

## **CHAPTER THREE**

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### **3. REVIEW OF SCIENTIFIC LITERATURE ON OBESITY**

The escalation of global epidemic of obesity affecting men, women, and children as one of today's most deliberately visible, yet most neglected public health problem. Obesity has received considerable attention as a major health problem due to the prevalence of obesity not only in the United States but also in several other countries worldwide.

Obesity is caused by environmental factors, genetic predisposition, and human behavior. The growing problem of obesity is associated with multiple morbidities, including increased risk of diabetes, hypertension, heart disease, sleep apnoea and cancer. Obesity in childhood causes a wide range of serious complications, and increases the risk of premature illness and death later in life, raising public-health concerns (Kitzinger & Karle, 2013).

Excess adiposity is also known as obesity is a serious public health issue observed in developing & developed countries. High calorie fast food, sugar & sweet intake without physical activity & sedentary life style are factors in the development of obesity (Sarnali & PK, 1970).

Results of research have provided new insights into the physiological basis of bodyweight regulation. However, treatment for childhood obesity remains largely ineffective. Excess body weight is the most important risk factor contributing to the overall burden of disease worldwide. Individuals with normal body weight by body mass index (BMI) and high body fat percentage show a high degree of metabolic deregulation. Recent studies also show that coronary artery disease patients with normal BMI and central obesity have the highest mortality risk as compared to other adiposity patterns. There is a need for an updated definition of obesity based on adiposity & not on body weight (Oliveros, Somers, Sochor, Goel, & Lopez-Jimenez, 2014).

Obesity, with its array of co morbidities, necessitates careful clinical assessment to identify underlying factors and to allow coherent management. The epidemic reflects reduction in physical activity with substantial dietary changes and over-consumption of energy. Effective long-term weight loss depends on permanent changes in dietary quality, energy intake, and activity. Medical management or the societal protective challenges are currently being met levels of physical activity, as well as differences in calorie intake, may have contributed to the growing obesity gradient (Frederick, Snellman, & Putnam, 2014).

Overweight and obesity increases morbidity and mortality in different disease in association with children and adults and in both sexes. Its rate in children and adolescents are increasing in

higher as well as lower socio-economic income groups. In lower socio-economic groups malnutrition is still a major concern at the same time there is need for a balanced and sensitive approach addressing economic and nutrition transitions to effectively tackle this double burden paradox in India (Ranjani et al., 2016).

Dhanajai et al in their study showed that Yoga is an effective tool with no diet restriction to improve anxiety and depression symptoms, which were assessed by Hamilton rating scale as well as obesity in obese subjects. The practices were 60 min per day, five days a week practice of Yoga (Dhananjai, Sadashiv, Tiwari, Dutt, & Kumar, 2013). They suggested that incorporating yogic asana in the treatment of patients suffering from anxiety and depression may be beneficial on a long term basis.

Hagen & Nayar showed that Yoga may help children and young people in managing stress better and so help positively to balance life, well-being, and mental health. They also suggested that Yoga in schools helps students to improve resilience, mood, and self-regulation skills (Hagen & Nayar, 2014).

Yoga practices are useful to reduce back pain and reduces stress and improvises attitude of enjoyment of food which helps to reduce food intake (Bernstein, Bar, Ehrman, Golubic, & Roizen, 2013).

Seo, Dae Yun et al in the study showed that eight weeks of yoga practices improved the body composition and TC levels and is effective in controlling obesity metabolic syndrome factors (Seo et al., 2012).

Yoga and physical exercise are useful additions to the school routine. 98 school children between 8 to 13 years were randomized as Yoga and physical exercise groups to assess the effects of Yoga or physical exercise on physical fitness, cognitive performance, self-esteem, and teacher-rated behavior and performance, in school children were assessed by the Euro fit physical fitness test battery, Stroop color-word task for children & Battle's self-esteem inventory. The practice was for 45 minutes each day, 5 days a week for three months, Yoga group showed a lot of improvement (Telles, Singh, Bhardwaj, Kumar, & Balkrishna, 2013).

A study was conducted in a private school in Bangalore with children aged 12-15 years, adequate physical activity and healthy dietary habits were found to be useful in implementation in addition to academic excellence. Pretested questionnaire was used to collect the data on

physical activity, eating habits and leisure time activity (Kamath Burde & Honnedevasthana Shama Rao, 2011).

In a study conducted in Lahore, out of 293 children 11.9% were obese while 21.8% were overweight; among obese children 74.3% watched TV for 1-2 hours daily, 25.7% for 3-4 hours. 48.6% of obese children did not participate in any field sports while 34.3% have less than 3 hours participation in field sports. Among parents of obese children, 60% were found to have little or no influence on their children's food intake at school whereas 22.9% parents of obese children never advise them against eating junk food. Children included in the study were healthy and had no chronic illness. This study shows that high prevalence of obesity and overweight among children in private schools has direct relationship with decreased physical activity and factors like watching TV, role of media and lack of diet control by parents (Anwar et al., 2010).

In observational studies, it has been found that, children and adolescents in urban areas showed higher BMI, Waist-Hip ratio and skin fold score than that of rural areas. Henceforth, they are more prone to develop disorders associated with obesity in their later life (Ranjani et al., 2016).

The estimated total numbers of overweight and obese adults in 2005 were 937 million in men and 396 million in women. If left unmanaged by 2030, the respective number of overweight and obese adults is projected to be 1.35 billion and 573 million individuals which is a serious global issue (Kelly, Yang, Chen, Reynolds, & He, 2008). To estimate the overall prevalence and absolute burden of overweight and obesity in the world and in various regions in 2005 and to project the global burden in 2030. Sex and age-specific prevalence of overweight and obesity in representative population was identified samples from 106 countries, which cover approximately 88% of the world population, Sex- and age-specific prevalence of overweight and obesity were applied to the 2005 population to estimate the numbers of overweight and obese individuals in each country, of the entire world. Kelly & others showed through survey through MEDLINE and other computerized databases, and a manual search of references from retrieved articles that Overweight and obesity were important clinical and public health burdens and National programs for their prevention and treatment should be a public health priority (Kelly, Cotter, & Mazzeo, 2012). Koenig & others examined the effectiveness of the Get Ready to Learn (GRTL) classroom Yoga program among children, study showed use of daily classroom wise Yoga interventions has a significant impact on classroom behaviors among children with ASD (Koenig, Buckley-Reen, & Garg, 2012).

In another study Yoga and dance, showed results in treating behavior of autistic children (Rosenblatt, 2011).

In a study which was conducted on the prevalence of hypertension and risk factors among school going children between 6 to 18 years of age in Surat city, south Gujarat. Two schools were selected by purposive sampling method and blood pressure measurements were taken as per recommendation of American heart association. Prevalence of hypertension in the study was 6.48%, in males it was 6.74% and in females it was 6.13%. Prevalence of obesity in hypertension was 8.7%. It was identified that obesity, family history of diabetes mellitus, ischemic heart disease was found to have significant association for childhood hypertension (Charan et al., 2011).

*Suryanamaskara* practices help the students to achieve mental, emotional and physical balance. It improves fitness, promotes relaxation, develops self-concept, self-confidence and attitude and reduces stress as well as anxiety. Sixty school boys of District Howrah, West Bengal State were selected at randomly the study of age 10-12 years & were divided into two equal groups. Assessment was done by Beena shah's Self-concept Inventory scale and Gopal Rao's school attitude inventory scale. *Suryanamaskara* practices for four days in a week and continued three months were given. Self-concept and attitude of school boys were improved significantly among *Suryanamaskara* group after three month of practice *Suryanamaskara* as a treatment (Thakur, 2013).

Yoga includes wide range of practices such as asana, pranayama, meditation, stretches and many more out of which *Suryanamaskara* is a very efficient practice for weight management. In a study of effect of *Suryanamaskara* on body fat and BMR, it is found that percentage of body fat and basal metabolic rate is reduced and this was due to the influence of *Suryanamaskar* practices.

*Suryanamaskar* were also studied as management of physical fitness in obese females which suggests that *Suryanamaskar* are more effective in improving cardio-respiratory fitness and upper limb muscle endurance and body flex (Jakhotia, Shimpi, & Yoga, 2015).

In the study conducted for heart rate, breathing rate, and skin resistance were recorded for 20 community home girls and for 20 age-matched girls from a regular school. The first group had a significantly higher rate of breathing and a more irregular breath pattern known to correlate with high fear and anxiety, than the other group. One hour daily for six months both groups

showed a significant decrease in the resting heart rate relative to initial values, the Yoga group showed a significant decrease in breath rate, which appeared more regular. These results suggest that a Yoga program which includes relaxation, awareness, and graded physical activity is a useful addition to the routine of community home children (S Telles, Narendran, Raghuraj, Nagarathna, & Nagendra, 1997). The study conducted to check that breathing exclusively through one nostril may alter the autonomic functions and whether breathing is consciously regulated. 48 male subjects, with ages ranging from 25 to 48 years were randomly assigned to different groups. Each group was asked to practice one out of three *pranayamas*, right nostril breathing, left nostril breathing or alternate nostril breathing. These practices were carried out as 27 respiratory cycles, repeated 4 times a day for one month. Parameters were assessed at the beginning and end of the month. The 'right nostril pranayama' group showed a significant increase of 37% in baseline oxygen consumption. The therapeutic implications of being able to alter metabolism by changing the breathing pattern have been mentioned (Telles, Nagarathna, & Nagendra, 1994).

These Yoga practices provide an opportunity to study the effects of right nostril breathing practiced for ten minutes four times a day, were found to be significantly different from the effect of a left nostril breathing, *pranayama*. There is also a need for increased training opportunities related to obesity prevention and treatment. The results of this study provide directions and urgencies for training, education, and encouraging efforts. The study suggest that school-based PA during short & long breaks or after-school in good environments in school playground, has a vital role in obesity and overweight reduction in children (Sigmund, El Ansari, & Sigmundová, 2012).

Yoga intervention of 12 weeks on women obesity showed significant results on anthropometric and abdominal obesity. Study shows that Yoga can be recommended as a technique for reducing abdominal obesity in women (Cramer H, Thoms M, Anheyer, D et al., 2016).

A study on short term health impact of a Yoga and diet program on obesity resulted in decrease in bio chemical variables like total cholesterol, HDL and serum leptin levels. It showed results for better postural stability, grip strength and also reduction in anthropometric variables like waist and hip circumferences (Telles, Naveen, Balkrishna, & Kumar, 2010).

