A Study on Several Aspects of Obesity

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***ABSTRACT:** Obesity is caused by a complex interaction of environmental and genetic variables, and it is linked to high morbidity and death rates. Obesity has a number of negative health consequences, including metabolic syndrome, cardiovascular disease, diabetes, cancer, and high blood pressure. Obesity causes a build-up of metabolic and physical stress, which has negative health implications. Obesity is also defined by a large quantity of bodily fat, often known as adipose tissue. Obesity causes aberrant alterations in secretory factors/adipokines produced from these adipose tissues, resulting in a range of inflammatory diseases. Understanding the genetics of obesity will progressively assist in medication development and improved therapeutic targeting to individual patients, as inherited genetic variation is a major risk factor for obesity. This article discusses the variables that contribute to obesity, how to measure obesity, and the importance of recognising its prevalence. Topics such as therapy and creating successful pharmaceutical methods are also covered.*

***KEYWORDS:** Body Mass Index (BMI), Fat, Health, Obesity, Overweight.*

1. INTRODUCTION

The World Health Organization has identified overweight and obesity as a worldwide problem (WHO). The "New World Syndrome" is another name for it. Obesity has grown from 12–20 percent in males and 16–25 percent in women during the previous 10 years, according to statistics. Obesity is a diverse set of diseases with various causes, each of which manifests as an obese phenotype at the end of the day. The combination of genetic, environmental, and psychosocial variables working through the physiological mediators of energy intake and expenditure determines body weight [1].

Obesity is commonly defined as a disorder characterised by abnormal or excessive fat build up in adipose tissue to the point that one's health is jeopardised. It is also a chronic and stigmatising medical disease that, because to its great prevalence, causative connection with significant medical conditions, and economic effect, has become a major health concern in most developed nations. In comparison to Europeans, Indian Asians have a higher prevalence of metabolic syndrome, which appears to be highly heritable. The body mass index (BMI) has been proven to be a measure of weight (for height) rather than body fat. Obesity-related poor health is connected to excess fat rather than excess weight [2].

Furthermore, because BMI does not indicate where fat is placed, and because intra-abdominal fat is considered to be more likely to cause illness than fat deposited9 in other regions of the body, waist circumference (WC) has been used as a clear indicator of obesity. Obesity is a 21st-century epidemic that is a key contributor to a variety of metabolic diseases. National programmes for public awareness, education, and enhanced structural facilities should be implemented to promote a healthy lifestyle and, as a result, become the keys to reducing the economic and health-care costs associated with obesity-related diseases [3].

Obesity may be described as a condition of imbalance between calories consumed and calories expended that results in excessive or abnormal fat build up. The Body Mass Index (BMI) is a weight-for-height measurement that measures total body fat and is the most widely used metric for determining obesity [4].

BMI = Weight of an individual (in kg) /Height (m^2)

Optimal BMI increases with age. WHO also classified over weight according to BMI. There is a very good correlation between BMI and the percentage of body fat in large populations.

1.1 Hormones and Obesity:

Obesity is connected to a variety of metabolic diseases, thus its progression can result in changes in metabolic and hormonal circumstances, as well as the storage of extra energy in various forms in the human body. In Asian Indians, BMI is not regarded a useful predictor of obesity because they have a distinct obesity phenotype, with a lower BMI but central obesity. It has been proposed that fat in the abdominal area, particularly visceral fat, is more metabolically essential than fat in other locations. As a result, abdominal adiposity as measured by waist circumference is thought to be a better predictor of metabolic problems than generalised adiposity. The inflammatory response that appears to be activated in the presence of obesity appears to be triggered in adipose tissue as well as other metabolically important sites that may be implicated

during the course of any metabolic diseases23. Adipose tissue is now recognised as an endocrine organ that secretes a variety of hormones, growth factors, matrix proteins, enzymes, cytokines, and complement factors that have a variety of local and systemic effects[5].

1.2 Genetics and Obesity:

Obesity is caused by a combination of environmental (overeating or reduced physical activity, or both) and genetic causes. Obesity is defined as a collection of polymorphisms found in genes and candidate areas across the genome that control an individual's susceptibility to weight gain in a permissive environment. Obesity has been linked to a number of hereditary disorders. Patients with 20-30 Mendelian diseases are clinically obese, but they are also marked by mental retardation, dysmorphic traits, and organ-specific developmental defects. Syndromic obesity is the term used to describe such situations. These syndromes are autosomal and X-linked diseases that are caused by distinct genetic flaws or chromosomal abnormalities. Prader-Willi syndrome (PWS) and Bardet-Biedl syndrome (BBS) are the most well-known diseases, although many others have been reported. Numerous epidemiological research in vast and diverse groups (twins raised together or separately, adopted children, nuclear families, and so on) have concluded that family obesity is caused by hereditary factors rather than environmental variables. Because genetic predisposition exists, the impact of the environment on the development of overweight or obesity would be minimal. These findings highlight the significance of identifying at-risk households in order to reduce present and future childhood obesity[6].

