CHAPTER 1: INTRODUCTION

1.1 Introduction to overweight and obesity

Overweight and obesity are defined as excessive fat accumulation in the body, that may impair health and increase the risk of morbidity from several pathologies, including hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, non-alcoholic fatty liver disease, osteoarthritis, sleep apnea, and cancers of endometrium, breast, prostate, and colon (1). Overweight and obesity are one of the major health problems worldwide including developing countries like India (2). In India, obesity is emerging as a major health problem, particularly in urban areas. Rates of overweight and obesity have escalated in epidemic proportions in developed countries and continued to increase in developing countries (3).

Overweight and obesity are considered as global epidemics by the World Health Organization (WHO) (4). According to WHO data, in 2008 more than 1.4 billion adults were overweight, whereas 200 million men and 300 million women were obese. Overweight and obesity are the 5th leading risk factors for death globally. The data from WHO suggests that, in 2008 overall 10% of the total world population was obese (4). The tendency towards obesity is fostered by our environment; lack of physical activity combined with high calorie and low quality foods (5). The prevalence of adolescent and adult obesity is increasing at an alarming rate. Studies have demonstrated that almost 30 to 65% of the urban Indian population is either overweight or obese or has abdominal obesity (1). But the study conducted in Dakshina Kannada reported that the prevalence of overweight and obesity was 4-7 % (6).

1.2 Diagnosis of overweight and obesity

Body mass index (BMI) is considered as an indicator and diagnostic criteria for overweight and obesity. It is calculated by dividing the weight in kilograms with the square of height calculated in meters. The WHO defines overweight as BMI≥25 kg/m² and obesity as ≥30 kg/m² (4). BMI categories for Asian population have been revised by the WHO, in expert consultation which concluded in 2004, since the Asians have a higher percentage of body fat than Caucasian people of same age, sex, and BMI. So, in the present study for the screening
of the subjects revised BMI classification was used which defines overweight as BMI between 23.0-24.9 kg/m\(^2\) and obesity as a BMI ≥25 kg/m\(^2\) (7). Even though BMI is widely used to discriminate the degree of overweight and obesity, it has limitations due to its inability to discriminate lean body mass from fat mass. In addition, BMI does not show distribution of fat in the body. It is now well recognized that abdominal/visceral fat is a major risk for obesity-related diseases. Accumulation of visceral fat contributes to pro-oxidant, pro-inflammatory states, and also causes alterations in glucose and lipid metabolism (8). Waist circumference (WC) is measured midway between the lower rib margin and iliac crest, with a horizontal tape at the end of gentle expiration. Hip circumference is measured around the widest portion of the buttocks, with the tape parallel to the floor. Waist circumference or waist-to-hip ratio (WHR) is a useful indicator of visceral fat distribution. Waist circumference ≥0.80 cm (in women) or 94 cm (in men) and WHR>0.90 for males and 0.85 for females are associated with cardio-metabolic risk in the Europeans (8).

1.3 Dyslipidaemia in overweight and obesity

Overweight and obese subjects are associated with altered lipid levels, called dyslipidemia. It is a major risk factor for the development of coronary and cerebrovascular diseases (9). Typical dyslipidaemia of obesity consists of increased triglycerides (TAG) and free fatty acids, decreased HDL cholesterol (HDL-C) with HDL dysfunction and normal or slightly increased LDL cholesterol (LDL-C) with increased small dense LDL. Several studies report that overweight and obesity is associated with hyperlipidemia characterized by, reduced HDL-C, raised LDL-C and increased TAG (10-12). Furthermore, studies reveal that increased levels of circulating LDL leads to atherosclerosis and thereby increasing the risk of heart attack and ischemic stroke. HDL-C reduces the possibility of cardiovascular disease as it carries cholesterol away from the circulation (13). Studies also show that there is an improvement in blood lipid levels with a reduction in body weight (14-16).

1.4 Oxidative stress in overweight and obesity

Epidemiological, clinical, and animal studies show that obesity is associated with oxidative stress (17-19). Oxidative stress arises when the production of reactive oxygen species (ROS)
overwhelms the intrinsic anti-oxidant defenses (20). Intake of a high amount of fat for the long duration, chronic hyper nutrition, as well as high dietary saturated fatty acids and trans-fatty acids, are the key factors for the generation of oxidative stress in obesity (21-23). Low-grade inflammation associated with obesity and oxidative stress, appear to be closely interlinked (24). It is recently proposed that oxidative stress may be a primary factor in the etiology of obesity-induced insulin resistance and type 2 diabetes mellitus (25). Thus, controlling the obesity associated oxidative stress is crucial for the reduction of future health problems and morbidity (26).