In a survey conducted of Yoga practitioners showed that Yoga benefits physical and mental health in comparison with the effects of Yoga and exercise on health. Yoga intervention is

equally as effective as or more better than exercise for improving health-related outcome measures (Ross & Thomas, 2010).

In an observational study, it is concluded that the Yoga practice is effective for obesity control for adult male in an urban setting (Rshikesan PB, 2016).

### **3.1 CHILDHOOD OBESITY**

Definition:

#### **Obesity According to Conventional Medicine**

Overweight is defined as excess body weight than the normal healthy weight of a person given the height and age. Body mass index a simple index of weight for height used to classify overweight & obesity.

Obesity can be defined as a condition of abnormal or excessive fat accumulation in adipose tissue to the extent that health may be impaired (WHO, 2012). Adipose tissue or body fat is a loose connective tissue composed of adipocytes and is about 80% fats. Storing energy in the form of fat, cushioning and insulating the body are the main functions of adipose tissue.

Obesity does not depend on body weight but on the amount of adipose tissue. Obesity is a state of imbalance of energy intake and energy expenditure. It is not merely an increase of body weight but an increase in body fat mass percent.

Childhood obesity is a known precursor to obesity and other non-communicable diseases in adulthood. The magnitude of the problem among children and adolescents in India is unclear due to lack of well-conducted nationwide studies and lack of uniformity in the cutpoints used to define childhood overweight and obesity.

### **3.2 DEFINITION OF ADOLESCENT**

Pediatric overweight (ages 2-19) is a national epidemic with significant long term consequences for the individual and society. Adolescence is defined 'period of life from puberty to adulthood (roughly ages 12 – 20) characterized by marked physiological changes, development of sexual feelings, efforts toward the construction of identity, and a progression from concrete to abstract thought. Adolescence is sometimes viewed as a transitional state, during which youth begin to separate themselves from their parents but still lack a clearly defined role in society. It is

generally regarded as emotionally intense and often stressful period. Childhood and adolescent obesity is associated with a range of serious physical health problems, and is a recognized risk factor for adult obesity and other risks –Wikipedia.

### **3.3 BMI: OBESITY**

Definition for the CDC, a BMI greater than the 85th percentile but less than the 95th percentile is considered overweight, and a BMI of greater than or equal to the 95th percentile is considered obese. WHO parameters for BMI-for-age parameters are defined by standard deviations and describe overweight to be greater than +1 standard deviation from the mean (equivalent to BMI=25 kg/m<sup>2</sup> at 19 years) and obese as +2 standard deviations from the mean for 5 to 19 year-olds (equivalent to BMI=30 kg/m<sup>2</sup> at 19 years) Wikipedia

The standard BMI for age percentile charts were developed in the USA by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion. This is a widely accepted definition of child BMI, even though some argue that this measurement is not of global standard. For children and teens, BMI is age and sex specific and is often referred to as 'BMI-for-age.

The 2000 Centers for Disease Control and Prevention growth charts are unable to define BMI percentiles beyond the 97th percentile. New growth charts are developed at Children's Hospital Colorado, to track BMI values in obese children which defines a child's BMI as a "percentage of the 95th percentile." Which is very effective to define severe obesity & review trends in obese children (Gulati, Kaplan, & Daniels, 2012).

The usage of BMI is different for children and adolescents. The U.S. Centers for Disease Control and Prevention (CDC) have developed BMI charts for children and adolescents adjusted for age and sex, Kuczmarski et al., 2002. These charts are suitable for children and adolescents aged 2 to 20 years and are used to obtain a percentile ranking, which allows comparison with children of the same gender and age. After BMI is calculated for children and teens, the BMI number is plotted on the CDC BMI-for-age growth charts (for either girls or boys) to obtain a percentile ranking. Percentiles are the most commonly used indicator to assess the size and growth patterns of individual children in the United States. The percentile indicates the relative position of the child's BMI number among children of the same age and sex. The growth charts show the weight status categories used with children and teens, underweight, healthy weight, overweight, and obese.



Defining obesity in terms of individual's Body Mass Index (BMI) is traditional. This is debatable as, variations in body fat account for weight differences between individuals only partly. Body mass index (BMI) is the cornerstone of the current classification system for obesity and its advantages are widely exploited across disciplines ranging from international surveillance to individual patient assessment (Prentice & Jebb, 2001).

The body mass index (BMI) is an indirect measure of the human body composition based on an individual's height and weight to determine whether a person is underweight, healthy weight, overweight or obese.

It is calculated by using the weight in kilograms divided by the square of height in meters ( $\text{kg}/\text{m}^2$ ). The WHO developed a classification of BMI of adults according to their weight and height, WHO, 2000.

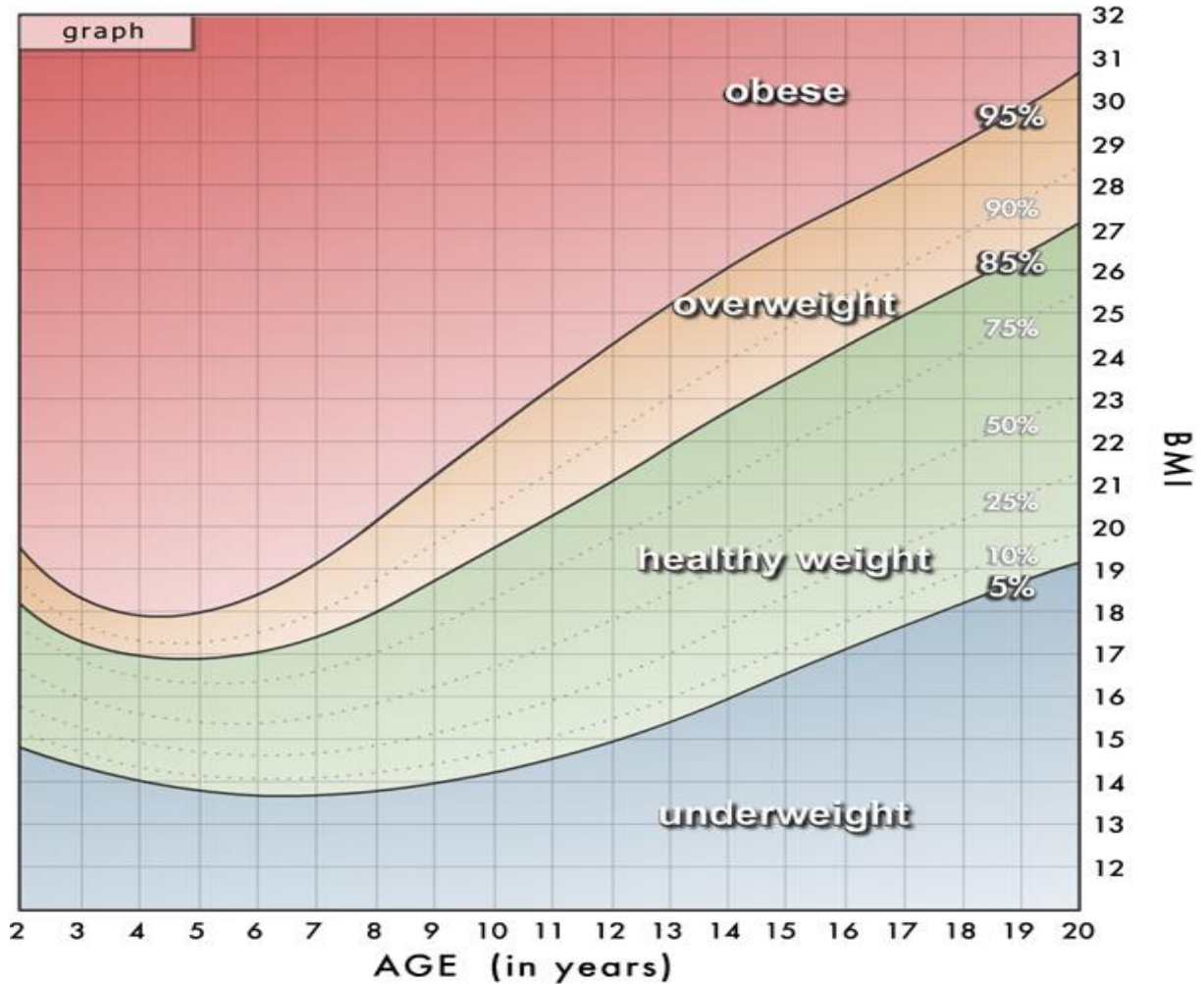
Table 1 shows the international classification of adult underweight, overweight and obesity according to BMI.

Figure 1: BMI-for-age weight status categories and the corresponding percentiles are shown in the below figure one shows the weight status category of children based on their BMI and the corresponding percentiles.

**TABLE- 1: BMI PERCENTILE**

<b>Weight Status Category</b>	<b>Percentile Range</b>
<b>Underweight</b>	<b>Less than the 5th percentile</b>
<b>Healthy Weight</b>	<b>5th percentile to less than the 85th percentile</b>
<b>Overweight</b>	<b>85th to less than the 95th percentile</b>
<b>Obese</b>	<b>Equal to or greater than the 95th percentile</b>

FIGURE:1



### 3.4 ETIOLOGY OF OBESITY

The common type of obesity is considered to be a consequence of interaction between the environmental and genetic factors which are more difficult to manage. Obesity has been described as a medical condition as well as lifestyle disorder. It is influenced by several factors like genetic, personal lifestyle, social environment, medical condition etc.

**3.4.1: Eating Habits & Physical Activities:** All weight loss programs need change in eating habits, dieting, and increase physical activities. The maintenance of the reduced body weight is much more difficult and a substantial proportion of the patients eventually return towards their initial body weight and in most cases even heavier than before. Prevention of weight gain seems to be the general strategy to tackle the obesity. Most food plans for weight loss emphasizes providing age-appropriate food portion sizes, reducing fast food meals, increasing fruits and vegetable consumption and structured meal times. Fiber rich diets containing non starchy

vegetables, fruits, whole grains, legumes, and nuts may be effective in the prevention and treatment of obesity in child primary school children physical fitness is associated with their eating habits and decreases with the number of unhealthy eating behaviors cumulated (Thivel, Tremblay, & Chaput, 2013). The study conducted in four Universities in England and Scotland to directly measure changes in body weight, waist circumference and body composition of 250 students of first year & psychometric eating behavior questionnaires and a validated physical activity .The transition to University has been identified as a possible period for weight gain in the first year. Psychological markers underlying changes in body composition can inform strategies to promote self-regulation in young adults during a critical life period for weight gain (Finlayson, Cecil, Higgs, Hill, & Hetherington, 2012). In obesity reduction, regular physical activity has been traditionally considered as a strategy to burn calories & a stimulus if properly managed, contributes to a significant improvement of energy and macronutrient balance regulation and body functionality .Effective long-term weight loss depends on permanent changes in dietary quality, energy intake, and activity. Neither the medical management nor the societal preventive challenges are currently being met ((Haslam & James, 2005).