The genetic factors associated to obesity are depicted as follows:

a)　Single mutations contribute to the development of obesity (monogenic obesity). These forms of obesity are rare, very severe and generally start in childhood.
b)　b) Polygenic obesity, in which several genetic variations interact with the environment to cause obesity in the general population. The risk of common obesity might be attributed to a vast number of loci, each having numerous disease-causing alleles but low frequency. The examination of changes in genomic DNA (genetic polymorphism or SNP, Single Nucleotide Polymorphism) located within or near potential genes is used in the genetic research of common obesity.

1.3 Prevention of Obesity:

Obesity is a significant, long-term medical problem that is linked to a variety of disabling and life-threatening illnesses. Obesity prevalence continues to rise at an alarming rate in nearly every part of the world, which is cause for serious worry. As a result, successful obesity control necessitates the creation of cogent methods that address the key challenges associated with preventing:

i)　The development of overweight in normal weight individuals
ii)　The progression of overweight to obesity in those who are already over weight
iii)　Weight regain in those who have been overweight or obese in the past but who have since lost weight
iv)　Further worsening of a condition already established.

Obesity prevention requires intervention at many levels: I primary, ii) secondary, and iii) tertiary. Primary prevention aims to minimise the number of new cases, secondary prevention aims to reduce the rate of established cases in the community, and tertiary prevention aims to stabilise or lessen the severity of the disorder's impairment. When it comes to multi-factorial conditions like coronary heart disease (CHD), primary prevention entails national programmes to control blood cholesterol levels, secondary prevention entails lowering CHD risk in those who already have high blood cholesterol levels, and tertiary prevention entails preventing re-infarction in those who have already had a heart attack. This categorization method for obesity prevention, on the other hand, creates a lot of uncertainty and misunderstanding. The US Institute of Medicine has recommended an alternate system categorization to prevent this. The new method divides preventive efforts into three categories. Measures that are universal (or public health) in nature (directed at everyone in the population), selective (for a subset of people who have a higher than average risk of becoming obese), and indicated (targeted at high risk individuals who may have a detectable amount of excess weight which fore-shadows obesity). However, while preventative interventions for any illness may not be effective in all situations, correct management techniques can be included into the mix [7].

1.4 Management of obesity:

Weight control or lowering excess body weight and sustaining that weight reduction, as well as beginning additional actions to decrease related risk factors, are all part of the management process. Obesity should be evaluated on a regular basis using BMI, waist circumference, and other measures to determine risk factors. Treatment options might be given based on the results of the examination. Dietary changes, increased

physical activity, behavioural counselling, and, in certain cases, weight reduction medication and surgery are all options for treatment.

1.4.1 Dietary therapy:

In all situations except pregnancy, breastfeeding, terminal disease, anorexia nervosa, cholelithiasis, and osteoporosis, calorie restrictions are the first line of treatment. Low-calorie diets (LCD), which offer 100–1500 kcal/day, resulted in a weight reduction of 8% of baseline body weight over six months, although most of the weight lost is recovered in the long term. Under proper medical supervision, very low calorie diets (VLCD) of 300–800 kcal/day can be beneficial in extremely obese people. They are shown to generate a 13 percent weight reduction over six months, indicating that they provide more early weight loss than LCDs; but, long-term (>1 year) weight loss by VLCDs is not proven to be superior to LCD. Meal replacement programmes and formula diets are both successful weight-loss strategies. Physicians or hospitals can prescribe Optifast or Medifast as part of a bundled weight-loss regimen. These products appear to be safe, but long-term weight loss is difficult to achieve.

1.4.2 Physical activity:

Regular exercise is beneficial to everyone. Physical exercise, which boosts energy expenditure, helps obese people lose weight and maintain a healthy energy balance. Various exercises, preceded and followed by brief warm-up and cool-down sessions, aid in the reduction of belly fat and the preservation of muscle mass. Patients who exercised frequently had improved cardio vascular fitness as well as improved mental and emotional health, according to studies. As a result, as part of complete weight reduction therapy, a minimum of 30 minutes of exercise is suggested for persons of all ages.