1.5 Management of overweight and obesity

Potential therapeutic regimes for severe obesity are pharmacotherapy and for severe obesity is bariatric surgery (27). These treatments are expensive and also have side effects, so most of the obese individuals are not able to afford them. Therefore, controlling obesity is important for good health and quality life. It can be achieved by using a few non-invasive and non-pharmaceutical treatment options, such as, modification of food habits, yoga training and increasing physical activity (28).

1.6 Yoga in the management of overweight and obesity

Yoga is a practice which has its genesis in ancient India. Yoga was developed in India to facilitate a vibrant lifestyle and meditation (29). This practice includes asanas (physical postures), voluntarily regulated breathing techniques (pranayamas), meditation, and certain philosophical principles (30). Regular practice of asanas develops physical strength, flexibility, and endurance (31), and can be used as a moderate-intensity exercise for patients with limited aerobic capacity or restricted ability to exercise (32). Furthermore, yoga has been effective in decreasing hypertension and cardiac inflammation, stabilizes the sympathetic nervous system, and improves psychological health and cardiac function (33-35). A study conducted with participants having type 2 diabetes mellitus showed a significant decrease in BMI, blood glucose level and positive changes in the oxidative stress status following three months of yoga intervention (36). A decrease in percent body fat, total cholesterol, TAG, and LDL, as well as systolic blood pressure, diastolic blood pressure and heart rate, were observed in persons with CAD and following yoga practice (37).
Beneficial changes in the risk factors for metabolic syndrome were observed in healthy post-menopausal women following yoga practice (38). After yoga practice, patients with more than 36% of body fat showed improved serum lipid profile and beneficial changes in the risk factors for metabolic syndrome. Also, a short-term intensive yoga program caused a decrease in serum leptin levels, along with favorable changes in the BMI, waist to hip ratio, and total cholesterol (39).

Performing suryanamaskaras increases energy expenditure resulting in statistically significant changes in the body composition and body weight (40). Reduction in the body weight is reported to decrease the markers of oxidation, and improvement in metabolic and cardiovascular risks related to obesity (41). The above-mentioned studies show that yoga gives support to overcome overweight or obesity, and to manage associated co-morbid conditions by providing the recommended levels of exercise, and reducing the oxidative stress level. Moreover, it can be an attractive alternate exercise training program, which requires virtually no equipment (42).

1.7 Need for the study

Overweight and obesity contribute to the 5th foremost cause for death globally. Obesity will impair health and increase the risk of morbidity from several pathologies. However, a wide range of treatment options is available for obesity like medication therapy, and bariatric surgery. These treatments are expensive and also have side effects, so most of the obese individuals are not able to afford them. This poses a huge and growing financial burden on national resources. Hence, to find the efficacy of yoga practice, as one of the non-pharmaceutical treatment strategies that can be used to manage and prevent the occurrence of obesity and overweight, this study is essential.

1.8 Aim of the study

To study the effect of yogic intervention on lipid profile, oxidative stress and physiological parameters in overweight and obese adults.

1.9 Objectives of the study
1.9.1 To study the effect of yoga on lipid profile, oxidative stress and physiological parameters, viz., anthropometric variables, body composition and blood pressure in overweight and obese adults.

1.9.2 To compare the effect of yoga on serum lipid profile, oxidative stress and physiological parameters between overweight and obese adults.

1.9.3 To compare the effect of yoga on serum lipid profile, oxidative stress and physiological parameters between the genders in overweight and obese adults.

1.10 The social relevance of the work

Obesity will impair health and increase the risk of morbidity from several pathologies including hypertension, dyslipidemia, type 2 diabetes mellitus, coronary heart disease, stroke, non-alcoholic fatty liver disease, osteoarthritis, sleep apnea, and cancers of endometrium, breast, prostate, and colon. Overweight and obesity contribute to the 5th foremost cause for death globally, even though a wide range of treatment options such as, medication therapy, and bariatric surgery (for the control of excess body weight), are available. These therapies have some side effects and expensive, so most of the obese individuals who are in need of these treatments cannot afford them. This poses a huge monetary burden on national resources. Hence, it warrants alternative forms of interventions which are economical, and without any side effects. This gap can be filled by considering yoga as a treatment option by providing sufficient scientific support as an effective treatment strategy for overweight and obesity because it does not have any side effects and requires virtually no equipment.