### **3:4:2 Genetic Factors in Obesity:**

Several studies have shown that there is a strong genetic basis to the development of obesity. It appears to be a polygenic disorder, with many genes currently linked or associated with a predisposition to excess adiposity. Overweight and obesity represent an increasing health problem. Both genetic and environmental factors contribute to the development of obesity. The genetic influence on body weight is shown by twin and family studies. Environmental changes in recent decades have promoted the development of obesity in individuals at risk because of their genetic composition. Our understanding of the molecular pathways underlying common obesity is limited. During the last decade a handful of monogenic disorders leading to early, severe obesity in humans have been identified. All affect the central regulation of appetite. Knowledge of genetic and environmental components may facilitate the choice of more effective and specific measures for obesity prevention based on the personalized genetic make-up (Qi & Cho, 2008).

### **3.4.3 Sedentary behavior:**

Sedentary life with little physical activity is the major life style change in the modern fast life that contributes to the increasing prevalence of obesity. Sedentary lifestyle patterns in children

and adolescents, playing digital games, using computers and watching television, have been associated with obesity. A review including published studies found in PubMed and other medical journals, dated between January 1990 and April 2007. The age between 2-18 years of the children and adolescents who were the object of the study, selected cross-sectional, longitudinal and intervention studies, video games and computers do not represent such a high risk compared to watching TV, when they do not replace physical activity too much (Rey-López, Vicente-Rodríguez, Biosca, & Moreno, 2008).

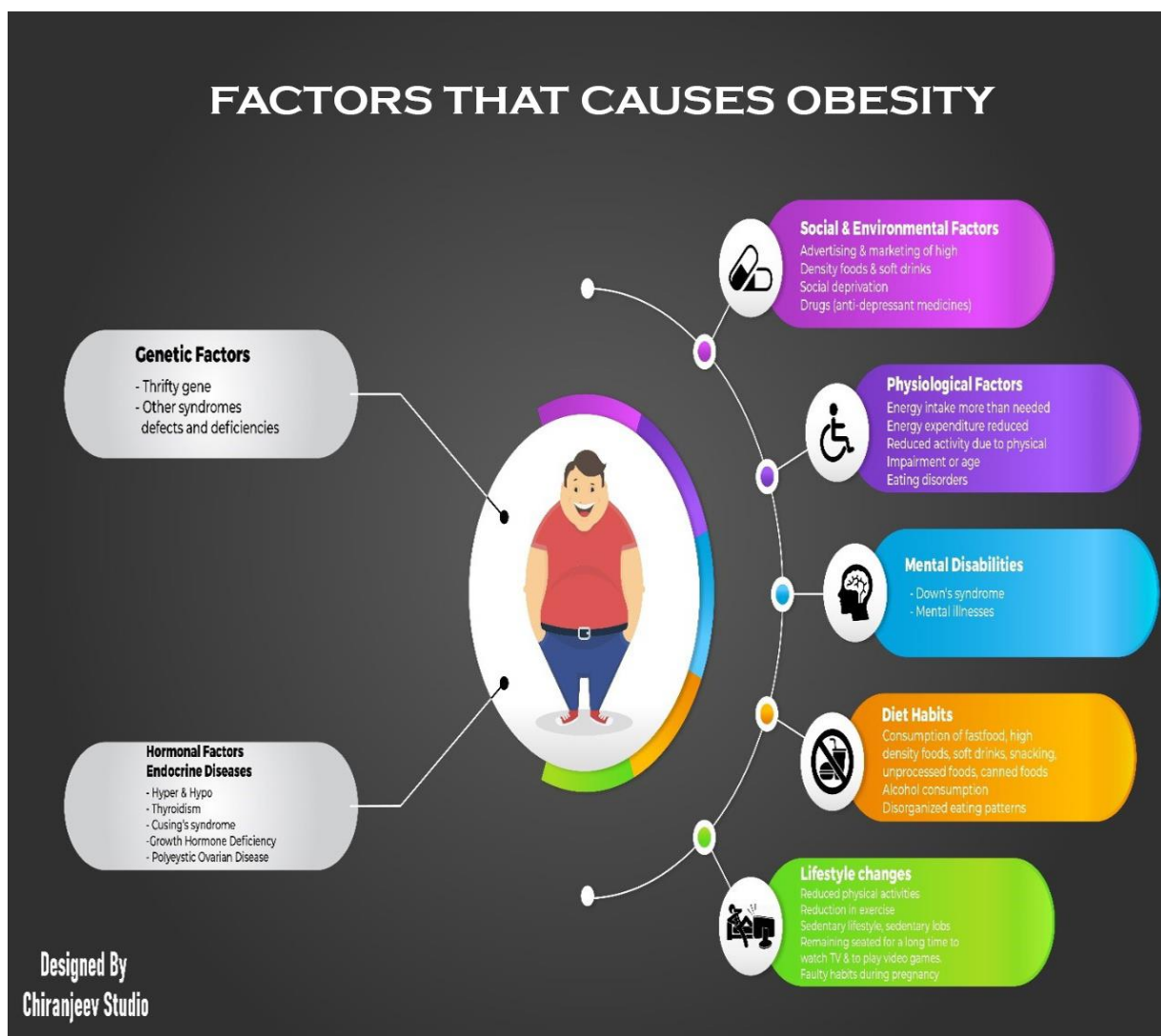
#### **3.4.4. Dietary Intake:**

Consumption of high calorie foods with little spending time for burning, results in accumulation of the surplus energy that gets accumulated in fat cells. Dietary intake throughout childhood is a key factor of growth and development and plays important role in the prevention and treatment of childhood overweight and obesity. The review on current dietary intake assessment methodologies for children, to provide guidance on how these can be improve reporting of dietary intakes of overweight children in the literature and to identify future research priorities (Collins, Watson, & Burrows, 2010).

#### **3.4.5. Parental obesity, eating patterns and attitudes:**

Parental obesity more than doubles the risk of adult obesity among both obese and non-obese children. Bad dietary habits of the mother of preschoolers are associated with subsequent excess weight gain in their daughters. Intensity of parental involvement and behavior change techniques are important issues in the effectiveness of long-term childhood weight control interventions (Van Der Kruk, Kortekaas, Lucas, & Jager-Wittenaar, 2013).

**FIGURE-2: FACTORS THAT CAUSES OBESITY**



### **3.5 CO-MORBID CONDITIONS IN OBESITY**

The relative risk of obesity in adulthood appears to increase with the age of the obese child or adolescent. Overweight in adolescence increases mortality from coronary heart disease, stroke and colorectal cancer, and increases morbidity from these diseases, including gout and arthritis. The increasing prevalence and severity of obesity in children and adolescents has provided greater emphasis on the wide variety of comorbid conditions and complications that can be experienced as a consequence of obesity, complications can occur both in the short term and in the long term which may occur in adulthood. The obesity epidemic might shorten the life span of the current generation of children(D. S, 2009). As a result of the global obesity epidemic, many chronic diseases are now appearing in childhood rather than in adulthood, which poses a significant economic burden on the individuals and on the society. Obesity is a chronic

nutritional disorder which is increasing in prevalence worldwide and is associated with increased risk of development of diabetes mellitus II, hypertension, cardiac ailments, gall bladder disease and certain forms of cancer. Obesity results in both increased morbidity as well as mortality. Increased mortality is basically from the diseases like cardiovascular disease, high blood pressure, and diabetes mellitus.

Complications can be the direct result of obesity or can also be an indirect consequence. Health impacts of obesity can be divided into two categories. First category is attributed to increased fat mass such as osteoarthritis, obstructive sleep apnea, social stigmatization and second is due to the increased number of fat cells diabetes, cancer, cardiovascular disease, non-alcoholic fatty liver disease (Haslam & James, 2005). Obesity alters the body's response to insulin, potentially leading to insulin resistance. Pro-inflammatory state and pro-thrombotic state are also result of excessive fat accumulation in body Obesity adversely affects cardiac function, increases the risk factors for coronary heart disease, and is an independent risk factor for cardiovascular disease. The risk of developing coronary heart disease is directly related to the concomitant burden of obesity-related risk factors. Modest weight loss can improve diastolic function and affect the entire cluster of coronary heart disease risk factors simultaneously (Klein et al., 2004). Pro-inflammatory state and pro-thrombotic state are also result of excessive fat accumulation in body (Peck, Kehle, Bray, & Theodore, 2005).

### **3.6 TYPES OF OBESITY**

**Android:** Android type of obesity is like a shape of an apple. The shoulders, face, arms, neck, chest and upper portion of the abdomen are bloated. The stomach arms, shoulders and breast give a stiff appearance. The back seems to be erect but the neck is compressed and there will be expanded chest because of the bulk in the stomach. The lower portion of the body the hips, thighs and legs are thinner beyond proportion in comparison with the upper part. In these persons the vital organs affected will be mostly the heart, liver, kidneys and lungs. Android type of obesity is a major risk for heart disease.

**Gynoid :** In this type the lower part of the body has the extra fat. This type of obesity is also common to both sexes though females are more affected. Gynoid type of obesity looks like a pear. The excess fat is in the thighs, buttocks, lower abdomen and legs, spine is never erect due to the heavy hips and thighs. The vital organs affected mostly are the kidneys, uterus, Cholesterol.

**Mixed Type:** Some obese belongs to Andriod nor to Gynoid. Whole body is affected and looks like a barrale. The fat tissues are all over the body and hinders the movement of all the internal organs (Nagarathna & Nagendra, 2014).

