

# CHAPTER 1

## INTRODUCTION

Health is referred as a “state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity” by the World Health Organization (WHO, 2023). The definition as per the Centres for Diseases Control and Prevention (CDC) is similarly put, i.e., “being healthy means getting and staying well so we can lead full, active lives” (CDCP, 2020). However, as observed by the present times there is a pressing need for a more vivid definition since the advent of lifestyle disorders into the big picture. A publication of the Croatian Medical Journal from 2017 emphasized that a definition of health needs to include the ability to adapt to evolving health needs over the stages of life and managing diseases efficiently for better physical, mental, and social well-being (Svalastog *et al.*, 2017). Therefore, fundamentally achieving peace and security may be related to the cooperation of individuals, families and countries as a whole, towards satisfactory standards in community health.

Non-Communicable Diseases (NCDs) are those that cannot be transmitted directly from an individual to others. NCDs that can be either acute or chronic include auto-immune diseases, strokes, most heart diseases, inborn metabolic disorders such as gluten and lactose intolerance, kidney disorders, osteoarthritis, osteoporosis, lifestyle disorders such as diabetes, hypertension, dyslipidaemia, most cancers, depression, anxiety and others. According to the WHO statistics (2022), NCDs account for 74% of the world’s deaths i.e., 41 million deaths annually around the globe. It is well established that risk factors including a person's upbringing, way of life, and surroundings raise their chance of developing several NCDs. These include their genes, sex, age and lifestyle behaviours such as unhealthy food intake, smoking and a lack of physical activity which can further lead to an increased risk of NCDs such as hypertension, hyperglycaemia, hyperlipidaemia or obesity. Since the majority of these NCDs are brought on by such risk factors that are modifiable, they are considered possible to prevent. As per the report, an important way to control NCDs is to “focus on reducing the risk factors associated with these diseases”. The WHO contends that a comprehensive strategy is required to decrease the impact of non-communicable

diseases (NCDs) on people and society. This involves sectors such as health, finance, education, transportation, and agriculture, and collaborating to lower the risks linked to NCDs and support interventions that are aimed at prevention (WHO, 2022).

Covid-19 is a disease known to have been caused by the coronavirus, also called SARS-CoV-2 which first became known to the world on 31<sup>st</sup> December 2019 (WHO, 2023). Besides Covid-19, one of the most researched non-communicable diseases is obesity also called adiposity-based-chronic-disease. The WHO says that obesity is a phenotypic manifestation of abnormal or excessive fat accumulation that affects health and increases mortality (WHO, 2023). After previous longitudinal research suggested that obesity is not limited to age, gender, income level, health status or general well-being, the scientific community called for dropping the one-size fits all approach to overcoming obesity and encouraging the use of personalized or tailor-made modifications for each individual (Ordovas *et al.*, 2018; Heindel & Blumberg, 2019; Visioli *et al.*, 2022).

Although there are genetic, metabolic, hormonal and behavioural influences on body weight, the primary reason for obesity is the intake of foods of higher calories than the ones burned through routine activities and exercises. Researched risk factors of obesity include socio-economic status, environmental factors, inter-uterine exposures, the genetic pre-disposition, perinatal antibiotic exposures, stress and most recently, Covid-19 (Pigeyre *et al.*, 2016; Sawadogo *et al.*, 2022; Mohajan & Mohajan, 2023).

Apart from this, obesity is in itself a risk factor for a number of lifestyle disorders. High blood pressure and excessive cholesterol levels are associated with obesity and increase the risk of heart disease or strokes. It may have an impact on how well the body utilises insulin to regulate blood sugar, which increases the chance of developing insulin resistance and, eventually, diabetes. It could also increase the risks of cancers of the cervix, uterus, endometrium, ovaries, breasts, colon, rectum, oesophagus, liver, gall bladder, pancreas, kidney and the prostate gland (Larsson *et al.*, 2022). Although not exclusively caused, obesity could lead to irregular periods in women, which in turn could cause Poly Cystic Ovarian Syndrome (PCOS) and subsequently infertility. Individuals with

obesity are also reportedly more likely to have sleep apnoea which is a condition where breathing stops and starts irregularly during sleep due to obstructions in the upper airways (Anderson *et al.*, 2019). This could eventually lead to an interrupted sleeping pattern and associated health problems in individuals with obesity. In addition, obesity causes inflammation in the body and puts more strain on joints that support weight bearing. This could lead to complexities such as lower back pain or osteoarthritis in men and women. Other consequences that result due to obesity include disruptive functioning of the thyroid gland and hormones (Walczak & Sieminska, 2019). Most of these reported outcomes have also been speculated to reduce, once the modification of lifestyle behaviours such as dietary behaviour and physical activity occur.

