associated with a higher risk of CVDs. Known as "good cholesterol," high-density lipoprotein cholesterol aids in the removal of cholesterol from the arteries. Metabolic

syndrome may be linked to low levels (< 40 mg/dL for men and 50 mg/dL for women) of high-density lipoprotein.

As per NCEP ATP III (2002, amended in 2005), the presence of any three of these variables regarded as Metabolic Syndrome diagnostic. However, as per the IDF, Metabolic Syndrome (MetS) population is defined to have abdominal obesity as a mandatory factor along with two other factors of Metabolic Syndrome. Various studies show that depending on the criterion chosen, there can be significant variations in the metabolic syndrome prevalence among individuals and populations.

The most commonly used Metabolic Syndrome criteria are as defined by WHO, NCEP ATP III and IDF. Raised waist circumference and central obesity are significant indicators of the entire metabolic syndrome. In a Srilankan study, diabetic individuals had Metabolic Syndrome prevalence of 70.6%, 43.8% and 28.9% when WHO, IDF (2021) and NCEP-ATP III (2005) definition was used respectively (Herath *et al.*, 2018). If in regular health checkups metabolic syndrome parameters or concerns about your health are observed then, it's essential to consult a healthcare professional for proper evaluation and personalized advice. Individualized and tailor-made lifestyle programs can lower risk factors and enhance general health. Although the precise aetiology of the metabolic syndrome is unknown, a mix of genetic and environmental factors are thought to be responsible, such as a sedentary lifestyle, poor diet (high in refined carbohydrates and saturated fats) and obesity. Metabolic syndrome is becoming more prevalent worldwide, largely due to the increasing incidence of obesity and sedentary habits in many societies.

Meeting certain requirements connected to the aforementioned risk factors is the basis for the diagnosis of metabolic syndrome. When three or more of the risk factors are present, metabolic syndrome is usually diagnosed. The 2002 WHO Expert Consultation on Appropriate Body Mass Index for Asian Populations and Its Implications for Policy and Intervention Strategies evaluated the body mass index cut-off values that took ethnicity into consideration (WHO, 2004). The bulk of the population in the community tended to be centrally or abdominally fat, which increased the chance of developing Metabolic Syndrome. It was advised by the expert consultation to evaluate waist circumference independently of BMI cut-off values. Globally, overweight and obesity are categorized using the Body Mass Index,

which is based on data on illness and mortality from white populations. Nonetheless, a number of studies have demonstrated that compared to White individuals, Asians with lower BMIs had greater amounts of body fat, elevated risks of metabolic syndrome, and cardiovascular risk factors. Asian Indians in India are classified as overweight or obese if their BMI is ≥ 23 kg/m² or ≥ 25 kg/m², according to the Indian Consensus Group. In 2015, the NICE of the United Kingdom recommended screening for diabetes among migratory South Asians, while the ADA recommended screening for all Asian ethnic groups in the US with a BMI of ≥ 23 kg/m². Many research studies and guidelines recommend early intervention with diet and activity in Asian ethnic groups to prevent and control obesity-related non-communicable diseases. An additional 10-15% of Indians would be considered overweight or obese if these guidelines were followed, and more South Asians and Asians overall would receive diabetes diagnoses in the US and the UK.

The major reasons for obesity in India are urbanization- reduced physical activity levels and increased availability and consumption of processed and fast foods. The reduced physical activity level happened due to the usage of mechanical transport, sedentary patterns while at work and other sedentary activities like increased indoor games, video games, cell phone usage or television viewing, and adoption of less physically active lifestyles. The consumption of food and beverages that are more energy-dense and compromised in nutrients is another cause of obesity. This is demonstrated by the higher prevalence of generalized and abdominal fat in the metropolitan population (Deepa *et al.*, 2009 and Bhardwaj *et al.*, 2011), where the above-mentioned characteristics are more prevalent. Body composition specifies to the proportions of the various components that make up a person's body, which are commonly fat mass and fat-free mass. These elements include fat mass: This is the body's overall fat content, which includes both essential and non-essential fat. Fat-Free Mass including muscle, bones, organs, and fluids. Body composition is a more accurate and insightful technique to determine overall health than merely measuring body weight. Even two persons of the same weight can differ significantly in terms of their body composition, which has an impact on their degree of fitness and health. Examining body composition usually requires the use of various tools. DEXA, or dual-energy X-ray absorptiometry, is thought to be one of the most precise techniques for measuring body composition. It differentiates between bone mineral density, lean mass, and fat mass using low-dose X-rays. In

order to determine body fat and lean mass, bioelectrical impedance analysis, or BIA (Mahmood *et al.*, 2022), examines the resistance of bodily tissues. Skinfold Thickness Measurement is a technique that uses calipers to determine the skin fold thickness at various body regions. The measurements are then used to calculate body fat percentages. Hydrostatic Weighing is the method that measures body volume by submerging the individual in water and then calculates body density and composition based on the data. By detecting air displacement in a contained space, Air Displacement Plethysmography (ADP), popularly referred to as the Bod Pod, calculates body volume. Body composition helps in doing health assessments and assessing the risk of various health conditions. Especially excess visceral fat and body fat in general, is linked to an increased risk of chronic illnesses such as heart disease, diabetes, and certain malignancies. By understanding body composition, it will be more useful than just relying on the scale for weight management. Concentrating on maintaining lean muscle mass and decreasing body fat is often a healthier approach than solely aiming for weight loss. For individuals undergoing fitness or weight loss programs, tracking changes in body composition over time provides a more accurate picture of progress than just monitoring weight; thus, helps in monitoring progress. Everyone's body composition goals and requirements are different, so it's essential to consult with a healthcare professional, nutritionist, or fitness expert to understand what's best for your specific needs and goals. The key components of health are body composition and growth in both individuals and populations. The recent epidemic situation of obesity has shown that for health in the short- or long-term body fat also plays a vital role. The other components of body composition influence an individual's health as well, and body composition is an essential measure in clinical practice.