### **3.7 PREVALENCE OF OBESITY**

#### **3.7.1: Obesity In India:**

The burden of obesity is significant. Obesity is more common in urban residents, followed by peri-urban/slum and lowest among rural residents. Generalized obesity was found to be as follows: 30.7% in Urban men and 38.8% in urban women; 16.7% in peri-urban/slum men. 26.1% in peri-urban/slum women; 9.4% in rural men and 14.1% in rural women. In contrast abdominal obesity is more prevalent in women as seen by these figures: Urban men: 30.9% and women: 57.8%, peri-urban/slum men: 17.9% and women: 41.1% and rural men: 12.2% and women: 29.6%. World Health Organization (WHO) - Indian Council of Medical Research (ICMR) NCD risk factor surveillance study and the Integrated Disease Surveillance Project (IDSP). The NCD risk factor surveillance showed that high prevalence of diabetes, hypertension and obesity in urban areas with slightly lower prevalence rates in semi-urban and rural areas. Improving country-level surveillance and monitoring is a valuable step in prevention and control of NCDs in India (Deepa, Pradeepa, Anjana, & Mohan, 2011). Incidence of obesity in the younger population is also increasing in both developed as well as developing countries. A study in Pune, suggested that the prevalence of overweight and obesity in apparently healthy children from five zones of India in the age group of 2 to 17 years and to examine trends in body mass index (BMI) during the last two decades with respect to published growth data is showing a gradual and insidious shift towards higher weights and BMI (Khadilkar, Khadilkar, Cole, Chiplonkar, & Pandit, 2011). In Ludhiana city of Punjab, 3.4% was the overall incidence of obesity in adolescents, the study indicates a significantly greater number of boys (15%) were overweight as compared to girls (10%) (Aggarwal, Bhatia, Singh, & Sobti, 2008).

Study conducted in India during 1981 to 2013. Literature search was done in various scientific public domains of the last three decades using key words such as childhood and adolescent obesity, overweight, prevalence, trends, etc. Prevalence data from 52 studies conducted in 16 of the 28 States in India were included in analysis. The study indicates the combined prevalence of childhood and adolescent obesity showed higher in north, compared to south India. The pooled data after 2010 estimated a combined prevalence of 19.3 per cent of childhood

overweight and obesity which was a significant increase from the earlier prevalence of 16.3 per cent reported in 2001-2005. The review shows that overweight and obesity rates in children and adolescents are increasing not just among the higher socio-economic groups but also in the lower income groups where underweight still remains a major concern (Ranjani et al., 2016).

**TABLE NO.2**  
**REVIEW OF STUDY OF OVERWEIGHT & OBESITY PREVALENCE IN INDIA**  
**BOTH GENDERS AGE GROUP 2-19 YEARS STUDY 1**

NO.	AUTHOR	NO.	REGION	AGE GROUP (yr)	SAMPLE SIZE (n)	METHOD CUT POINT	OVERWEIGHT PREVALENCE (%)			OBESITY PREVALENCE (%)		
							OVERALL	BOYS	GIRL	OVERALL	BOYS	GIRL
1	Gupta et al	1998	Jaipur, NI	13 -17	237	WHO	-	-	-	10.1	-	-
2	Kapil et al	2002	New Delhi, NI		870	IOTF-Cole et al	24.7	23.1	27.7	7.4	8.3	5.5
3	Ramachandran et al	2002	Chennai, SI	13 - 18	4700	IOTF-Cole et al	-	17.8	15.8	-	3.6	2.9
4	Subramanyam et al	2003	Chennai, SI		707(1981)	IOTF-Cole et al	9.6	-	-	5.9	-	-
					610 (1998)		9.7	-	-	6.2	-	-
5	Chhatwal et al	2004	Punjab, NI		2008	WHO	14.2	15.7	12.9	11.1	12.4	9.9
6	Mohan et al	2004	Punjab, NI	11 – 17	3326	IOTF – Cole et al	11.6(U)	-	-	2.4(U)	-	-
							4.7(R)	-	-	3.6(R)	-	-
7	Khadiilkar & Khadiilkar	2004	Pune, WI	10 – 15	1228	IOTF – Cole et al	19.9	19.9	-	5.7	5.7	-
8	Sidhu et al	2005	Punjab, NI	10 – 15	640	Must et al	10.9	9.9	12	5.6	5	6.3
9	Gupta et al	2006	Jaipur, NI	11 – 17	1224(1997)	IOTF – Cole et al	10.9	-	10.9	5.5	-	5.5
					915(2003)		10.5	-	10.5	6.7	-	6.7
10	Kaneria et al	2006	Rajsthan, NI	12 – 17	268	IOTF – Cole et al	3.25	-	-	3.73	-	-
11	Iyer et al	2006	Baroda, WI	12 – 18	5329	IOTF – Cole et al	8.5	8	9	1.5	1.4	1.7
12	Singh et al	2006	New Delhi, NI	12 – 18	510	CDC Growth	-	-	-	-	18.6	16.5
						Charts	-	-	-	-	-	
13	Sood et al	2007	Bangalore, SI	09 – 18	794	IOTF – Cole et al	13.1	-	13.1	4.3	-	4.3
14	Rao et al	2007	Pune, WI	09 – 16	2223	IOTF – Cole et al	-	27.5	20.9	-	-	-
15	Laxmaiah et al	2007	Hyderabad, SI	12 – 17	1208	IOTF – Cole et al	-	6.1	8.2	-	1.6	1
16	Global School Based Student Health Survey (CBSE)	2007		13 – 15	8130	WHO	10.8	11.6	9.7	2.1	2.5	1.5
17	Innithan & Syamakumar	2007	Kerala, SI	10 – 15	3886	IOTF – Cole et al	17.7	-	-	5	-	-
18	Aggarwal et al	2008	Punjab, NI	12 – 18	1000	Rosner et al	12.7	-	-	3.4	-	-
19	Bharati et al	2008	Wardha, WI	10 – 17	2555	CDC Growth	3.1	-	-	1.2	-	-
						Charts						
20	Goyal et al	2010	Ahmedabad, WI	12 – 18	5664	IOTF – Cole et al	-	14.3	9.2	-	2.9	1.5
21	Jain et al	2010	Meerut, NI	10 – 16	2785	EHPA	-	18.4	19.7	-	10.8	5.3
22	Gupta et al	2011	New Delhi, NI	14 – 17	3493(2006)	Pandey et al	24.2	-	-	9.8	-	-
					4908(2009)		25.2	-	-	11.7	-	-
23	Saraswathi et al	2011	Mysore, SI	13 – 17	1439(U)	WHO	-	-	-	8.8(U)	7.7(U)	10.4(U)
					750 <sup>o</sup>		-	-	-	0.8(R)	0.5(R)	1.0(R)
24	Kumar et al	2011	Udipi Dist.SI	12 – 15	500	WHO	3	-	-	2.6	-	-
25	Kumar et al	2012	Surat, WI	13	277	IAP	-	-	12.6	-	-	6.5
				14	271		-	-	13.3	-	-	6.6
				15	215		-	-	14	-	-	6.7
26	Jain et al	2012	Chattisgarh EI	13 – 17	500	CDC Growth	-	-	23.8	-	-	8.4
						Charts						
27	Alok et al	2012	Surat WI	14 – 16	213(U)	IOTF – Cole et al	26.3(U)	27.4(U)	24.9(U)	14.6(U)	14.3(U)	15.0(U)
					176(R)		25.8(R)	25.6(R)	26.2(R)	12.8(R)	11.2(R)	14.1(R)
28	Gupta et al	2013	Bankura EI	10<-18	452	WHO	7.7	8.9	6.3	4.0	4.0	3.9



Table no 3:

Most studies include age group 10 years onwards in the adolescent age group except for two studies which included age 9 years onwards.

BMI ( $\text{kg}/\text{m}^2$ ), <sup>2</sup> Girl only, Boys only, based on triceps skin fold thickness (TSFT), based on a representative sample of students going to CBSE school in India, >95 or <90 percentile = obesity >85 or 80 percentile = overweight & obesity; NI, North India; NEI, North East India; SI, South India; CI, Central India; EI, East India; WI, West India. **Various cut – points used:**

Must et al (1991), International Obesity Task Force (IOTF) – Cole et al (2000), World Health Organization (WHO) Age and Gender Specific Cut – off for Overweight & Obesity (1995, 2006) Centres for Disease Control and Prevention (CDC), Atlanta, USA, CDC Growth Charts for the United States , Eliz Health Path for Adolescents and Adults (EHPA) , Pandey et al , Indian Academy of Paediatrics(IAP) 2001, Rosner et al .

**TABLE NO.3**  
**REVIEW OF STUDY OF OVERWEIGHT & OBESITY PREVALENCE IN INDIA**  
**BOTH GENDERS AGE GROUP 2-19 YEARS STUDY 2**

NO.	AUTHOR	NO.	REGION	AGE GROUP (yr)	SAMPLE SIZE (n)	METHOD CUT POINT	OVERWEIGHT PREVALENCE (%)			OBESITY PREVALENCE (%)		
							OVERALL	BOYS	GIRL	OVERALL	BOYS	GIRL
1	Monga	2004	New Delhi,NI		1238	11.3	6.2	-	-	8.2	-	-
2	Sidhu et al	2006	Punjab,NI	6 - 11	1000	IOTF-Cole et al	-	12.2	14.3	-	5.9	6.3
2	Bose et al	2007	Kolkata,EI	6 – 9	431	IOTF-Cole et al	-	-	17.6	-	-	5.1
4	Kumar et al	2008	Mangalore, SI	2 – 5	425	WHO cut-points	4.5	-	-	1.4	-	-
5	Wang et al	2009	National54NFHS-1(1992-1993)	<4	25584	WHO	-	-	-	1.6	-	-
			National 55NFHS-2(1998-1999)	1 – 5	-	-	-	-	-	1.6	-	-
			National 56NFHS-3(2005-2006)	< 5	46655	-	-	-	-	1.5	-	-
			National 57NNMB 2000-2001	1 – 5	28392	Gomez et al	-	5.7	8.2	-	0.4	1.2
			National58NNMB 2005-2006	1 – 5	32642	Must et al	-	7.8	10.9	-	0.8	1.8
6	Dhingra et al	2011	Srinagar, NI	7 – 11	128	WHO	-	-	-	25	-	-
7	Preetam et al	2011	Puducherry,NI	6 - 12	12685	CDCGrowth Charts	4.4	4.2	4.6	2.1	2.0	2.3

BMI ( $\text{kg}/\text{m}^2$ ), Girl only,; Ponderal index ( $\text{kg}/\text{m}^3$ ) – is a measure of leanness of a person calculated as a relationship between mass and height. It is similar to the body mass index, but the mass is normalized with the third power of body height ( $\text{m}^3$ ) rather than the second power ( $\text{m}^2$ ).