For nutritional assessment purposes, defining overweight according to the WHO classification puts the Body Mass Index (BMI) cut-offs at greater than or equal to  $25\text{kg/m}^2$  for non-Asians. Asians, due to their genetic predisposition to NCDs have the cut-off between  $23.0\text{kg/m}^2$  to  $24.9\text{kg/m}^2$ . Obesity in adults according to the WHO classification puts the BMI cut-off at greater than or equal to  $30\text{kg/m}^2$  for non-Asians while the Asians, have it at greater than or equal to  $25\text{kg/m}^2$  (WHO, 2004; Dhawan & Sharma, 2020).

In its factsheet, the WHO says that global obesity trends have nearly tripled since 1975. Over 1.9 billion persons who were 18 years of age or older were overweight in 2016. Over 650 million were obese, i.e., 39% of individuals were overweight while 13% were obese. As per the WHO, most of the global population resides in countries where overweight and obesity causes more mortality as compared to underweight (WHO, 2021).

In India, the prevalence of adiposity has been on an increasing trend from 19.75% in 2016 to 23.45% by 2021. Among this, exclusively among women, obesity has increased from 20.6% to 24.0% between 15 and 49 years. A much higher increase than that of the national average was seen in the men and women belonging from Tamil Nadu. Almost an eight to nine percent increase was observed in both the genders, an 8.8% difference in men and a 9.5% difference in women from 28.1 to 37.35 in men and 30.8 to 40.75 in women (IIPS-ICF, 2017, 2021).

Millions of people and health care systems are impacted by the global health catastrophe that is obesity. In recent years, an abundance of research has shed light on the value of physical activity in the prevention and management of obesity. Physical activity is a vital component of energy expenditure, alongside basal metabolic rate and diet. When individuals engage in regular physical activity, they burn calories, promoting weight maintenance or loss when coupled with a balanced diet. Sedentary behaviour, characterized by prolonged periods of sitting or inactivity, has been recognised as a significant determinant of obesity. A 2017 publication of the International Agency for Research on Cancer found that individuals who spent more time sitting had a higher likelihood of developing obesity, independent of their physical activity levels (Leitzmann, 2017). This emphasizes the need to reduce sedentary behaviour alongside increasing physical activity. Studies have confirmed that there is a dose-response association between being physically active and being obese. In other words, the more physical activity individuals engage in, the lower their risk of obesity. Research by Ekelund *et al.* (2019) demonstrated that even small increases in daily physical activity can significantly reduce the risk of obesity, highlighting the importance of incorporating movement into daily routines. The type and intensity of physical activity also play a crucial role. High Intensity Interval Training (HIIT) and resistance training have gained attention for their effectiveness in promoting weight loss and metabolic health. A study by Williams *et al.* (2021) highlighted the potential of HIIT in reducing abdominal obesity and improving insulin sensitivity. Sustainable weight management is a key concern in the fight against obesity. Research by Recchia *et al.* (2023) emphasized that long-term success in weight loss maintenance is closely linked to continued engagement in physical activity. This highlights the need for personalized physical activity strategies tailored to individual preferences and lifestyles.

For designing effective interventions to promote physical fitness and prevent chronic diseases, assessing physical activity is crucial. Over the years, various methods and technologies have been developed to assess physical activity, ranging from self-report questionnaires to advanced wearable devices and smartphone applications. Self-report questionnaires are commonly used to assess physical activity due to their simplicity and cost-effectiveness. One widely used

questionnaire is the International Physical Activity Questionnaire (IPAQ), which collects information on the frequency, duration, and intensity of physical activities. Another popular tool is the Global Physical Activity Questionnaire (GPAQ), developed by the WHO in 2002. Although both the questionnaires are commonly used tools for assessing physical activity levels in populations, whether one is better than the other depends on the specific context and research goals. However, GPAQ is sometimes preferred over IPAQ owing to its non-dependence on subjects' recall, global standardization (available in multiple languages, making it applicable to diverse populations across the globe), simplicity (relatively simpler consisting of a shorter set of questions designed to be administered in about 10 to 15 minutes), and focus on domains (three main domains of an individual's lifestyle - work, transport, and recreational activities). Recent research has focused on improving the accuracy of self-report questionnaires by incorporating technology, such as smartphone apps, to reduce recall bias and enhance data collection (Kwak *et al.*, 2020). Besides questionnaires, accelerometers (small devices that measure acceleration), have gained popularity in research and clinical settings due to their objectivity and precision in the assessment of physical activity by detecting body movements. Recent advancements in accelerometer technology have led to the development of wearable devices, which not only monitor physical activity but also provide real-time feedback to users, enabling step-tracking, heart rate monitoring, and estimation of energy expenditure (Zhang *et al.*, 2020; Case *et al.*, 2021).