Direct measurements are not possible with *in vivo* techniques, but they are predicted from measurements of body properties. The researchers and clinical care practitioners aim is to observe, detect and provide therapeutic recommendations to treat obesity and associated comorbid conditions of Type II diabetes mellitus/ CVDs. There is no single best standard method for measuring or classifying obesity. But the increasing epidemic situation of obesity is of concern and the necessity to assess the body composition accurately is essential to frame guidelines to reduce the epidemic state of obesity. The individual's height and weight can be measured using accepted

methods, and the BMI can be computed from those values using World Health Organisation classification normal weight, overweight, or obese individuals are categorized. However, the BMI measure has its shortcomings as it doesn't consider Body Fat/ Visceral fat. Given the limitation of BMI; the importance of assessing the body composition arises here. Therefore, the body composition is assessed using the next best methods like DEXA scan or Bioelectrical Impedance Analysis (BIA) method. It is better to choose the body composition analysis method based on the clinical condition too. Preventive health checkups periodically to check on the Metabolic Syndrome and Body composition parameters are important and if found deranged; the various influencing factors, including lifestyle, genetics and socio-economic conditions are to be studied. Fortunately, lifestyle adjustments can dramatically lower the risk of metabolic syndrome and its related health consequences (Casadei *et al.*, 2022, Santos *et al.*, 2022, Budreviciute *et al.*, 2020, Chun-Cheng *et al.*, 2020, Nikhil *et al.*, 2014 and Dalle *et al.*, 2010) .

THE HYPOTHESIS OF THE STUDY: The null hypothesis (H_0) framed in the study:

- H_0 1. Developing and framing questionnaires to determine the Metabolic Syndrome's prevalence and KAP of the subjects is not possible.
- H_0 2. It is difficult to associate Metabolic Syndrome and Body composition parameters.
- H_0 3. There is no relation between Metabolic syndrome and body composition parameters with lifestyle habits like diet, exercise, physical activity level and social habits- smoking and alcohol of an individual.

THE RATIONALE OF THE STUDY:

Metabolic syndrome is increasing in the young and middle-aged adults of India. It is adversely affecting their health and performance. Keeping in view the above facts, an attempt is made to identify the Metabolic Syndrome in relation to body composition and lifestyle adaptation among adults residing in Bengaluru. There are different methods to analyse body composition analysis. Validating the easily accessible Bioelectrical Impedance Analysis (BIA) equipment, to perform Body Composition Analysis (BCA), with that of the golden standard BCA of DEXA is essential. Very little is known about body composition analysis, lifestyle modifications, and metabolic syndrome in persons living in Bengaluru. Therefore, it is necessary to do the current research study.

The current research study titled “**Metabolic syndrome in relation to body composition and lifestyle adaptation among selected adults residing in Bengaluru**” is majorly aiming at these aspects of identifying, preventing and reducing the risk of Metabolic syndrome by adopting a healthy lifestyle.

OBJECTIVES OF THE STUDY: The following are the study's objectives:

Primary Objective: To

- Evaluate prevalence of metabolic syndrome in the selected adults residing in Bengaluru
- Assess the metabolic syndrome participants' body composition parameters of the sub-sampled research subjects
- Assess the relation between metabolic syndrome, body composition and lifestyle adaptations in the enrolled sub-sampled research subjects
- Develop and educate on a healthy lifestyle about diet, exercise and social habits of the subjects to prevent/ cure metabolic syndrome
- Evaluate the subjects' Knowledge, Attitude, and Practice (KAP) regarding metabolic syndrome, body composition and lifestyle

Secondary Objectives: To

- Emphasize the importance of Body composition parameters to prevent Non-Communicable Diseases
- Validate the InBody 770 BIA (Body Impedance Analysis) with DEXA (Dual-energy X-ray Absorptiometry) method used in the current study is reliable in assessing Body Composition Analysis.

SCOPE OF THE STUDY:

Non- Communicable Diseases are rising in the current scenario. Metabolic Syndrome is among the diseases that are not transmissible. With a healthy lifestyle of diet, exercise and good social habits the Metabolic Syndrome can be prevented or the individual parameters leading to Metabolic Syndrome can be brought to normal values. Body composition parameters assessment's importance has to be imparted; to live healthy; beyond the general assessment of weight and Body Mass Index. Healthy life adaptations of an adult are very important for a healthy community to facilitate the Sustainable Development Goal (SDG) 3.4- reducing NCD's through prevention and treatment (WHO, 2020).