>95 or >90Percentile = obesity > 85 or 80 Percentile = overweight & obesity ; NFHS, National Family Health Survey; NNMB, National Nutrition Monitoring bureau; NI, North India; NEI, North East India; SI, South India; CI, Central India; EI, East India; WI, West India

**Various cut – points used:**

Gomez et al (2000), Must et al (1991), International Obesity Task Force (IOTF) – Cole et al (2000), World Health Organization (WHO) Age and Gender Specific Cut-offs for Overweight & Obesity (1995, 2006), Centres for Disease Control and Prevention (CDC), Atlanta , USA, CDC Growth Charts for the United States.

**TABLE NO.4: REVIEW OF STUDY OF OVERWEIGHT & OBESITY  
PREVALENCE IN INDIA BOTH GENDERS AGE GROUP 2-19 YEARS STUDY 3**

NO.	AUTHOR	NO.	REGION	AGE GROUP (yr)	SAMPLE SIZE (n)	METHOD CUT POINT	OVERWEIGHT PREVALENCE (%)			OBESITY PREVALENCE (%)			
							OVERALL	BOYS	GIRL	OVERALL	BOYS	GIRL	
1	Gupta & Ahmad	1990	New Delhi, NI	5 – 15	3861	>2.26	-	-	-	-	8	7	
2	Chatterjee	2002	New Delhi, NI	4 – 18	5000	IOTF-Cole et al	29	-	-	6	-	-	
3	Marwaha et al	2006	Delhi, NI	5 – 18	21485	IOTF-Cole et al	-	16.8	19	-	5.6	5.0	
4	Sharma et al	2007	Delhi, NI	4 – 17	4000	IOTF-Cole et al	22	-	-	6.0	-	-	
5	Raj et al	2007	Kerala, SI	5 – 16	24842(2003)	CDC Growth Charts	4.9	5.4	4.6	1.3	1.7	0.9	
					20263(2005)		6.6	7.3	5.9	1.9	2.5	1.3	
6	Kaur et al	2008	Delhi, NI	5 – 18	16595	IOTF-Cole et al	2.7(LI)	-	-	0.1(LI)	-	-	
							6.5(MI)	-	-	0.6(MI)	-	-	
							15.3(HI)	-	-	6.8(HI)	-	-	
								-	-	29.0(P)	-	-	
							Must et al	2.4(LI)	-	-	1.2(LI)	-	-
								4.9(MI)	-	-	2.5(MI)	-	-
				13.1(HI)	-	-	9.3(HI)	-	-				
7	Premanath et al	2010	Mysore, SI	5 – 16	43152	Agarwal Charts	8.5	8.8	8.2	3.4	3.7	3	
8	Khadilkar et al	2011	Delhi & Chandigarh, NI Chennai, Bangalore, Hyderabad,SI Mumbai, Pune Baroda WI Raipur CI	2 – 17	20243	IOTF-Cole et al	14.9	15.2	14.4	4.7	5.4	3.9	
							WHO	11.1	10.8	11.4	15.9	18.4	12.8
9	Misra et al	2011	New Delhi , Jaipur ,Agra, Allahabad,NI Mumbai, WI	8 – 18	38296	IOTF-Cole et al	14.4	-	-	2.8	-	-	
							CDC	14.5	-	-	4.8	-	-
							WHO	18.5	-	-	5.3	-	-
							Pandey et al	21.1	-	-	12.3	-	-
10	Patnaik et al	2011	Bhubaneswar EI	5 – 15	468	CDC	14.1	-	-	14.5	-	-	
11	Ghosh	2011	Kolkata EI	8 – 12	753	IOTF-Cole et al	9.4	-	-	6.1	-	-	
				13 – 15			9.7	-	-	5.3	-	-	
				16 – 18			10	-	-	5.4	-	-	
12	Chakraborty et al	2011	Kolkata EI	5 – 8	271	CDC	14.4	-	-	5.2	-	-	
				9 – 12			381	22.6	-	-	-	-	
				13 – 18			327	17.1	-	-	2.5	-	-
13	Singh & Devi	2013	Manipur, EI	6 – 12	192	IOTF-Cole et al	-	-	-	-	1.6	5.2	
14	Longkumar	2013	Nagaland, NEI	8 – 15	571	IOTF-Cole et al	2.3	2.1	2.5	-	-	-	
				13 – 18			192	-	-	-	-	3.1	5
15	Siddiqui & Bose	2012	Indore, CI	7 – 14	2158	IOTF-Cole et al	-	-	-	15.0	6.8	8.2	
16	Sonya et al	2014	Chennai, SI	6 – 11	8025	IOTF-Cole et al	-	16.2(P)	13.7(P)	-	4.2(P)	3.9(P)	
								1.6(G)	2.6(G)	-	0.3(G)	0.4(G)	
16	Sonya et al	2014	Chennai, SI	12 – 17	10930	IOTF-Cole et al	-	23.2(P)	23.2(P)	-	11.6(P)	11.5(P)	
								3.6(G)	5.7(G)	-	0.8(G)	1.1(G)	
17	Adinatesh & Prashant	2013	Karimnagar, SI	7 – 14	892	Agarwal Charts	11.9	-	-	2.7	-	-	

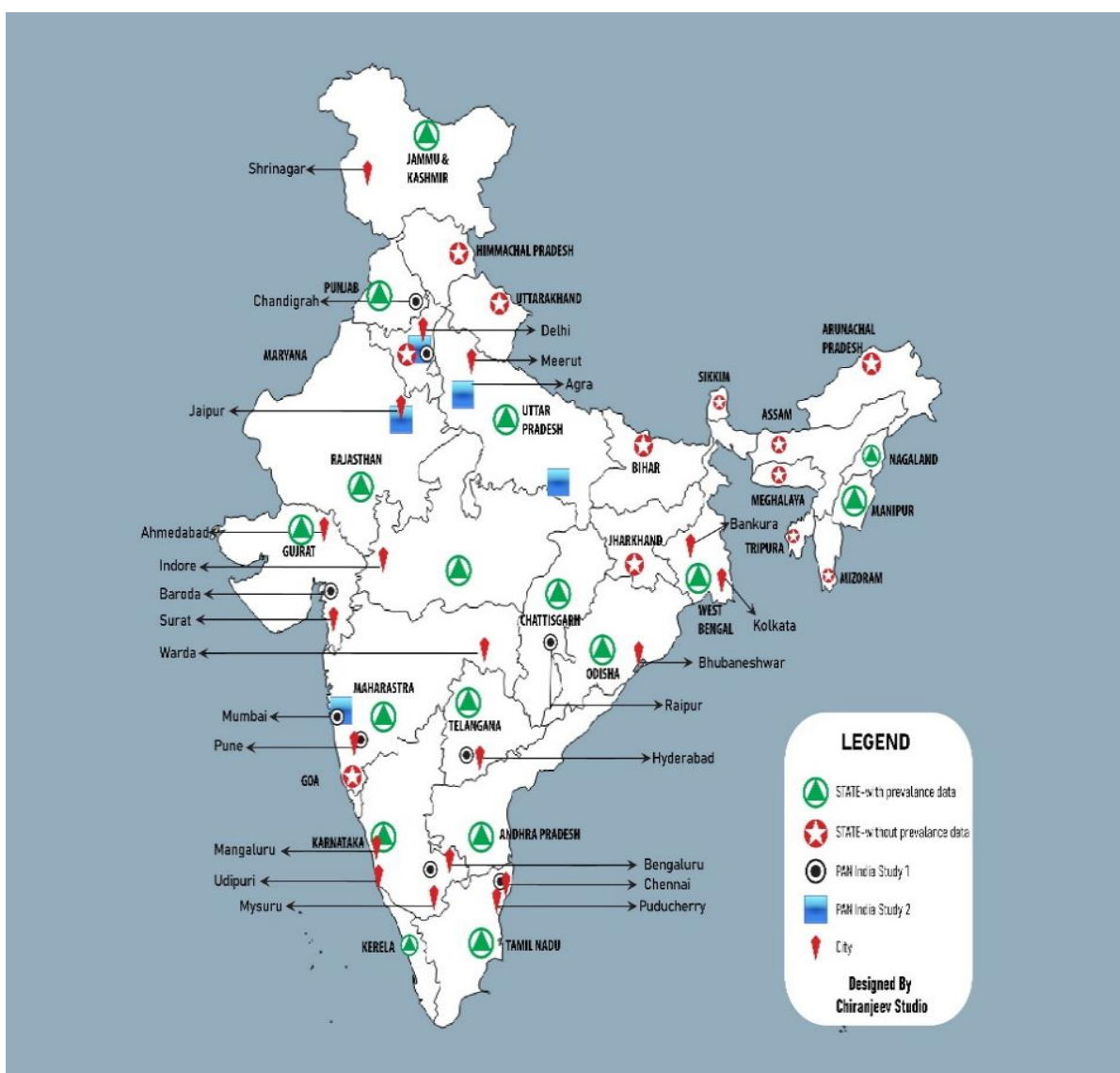
BMI (kg/ m<sup>2</sup>), Girls only, Ponderal index (kg/m<sup>3</sup>) – is a measure of leanness of a person calculated as a relationship between mass and height. It is similar to the body mass index, but the mass is normalized with the third power of body height (m<sup>3</sup>) rather than the second power (m<sup>2</sup>).

>95 or >90 Percentile, obesity;>85 OR 80 Percentile = overweight & obesity; NI, North India; NEI, North East India; SI, South India; CI, Central India; EI, East India; WI, West India; U, Urban; R, Rural; P, Private; G, Government; LI, Low Income; MI, Middle Income; HI, High Income .**Various cut-points used:**

Gomez et al (2000), Must et al (1991), International Obesity Task Force (IOTF)-Cole et al (2000), World Health Organization (WHO) Age and Gender Specific cut-offs for overweight & obesity (1995, 2006), Centres for Disease Control and Prevention (CDC), Atlanta, USA, CDC Growth Charts for the United States, Agarwal/Indian Academy of Paediatrics (IAP) growth monitoring charts (1992 , 2001), Pandey et al , Khadilkaret al.