Sleep patterns and obesity have also been linked in recent times where mounting evidence is proving that poor sleep quality and duration can significantly contribute to weight gain and obesity. A study published in *Nutrients*, found that adults with short sleep durations had a higher likelihood of obesity (Xu *et al.*, 2022). Sleep deprivation also disrupts the balance of appetite-regulating hormones. Ghrelin, which stimulates hunger, increases, while leptin, which signals fullness, decreases, leading to increased food intake and overeating. Sleep deprivation affects insulin resistance and glucose metabolism, making it harder for the body to control blood sugar levels, which in turn can promote fat storage and contribute to obesity (Theorell-Haglöw *et al.*, 2020; Al Dweik *et al.*, 2022; Chaput,

2023). Therefore, establishing and maintaining healthy sleep patterns is crucial in obesity prevention and management.

There are several validated questionnaires and assessment tools available to measure the quality of sleep in adults namely, Pittsburgh Sleep Quality Index (PSQI), Epworth sleepiness scale, Berlin questionnaire, insomnia severity index, Athens insomnia scale, sleep hygiene index, general sleep disturbance scale etc. However, it's essential to understand that the choice of questionnaire is based on the specific goals of the research study. The PSQI, developed by Daniel Buysse in 1989 has been used to measure self-reported sleep quality in different populations across the world and is regarded as a recognized benchmark or industry standard. (Dubey *et al.*, 2019; Fabbri, 2021; John *et al.*, 2022).

Obesity is fundamentally driven by an imbalance between the intake of energy or calories consumed and the energy expended or calories burned. To maintain a healthy weight, energy intake and expenditure should be in equilibrium. One of the main adjustable determinants of obesity is nutrition, and the extent to how much a diet lowers the risk of non-communicable diseases (NCDs) is known as diet quality (Asghari *et al.*, 2017). It has already been established that regardless of the level of obesity, diet quality, as determined by data-driven dietary patterns and evaluations, is associated with metabolic syndrome in young people (Osadnik *et al.*, 2020). Prior research has linked diets rich in processed foods, red meat, and sugary snacks but deficient in fruits, vegetables, fish, and dairy to elevated risks of metabolic syndrome across different age groups, genders and populations (Drake *et al.*, 2018; Vandevijvere *et al.*, 2019; Shan *et al.*, 2019).

Assessing diet quality yields information on dietary pattern and ways to manage obesity through quality dietary intake (Asghari *et al.*, 2017). There are different methods of dietary assessment techniques being used in community health research such as real-time recording and recall methods. Real-time recording methods include food diaries where every food or beverage consumed is recorded in real time with or without weighing them and the duplicate portion method where a set of two daily portions are used - one consumed by the person, and the second analysed for its chemical content. These techniques are less frequently employed in extensive epidemiologic studies linking nutrition to disease

because of their expense and complexity. Methods of recall include dietary histories, food frequency questionnaires (FFQs) which are mostly used in studies assessing relationships between diet and disease, and single or multiple daily recalls i.e., 24-hour dietary recalls (24-HDRs) which are usually used in nutrition surveillance studies to monitor population intake (Naska *et al.*, 2017). In a recent systematic review and meta-analysis, it was found that diet quality indices are increasingly being used to measure changes in diet quality in clinical and public health interventions since it can demonstrate changes in the quality of the diets in intervention trials in adults with and without chronic health conditions. It was also found that diet quality indices are effective only when the interventions differed significantly enough from the control diet and baseline dietary pattern to show a change in diet quality (McAuley *et al.*, 2023).

Overcoming one of the most current pandemics requires careful consideration – right from the grassroot levels. Effectively managing obesity calls for systematically assessing the factors which potentially affect the intake and expenditure of energy and metabolism (Matthias, 2019). Keeping this in mind, weight loss and other lifestyle changes are the first-in-line treatment of individuals with obesity since metabolic status and central adiposity have consistently predicted morbidity and mortality (Vlassopoulos *et al.*, 2021). Evidence has showed that energy intakes through “animal, saturated and trans fats” or “high intakes of sugar or sweetened beverages or fruit juice” were increasingly associated with weight gain, particularly in already overweight women, which was reversed with a reduction in the consumption of these foods and higher intakes of “vegetables, fruits, whole grains, nuts or yogurt” (Hruby *et al.*, 2016).