FIGURE NO 3

PAN INDIA STATEWISE STUDY 1 & 2



3:7:2 Globally:

Obesity has received considerable attention as a major health hazard because of the increase in the prevalence of obesity not only in the United States but also in several other countries worldwide.

Obesity has almost doubled since 1980 and reported that in the year 2008 there were more than 1.4 billion adults of age 20 years and older who were overweight; of these, around 200 million men and nearly 300 million women were obese, there have been no significant changes in obesity prevalence in youth or adults between 2003-2004 and 2011-2012 (C. L. Ogden, Carroll,

Kit, & Flegal, 2014). This means that at that time, over 10% of the world's adults aged 20+ were obese and around 35% (34% men and 35% women) were overweight. It is estimated that by 2015, around 2.3 billion of the world's adults will be overweight and at least 700 million people will be obese. In August 2012, Center for Disease Control (CDC) released the latest rates of obesity in the United States. Twelve states had an adult obesity rate above 30 percent. Mississippi had the highest rate of obesity at 34.9 percent, while Colorado had the lowest rate at 20.7 percent. Twenty-six of the 30 states with the highest obesity rates are in the Mid-west and South. Ten of the states with the high rates of type 2 diabetes and hypertension were in the South.

The pattern of childhood obesity differs from developed to developing nations. In developed countries, lower income families are more vulnerable, while in developing countries, childhood obesity is more prevalent among affluent groups. Childhood obesity is becoming an equally challenging, yet under-recognized, problem in developing countries including India.

Childhood obesity has more than doubled in children and adolescents in the past 30 years. The percentage of children aged 6–11 years in the United States who were obese increased from 7% in 1980 to nearly 18% in 2012. Similarly, the percentage of adolescents aged 12–19 years who were obese increased from 5% to nearly 21% over the same period. In 2012, more than one third of children and adolescents were overweight or obese. WHO projects that by 2015, approx. 2.3 billion adults will be overweight & more than 700 million will be obese. About 30% of the children in the USA, between ages 2 and 19 years of age are either overweight or obese and 18% of the adolescents/teenagers are obese. Rising prevalence of child obesity is more evident among Hispanic and African American children. 41% of the Hispanic children are overweight / obese and 23% of the adolescents are obese. In the African American community about 25% of the children are obese. Overall, there have been no significant changes in obesity prevalence in youth or adults between 2003-2004 and 2011-2012. Obesity prevalence remains high and thus it is important to continue surveillance (C. Ogden, Carroll, Kit, & Flegal, 2014).

Worldwide prevalence of childhood obesity has increased greatly during the past three decades. Progress has been made in understanding of the genetics and physiology of appetite control and from these advances, interpretation of the causes of some rare obesity syndromes. However, these rare disorders have so far taught us few lessons about prevention or reversal of obesity in most children. It is an issue of serious medical and social concern in developing countries

including India, it is a phenomenon seen in higher socio economic strata due to the adoption of a western lifestyle.

Childhood obesity is an issue of serious medical and social concern due to the adoption of a western lifestyle. Consumption of high calorie food, lack of physical activity and increased time on viewing television are major risk factors for childhood obesity. Obese adolescents are more prone to adopt the risk of medical and psychological complications like Insulin resistance, dyslipidemia, type 2 diabetes mellitus, hypertension, polycystic ovarian syndrome and metabolic syndrome in their adulthood. As prevention and treatment of obesity involves lifestyle modification of the entire family (Seth & Sharma, 2013).

Although quality of research into both prevention and treatment has improved, high-quality multicentre trials with long-term follow-up are needed. Meanwhile, prevention and treatment approaches to increase energy expenditure and decrease intake should continue. Recent data suggest that the spiralling increase in childhood obesity prevalence might be abating; increased efforts should be made on all fronts to continue this potentially exciting trend.

The pattern of childhood obesity differs from developed to developing nations. In developed countries, lower income families are more vulnerable, while in developing countries, childhood obesity is more prevalent among affluent groups.

Overall, there have been no significant changes in obesity prevalence in youth or adults between 2003-2004 and 2011-2012. Obesity prevalence remains high and thus it is important to continue surveillance (Karnik & Kanekar, 2012). Infant juvenile obesity is currently a worldwide public health problem and it is increasing at alarming rate in the Brazilian population, showing its relevance in terms of public health. Study indicates the prevalence of overweight and obesity in children and adolescents between 2 and 19 years old in different regions of Brazil (Niehues, Gonzales, Lemos, Bezerra, & Haas, 2014).

Childhood overweight/obesity is increasing rapidly in developing countries. There is a need to provide more evidence on its burden in sub-Saharan Africa, and to identify associated factors in order to set preventive measures. Study aimed to determine the prevalence of overweight/obesity and assess its association with the socioeconomic status in nursery and primary school children in urban Cameroon. In the cross-sectional study includes multi-staged cluster random sampling 1343 children from high (HSES, n = 673) and low (LSES, n = 670) socioeconomic status schools in Douala. Parent/child demographic data were collected, and

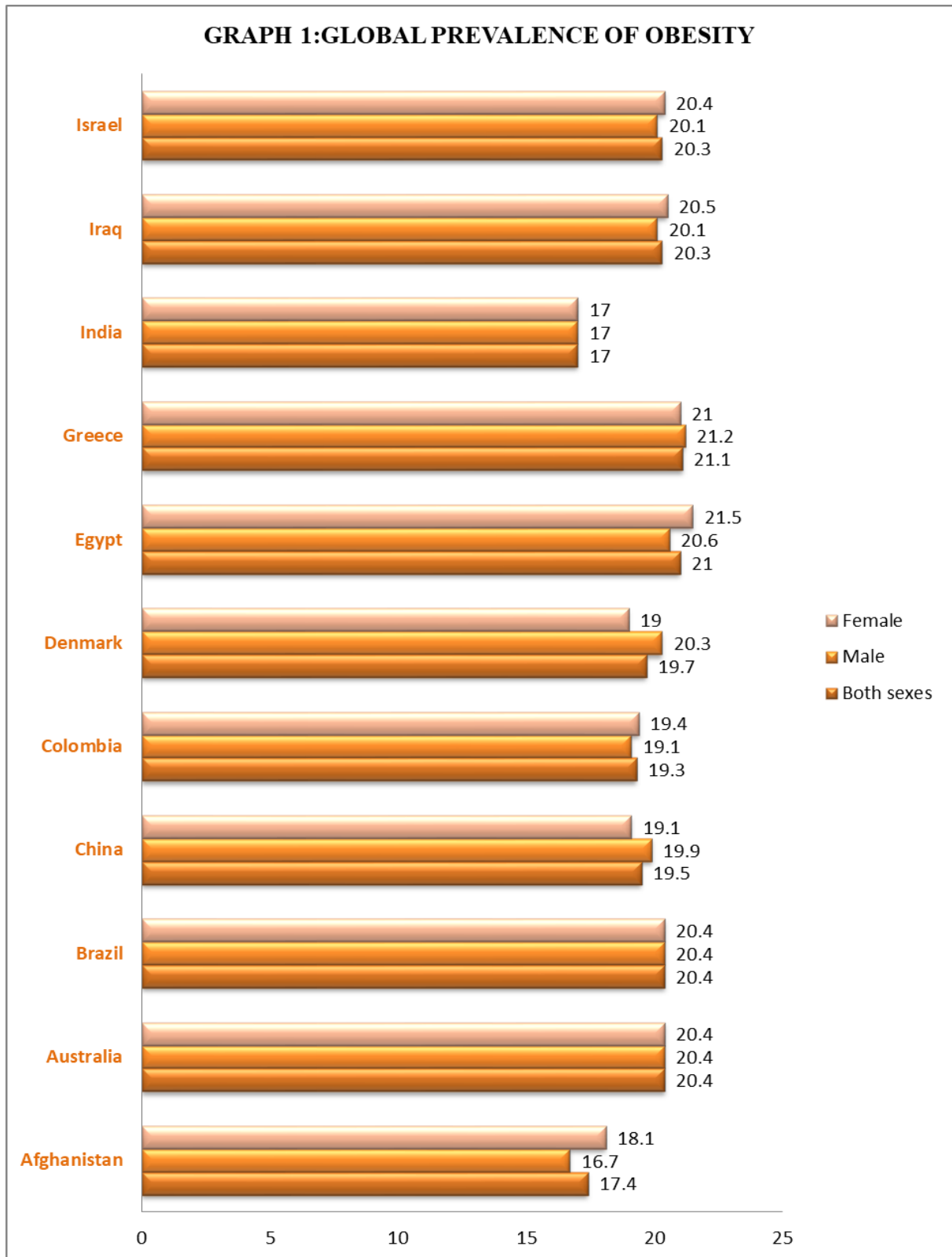
children's anthropometric parameters were measured using validated methods. The prevalence of overweight/obesity was 12.5% (13.2% in girls, 11.8% in boys). The risk of overweight/obesity was 2.40 (95% CI 1.70, 3.40) higher in HSES children compared to LSES after adjusting for age and gender. However this association was attenuated to 1.18 (95% CI 0.59, 2.35) Overweight/obesity is relatively common in sub-Saharan African children and prevalence is associated with HSES. This may be due to sweet drink consumption, and no sports activities at school (Choukem, 2017).