When it comes to physical activity, internationally, the WHO is of the view that reducing the risk of overnutrition includes a combination approach including diet and physical activity. WHO promotes that decreasing the number of calories consumed from the diet in terms of sugar and fat while increasing the intake of whole grains, legumes, vegetables, fruits, and nuts is the way to go. The WHO in its guidelines that have been updated recently recommends that all adults aged from 18 to 64 years are encouraged to have a minimum of 150 minutes of weekly aerobic physical activities of moderate intensity (WHO, 2022). As per the latest guidelines of the Centers for Disease Control and Prevention (CDCP) towards

physical activity, adults above the age of 18 are encouraged to “move more and sit less throughout the day as some physical activity is better than none.” The CDCP advises a combination of moderate to vigorous intensity physical activity to be used in conjunction with muscle strengthening activities – each, for at least 2 days in a week (CDCP, 2022). Similarly, in India, the Indian Council of Medical Research together with the National Institute of Nutrition (ICMR-NIN) recommends that a minimum of 30 to 45 minutes of physical activity of moderate intensity for five to six days every week (ICMR-NIN, 2010) as essential.

This is where the need to be aware about the lifestyle choices including mindful food consumption and physical activity counts. Towards this, as a factor of influencing individual’s physical, emotional, mental state of health, it becomes essential to impart the correct knowledge, attitudes and practices related to managing obesity. Knowledge, Attitudes and Practices (KAP) surveys are often semi-structured or structured questionnaires that are meant to be used to represent a target population by obtaining what is currently known, perceived, and practiced in the context of the topic of interest. In other words, they aid in identifying the misconceptions or lacunae in an individuals’ approaches to solving a problem that could otherwise be possible hindrances to beneficial changes to their lifestyle (Andrade *et al.*, 2020; Yalun & Khamaksorn, 2020).

Therefore, just as the current guidelines suggest, it is necessary that the effective management of obesity requires a combination outlook including strategies of behaviour change focusing on reduced dietary intake along with a rise in physical activity as early as possible (ICMR, 2020; Hills, 2022).

### **Hypotheses of the Study**

The null hypotheses ( $H_0$ ) constructed in the present study are as follows:

- **H<sub>0</sub>1:** Research tools and intervention methods cannot be formulated and validated to be utilised for the selected population
- **H<sub>0</sub>2:** There is no association between being overweight / obese and being less physically active, having poor dietary intake, poor sleep quality and poor knowledge, attitudes and practices related to the management of obesity

- **H<sub>0</sub>3:** Following the aerobic exercise and nutrition education interventions, there is no significant improvement in the levels of physical activity, dietary intake, sleep quality or knowledge, attitudes and practices related to the management of obesity

### **Rationale of the Study**

Along with urbanization, advancements in technology and rising economic stability of urban families that puts an electronic device in most individual's hands, reduced access to nutritious food (which may be due to lack of awareness or lack of time on their hands) and decreasing levels of physical activity are contributing to the trend of obesity. In order to formulate policies, plan public health initiatives, and make decisions based on the best available information, it is critical to monitor current trends in noncommunicable diseases and the risks that go along with them. It is an essential first step in reducing the rising burden of noncommunicable diseases and enhancing population health and wellbeing in general.

### **Significance of the Study**

The world is experiencing overnutrition especially obesity on an epidemic turned pandemic scale with the prevalence of obesity being elevated in areas spanning national and international borders. Identifying probable causes of obesity is becoming important to build a secure and healthy future generation. It is in such a scenario that the future of the management of this global pandemic across all ages and genders becomes essential. Hence, the present study aims to provide non-invasive, individual-centric, behaviour change based solutions to individuals especially women, to overcome the possible health issues related to overweight and obesity; thereby pursuing a healthy future for the coming generations.

### **Objectives of the Study**

The objectives of the study are presented below:

#### **1.1. Primary Objectives**

- To study the socio-economic status, dietary pattern, nutritional status and frequency of morbidities of 18 - 25 years old women.

- To determine the nutritional status, physical activity levels, sleep quality, and the Knowledge, Attitudes and Practices (KAP) of healthy lifestyles of these women.
- To develop aerobic exercise routines and nutrition education modules as interventions for the women based on their nutrition knowledge and health status.
- To assess the impact of intervention on the nutritional status, physical activity levels, sleep quality, and the knowledge, attitudes and practices of the selected women.

### **1.2. Secondary Objectives**

- To estimate the prevalence of obesity among women in urban Coimbatore
- To find out the degree of association (and whether it is positive or negative) between lifestyle interventions and the incidence of obesity among the selected women.
- In the case of an association, helping these women be aware of what they can do to decrease the incidence of obesity at their individual and family levels.