**TABLE NO 5**

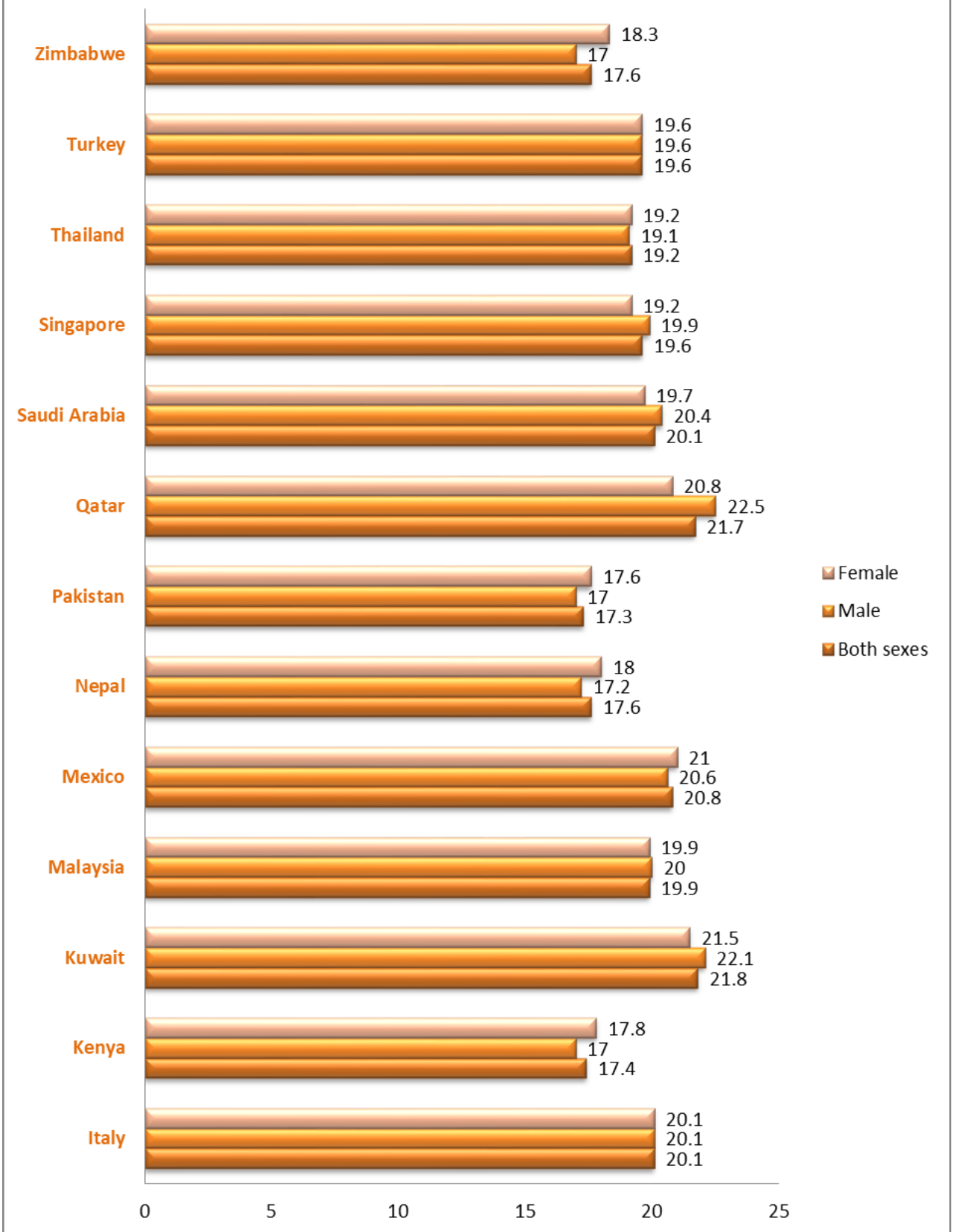
**GLOBAL PREVALENCE OF OVERWEIGHT & OBESE(5 – 19 AGE GROUP)**

<b>2016: Mean BMI : 5-19 years</b>			
<b>Country</b>	<b>Both sexes</b>	<b>Male</b>	<b>Female</b>
<b>Afghanistan</b>	17.4	16.7	18.1
<b>Australia</b>	20.4	20.4	20.4
<b>Brazil</b>	20.4	20.4	20.4
<b>China</b>	19.5	19.9	19.1
<b>Colombia</b>	19.3	19.1	19.4
<b>Denmark</b>	19.7	20.3	19
<b>Egypt</b>	21	20.6	21.5
<b>Greece</b>	21.1	21.2	21
<b>India</b>	17	17	17
<b>Iraq</b>	20.3	20.1	20.5
<b>Israel</b>	20.3	20.1	20.4
<b>Italy</b>	20.1	20.1	20.1
<b>Kenya</b>	17.4	17	17.8
<b>Kuwait</b>	21.8	22.1	21.5
<b>Malaysia</b>	19.9	20	19.9
<b>Mexico</b>	20.8	20.6	21
<b>Nepal</b>	17.6	17.2	18
<b>Pakistan</b>	17.3	17	17.6
<b>Qatar</b>	21.7	22.5	20.8
<b>Saudi Arabia</b>	20.1	20.4	19.7
<b>Singapore</b>	19.6	19.9	19.2
<b>Thailand</b>	19.2	19.1	19.2
<b>Turkey</b>	19.6	19.6	19.6
<b>Zimbabwe</b>	17.6	17	18.3

**GRAPH 1: GLOBAL PREVALANCE OF OVERWEIGHT & OBESITY AGE 5 YEARS TO 19 YEARS**



**GRAPH 1-CONTD.:GLOBALPREVALENCE OF OBESITY**





## **3.8 MANAGEMENT OF OBESITY ACCORDING TO MODERN TIMES**

Management of Obesity According to Modern Times Obesity has been described as a medical condition as well as lifestyle disorder. It is influenced by several factors: genetic, personal lifestyle, social environment, medical condition etc.

### **Obesity Management**

Treating obesity is simple but maintaining the weight and sticking to an exercise routine is the most difficult task. All weight-loss programs require changes in your eating habits and increased physical activity. The treatments are depends on the level of obesity, your overall health and your willingness to participate in the weight-loss plan. Other treatment tools include: Dietary changes, Exercise and activity, Behavior change, Prescription weight-loss medications and /or Weight-loss surgery.

#### **3.8.1: Different Approaches**

1. Medicines: Orlistat, Statins, Rimonabant, Ezetimibe, Sibutramine
2. Surgery Bariatric surgery, Liposuction
3. Life style change: Disciplined daily routine, Brisk walking, Abstinence from addiction, Proper diet and moderation in sleep.
4. Naturopathy: Weight reducing diet, Fasting, Sauna bath(Dry, Wet),Massage, Water therapy
5. Yoga: Breathing Exercises, Çithilikaraëa Vyäyâma, Āsanas, Sūryanamaskâra, Kriyäs, meditation, Yogic counseling for stress management, notional correction, emotion culture and action in relaxation.

#### **3.8.2: Weight-loss Medication:**

The main therapy to ensure weight loss is life style change that includes healthy diet, regular exercise and behavior modification. But in some cases of severe obesity (BMI>35) wherein other methods of weight loss haven't worked or high BMI is associated with other medical complications such as diabetes, high blood pressure or sleep apnea that need urgent weight loss, prescription of weight-loss medication is needed. Medication useful when they are combined with life style changes the list of medicines, their mode of action & side effects are.

1. Orlistat: Works by reducing the body's ability to absorb dietary fat by about one third. Side effects are Oily and frequent bowel movements, bowel urgency, stomach pain, flatulence
2. Lorcaserin: Works by affecting chemicals in the brain that help decrease appetite and make you feel full. So you eat less. Side effects are Headaches, dizziness, fatigue, nausea, dry mouth, constipation. Rare but serious side effect include chemical imbalance (serotonin syndrome) Suicidal thoughts, psychiatric problems.
3. Phenterminetopiramate: Suppression of appetite. Side effects: increased heart rate, tingling of hand and feet, Insomnia, dizziness, dry mouth, constipation. Serious side effects-Suicidal thoughts, sleep disorders
4. Sibutramine: Suppression of appetite. Side effects: Increased blood pressure, dry mouth, constipation, headache, insomnia

### **3.8.3: Surgical procedures available for obesity**

1. Roux-en-Y (gastric bypass): In gastric bypass, the surgeon creates a small pouch at the top of your stomach. The small intestine is then cut a short distance below the main stomach and connected to the new pouch. Food and liquid flow passes directly from the pouch into this part of the intestine, bypassing most of your stomach.
2. Biliopancreatic diversion with duodenal switch: In this procedure, most of your stomach is surgically removed.
3. Laparoscopic adjustable gastric Banding: In this procedure, your stomach separated into two pouches with an inflatable band. Pulling the band tight, like a belt, the surgeon creates a tiny channel between the two pouches. The band keeps the opening from expanding and is generally designed to stay in place permanently
4. Sleeve gastrectomy: In this procedure, part of the stomach is removed, creating a smaller reservoir for food.
5. Vertical banded gastroplasty: Stomach stapling a part of the stomach is permanently stapled to create a smaller pre-stomach pouch which serves as the new stomach (R,Nagarathna & H,Nagendra, 2014).

## 3.9 YOGA AS THERAPY

### 3.9.1: Definition of Yoga

The definition of Patanjali's Yoga encompasses a variety of practices which include Yama and Niyama (the moral injunctions for healthy living), asana or postures, breathing exercises or pranayama, four stages of meditation (Pratyahara, Dhāraṇa, Dhyāna and Samādhi) and lifestyle changes (diet, sleep). Sage Patañjali defines Yoga as

योगश्चित्तवृत्तिनिरोधः ॥ पतञ्जलि योगसूत्र १-२ ॥

*Yogaścittaṽṛttinirodhaḥ | | Patañjali Yogasūtra 1-2 | |*

‘Yoga is a process of gaining mastery over mind’.

तदा द्रष्टृस्वरूपेऽवस्थानम् ॥ पतञ्जलि योगसूत्र १-३ ॥

*Tadā draṣṭuḥ svarūpe'vasthānam | Patañjali Yogasūtra 1-3 | |*

Sage Patanjali goes on to describe the result of such mastery in the next Sūtra: ‘The seer establishes himself in his causal true state’

मनःप्रशमनोपायः योग इत्यभिधीयते ॥ योगवासिष्ठ ३।९।३२ ॥

*Manah praśamanopāyaḥ Yoga ityabhidhīyate | | Yoga Vāsiṣṭha 3 | 9 | 32 | |*

In Yoga Vāsishtha, the essence of Yoga is beautifully portrayed as: ‘Yoga is a skillful trick to calm down the mind’. It is an Upāya, a skillful subtle process and not a brutal, mechanical gross effort to stop thought in the mind.

Yoga as a mind body practice emphasizes mental discipline as much as physical, and both synergistically integrating to help with personal transformation that leads to perfect health as envisioned by WHO definition of health.

### 3.9.2: Yoga as Therapy:

Yoga represents a body of practices with an ancient history, derived from India about 5000 years ago. The word yoga in Sanskrit is ‘yuj’ meaning to unite, refers to the discipline of aligning the mind and body for spiritual goals. Yoga has also been practiced for positive health benefits, with increasing attention to prevent illness and treat disease. Yoga is being used by

youth and adults for improving overall health and fitness. The trend is also progressing to use of yoga as a mind-body complementary and alternative medicine to improve specific physical and mental health conditions. It is essential to provide clinicians the knowledge of therapeutically use of yoga. In the study the evidence of evaluating yoga as an effective intervention for children and adolescents with health problems is summarized.

A brief of yoga and yoga therapy is stated along with yoga resources and practical strategies which are available for children and adolescents. Study suggests benefits for using yoga as a therapeutic intervention showed adverse effects. These results are required to review and interpreted findings as many of the studies have limitations which prevent to draw the conclusions.

Whether yoga helps with weight loss which can be achieved with diet and exercise is required to study. In a study multiple databases was undertaken for peer-review meditation, mindfulness, obesity, and overweight. But studies on yoga and weight loss are challenged as small sample sizes, short durations, and lack of control groups ((Bernstein et al., 2014).

### **3.9. 3: Yoga and Diabetes:**

Yoga practices are useful in managing type 2 diabetes mellitus. Many studies have been undertaken and documented the benefits of effects of yoga in type 2 diabetics. The purpose of this study was to review studies using yoga in preventing or controlling diabetes. The inclusion were Practices of yoga asanas, pranayama, or dhyana as intervention; for diabetic patients and healthy volunteers, with insulin or glucose levels as outcomes, or individuals at risk for diabetes; also used quantitative design; and had biochemical, physiological, anthropometric, or clinical outcomes. Seventeen studies met the inclusion criteria. Out of 17 studies, 15 used yoga asanas, 12 used pranayama, and 1 each used shatkriyas (cleansing exercises) and yoga nidra (relaxation). Out of all the 11 studies that measured changes in fasting blood glucose & nine studies showed significant decrease (Sharma & Knowlden, 2012).

### **3.9.4: Yoga and Hypertension:**

Several studies have shown positive effects of yoga on hypertension. Study conducted to see change in weight status between adolescence and young adulthood was associated with the risk of developing hypertension among adolescents A higher risk of hypertension was noted for all

sex and racial/ethnic groups who became obese in adulthood (Suglia, Clark, & Gary-Webb, 2013).

### **3.9.5: Yoga and Lipid Profile:**

The efficacy of yoga in the management of hyperlipidemia and obesity is significant. In study conducted to check the effect of regular yoga practices and self-discipline in reducing body fat and elevated lipids in patients. In the study one hundred seventy participants were divided into two groups. The yoga intervention was for six months, for 35-40 minutes a day, five days in a week. Body fat testing and lipid profile were done of the both groups at pre & post in yoga group and without non-yoga group. Results have shown reduction of SBP, DBP, heart rate, body fat%, total cholesterol, triglycerides and LDL after regular yogic practices. The results indicate that yoga practices are beneficial for cardiac and hypertensive patients (Seo et al., 2012).

### **3.9.6: Yoga, Lipid Profile and Coronary Disease:**

In the study conducted to observe the effect of regular yoga practices in reducing body fat and elevated lipids in CAD patients. After yoga intervention reduction of Systolic Blood Pressure & Diastolic Blood Pressure, heart rate, reduction in body fat%, total cholesterol, triglycerides and low density lipoprotein. Therefore yoga practices are beneficial for coronary artery disease and hypertensive patients (Pal et al., 2011).

### **3.9.7: Yoga Metabolic Parameters :Uncomplicated Therapy for Obesity.**

The study was conducted to test the effect of an eight-week of yoga-asana training on body composition, lipid profile, and insulin resistance in obese adolescent boys. Twenty volunteers with body mass index greater than the 95th percentile were randomly assigned to yoga and control groups. After yoga training, body weight, BMI, fat mass, and body fat % were significantly decreased, results show that an 8-week of yoga training improves body composition and TC levels in obese adolescent boys. Yoga training may be effective in controlling some metabolic syndrome factors in obese adolescent boys (Seo et al., 2012).

### **3.9.8: Yoga for Back Pain:**

As per Tekur, Yoga is very effective for back pain. The study was to test the effects of A seven day randomized control single blind active study in an residential Holistic Health Centre in Bangalore, India, assigned 80 patients (37 female, 43 male) with CLBP to yoga and physical exercise groups. The Yoga program consisted of specific asanas and pranayamas for back pain, meditation, yogic counselling, and lectures on yoga philosophy. The control group program

included physical therapy exercises for back pain, and matching counselling and education sessions. Seven days intensive residential Yoga program reduces pain, anxiety, and depression, and improves spinal mobility in patients with CLBP more effectively than physiotherapy exercises (Tekur, Nagarathna, Chametcha, Hankey, & Nagendra, 2012).

### **3.9.9: Yoga for Personality Development:**

As per Telles, Yoga is a powerful medium for developing the personality of children and making them capable of facing the present-day challenges and problems, “Effect of Yoga on Mental Health in Children,” one of the world’s most prominent yoga researchers, Shirley Telles, concludes that yoga improves children’s physical and mental well-being. Similarly, the Harvard professor Sat BirKhalasa finds that yoga in schools helps students improve resilience, mood, and self-regulation skills pertaining to emotions and stress. Thus, yoga is an important life skill tool for children and young people to cope with stress and self-regulation in a life-long perspective. “If you practice yoga every day with perseverance, you will be able to face the turmoil of life with steadiness and maturity”(Shirley Telles, Gaur, & Balkrishna, 2009).

## **3.10 YOGA AND WEIGHT MANAGEMENT**

Yoga offers mind management and is one of the ways for slow and steady weight reduction as technique. Yoga is emphasizing on developing body awareness and physical discipline which supports the healthy dietary and exercise habits, which are affecting weight loss its management. The study conducted to determine the effect of Yoga on weight in youngster at risk for developing type-2 diabetes. The study was conducted for 20 adolescents for the duration of 12-week, *Ashtanga* Yoga program. The result showed weight loss around 2 kg. This indicates that regular Yoga practice being associated with reduced weight gain (Benavides & Caballero, 2009).

### **3.10.1: Kripalu Yoga :**

There are several possible mechanisms that might help weight loss through Yoga. Yoga improves exercise capacity and a vigorous practice for daily 60 minutes would expend sufficient energy to contribute directly to fat & weight control. Yoga makes one feel more connected to their bodies, promotes a positive body experience and sense of well-being and this might lead to reduced food consumption. A study explored the impact of a 5 day’s residential weight loss program, which was based on *Kripalu* Yoga for weight loss, and psychological

well-being in overweight/obese individuals. 37 overweight/obese program participants of age range from 32 to 65, BMI<25, baseline, post-program, and 3-month follow-up & reported their weight one year after program completion. Results showed Significant improvements, suggest a Kripalu Yoga-based, residential weight loss program may foster psychological well-being, improved nutrition behaviors, and weight loss (Braun, Park, & Conboy, 2012). Yoga helps in bringing about regularity, balance & stability through effortless discipline. Evidence quoted suggests right nostril breathing **सूर्यानुलोम विलोम प्राणायाम** increases metabolism & could be helpful for obese & reduces weight through life style.

### **3.10.2: Balanced Diet Holistic Nutrition:**

Being healthy and fit will make a great difference in anyone's life, which should inspire enough to start healthy diet habits. For weight management life style change program requires good eating habits. One needs to be aware of the facts and take responsible decisions to eat nutritious. It requires the desire to do so, strong will power, and determination helps. The study indicates the impact of diet on health, and role in obesity by saturated fats. Diet should be associated with fruit, fibre and vegetable consumption. The trend for more people, including children to become overweight is cause for concern, resulted in to increase in social costs. Study suggests that the food industry to improve access to healthy food, and help people achieve a balanced diet (Hu, 2008).

In Obesity there is an over-accumulation of subcutaneous and abdominal adipose tissue. Adipose tissue produces and releases a variety of adipokines leptin, adiponectin, resistin, and visfatin. Adipose tissue is also implicated in the development of chronic metabolic diseases such as type 2 diabetes mellitus or cardiovascular disease. Obesity is thus an underlying condition for metabolic diseases. Diet or dietary patterns play very important roles in obesity and other pathophysiological conditions (Lee, Lee, & Choue, 2013).

The food is what we eat is causes overweight and obesity problems. Food is vital for health & it's important to know what to eat, when to eat & under what circumstances, one should eat. Foods have a large number of calories but fruits and vegetables have low energy density. At adolsest age eating a three or four course meal using low density foods with variety and good nutrition satisfies the appetite. Consume less calories food and feel better. In one study of Overweight and obesity in children in Mexico was the highest prevalence's in the world. The intervention in study showed that intervention is effective in maintaining the BMI of school

children to help to solve the growth of public health problem. The aim of this study was to assess the effectiveness of a nutrition and physical activity strategy, called "Nutrition on the Go" in maintaining the BMI values of school children. : A two-stage cluster trial was carried out. Sixty schools were selected in the State of Mexico, of which 30 were randomly assigned to the intervention group and 30 to the control group. The intervention strategy aimed to decrease the energy content of school breakfasts and include fruits and vegetables, as well as increase physical activity and the consumption of water during the time spent at school. The intervention was implemented for 6-month period. The intervention is effective in maintaining the BMI of school children (Shamah Levy et al., 2012).

### **3.10.3: Effect of Food and Diet on Mind:**

The effect of food and diet on mind is well explained in ancient literature. Foods have been classified into three major types i.e., Sāttvik, Rājasik and Tāmasik foods. Sāttvik food makes man pure and happy, gives vitality and strength to build the body and promotes positive health. This includes simple vegetarian diet containing sufficient proportions of nutrients with fewer fats. Eat fresh cooked served with a good hospitality. The concept of moderation in quantity and quality is most important. Rājasik foods increase the stress & are those which excite the mind and prepare the system for fight or flight. Excessive spice, bitter, sour, pungent, salty, steaming hot foods which take away a lot of energy for digestion itself and also stimulate the mind leading to distress and unhappiness are considered. Rājasik. Stimulating drinks like coffee and tea also come under this category. Tāmasik foods are those that make one dull, lazy, heavy and unable to think clearly and lead to ill health.

*(Bhagavadgītā 14/8)*. Research confirms that due to western sedentary life style, the next generations can be affected with unhealthy genes which will increase the risk of life style disorder diseases like obesity, diabetic. So change in eating style is only solutions. If we change, next generation can be benefitted by healthy genes keeping them healthy and fit and will reduce economic burden.



**FIGURE - 4**

**FLOW CHART OF HYPOTHESIS**