1.4.3 Behaviour therapy:

When used in conjunction with other weight-loss and weight-maintenance treatments, behavioural therapy can be very effective. Patients must be taught how to regulate their eating habits on their own. Individual or group counselling of patients is included in behaviour modification programmes that aim to remove inappropriate eating behaviours (eating while watching TV, eating too quickly, eating when not hungry, etc.). Self-help organisations (weight watchers, Nutri-System) employ a diet, education, and self-monitoring programme that includes things like keeping a logbook, keeping track of food consumption, and so on.

1.4.4 Pharmacotherapy:

Only patients with a BMI > 27 and accompanying risk factors, or with a BMI > 30 and so at medical risk due to their obesity, are encouraged to take medication. It should not be used to lose weight for "cosmetic" reasons. Weight reduction medicines should only be used as a supplement to a healthy diet and regular exercise, as well as a behavioural therapy and nutritional counselling programme.

1.4.5 Pharmacological approaches in obesity treatment:

The majority of weight-loss medicines on the market are "appetite–suppressant" treatments. Amphetamine, metamphetamine, and phenmetrazine (Preludin) were the first medicines used to reduce appetite, but they are no longer used in the treatment of obesity due to their significant potential for misuse. Fenfluramine and dexfenfluramine, which inhibit 5-hyroxytryptamine (5-HT) reuptake, were approved for obesity treatment but were shown to induce pulmonary hypertension and increased valvular heart disease and were pulled from the market. Drugs like phendimetrazine (Plegine), diethylpropion (Tenuate), and phentermine (Lonamin) are on the market, however they are classed as restricted drugs and should only be used for a brief period of time.

1.4.6 Surgical treatment:

Surgery is recommended in addition to medication therapy when the BMI is extremely high (>40 kg/m2 or >30 kg/m2 with obesity-related medical co-morbidities) and other treatment options have failed [66]. Gastric portioning or gastroplasty, as well as gastric bypass, are the most common surgical techniques used to treat extreme obesity. Gastroplasty creates a tiny gastric pouch that is emptied by a narrow calibrated stoma. As a result, solids consumption is severely restricted. Bypassing the duodenum, gastric by-pass surgery generates a bigger pouch that is emptied into the jejunum via an anastomosis. It is currently widely regarded as the safest and most successful surgery for morbid obesity. Weight reduction is achieved by combining a low-calorie diet with a moderate degree of malabsorption. The initial weight loss after this operation is higher than after gastroplasty. The operation may have significant consequences in terms of gastric and nutritional problems. Surgical procedures are commonly linked to nutritional deficits and persistent vomiting. Most co-

morbidities of extreme obesity, such as hypertension, serum cholesterol levels and diabetes mellitus, are resolved by surgical therapies for obesity.

1.5 Obesity-associated diseases and risk factors:
1.5.1 Cardiovascular diseases (CVD):

Women with a BMI of 25–28.9 kg/m2 had a 2-fold increased risk of CVD, while women with a BMI of 29 kg/m2 or more have a 3.6-fold greater risk. In men, a ten percent increase in body weight raises the risk of CVD by 38 percent, whereas a twenty percent rise in weight raises the risk by 86 percent. Blood pressure rises by 6 mm systole and 4 mm diastole, resulting in a 10% increase in body fat. Obese individuals have 2.9 times the rate of non-obese adults in terms of hypertension, and losing weight lowers the chance of getting hypertension.

1.5.2 Respiratory diseases:

Obesity has a multitude of negative effects on pulmonary function. Increased fat in the chest wall and belly reduces lung capacity by limiting respiratory excursion. As obesity develops, so do apnoeic episodes, which cause frequent awakenings and sleep loss, culminating in daytime somnolence.

1.5.3 Metabolic disorders:

Increased BMI has a continuous graded association with the incidence of NIDDM and insulin resistance. Obesity affects 10 to 15 million Americans with type 2 diabetes. A 7 percent weight decrease reduces the chance of getting type 2 diabetes by more than 55 percent. In women, a BMI of 35 kg/m2 raises the risk by 93 times, while in males, it rises by 42 times. Obesity is linked to lipid diseases, which are marked by increased cholesterol, triglycerides, LDL-cholesterol, and low HDL-cholesterol levels. There is a commensurate drop of around 1% in HDL and a 3% reduction in triglycerides for every 1 kg of weight loss. Small weight reduction has been shown to decrease lipid abnormalities [30] and diabetes mellitus.

2. LITERATURE REVIEW

Srinivas Nammi et al. discussed overview on obesity's current perspectives and treatment options in which they discussed how Obesity is a multi-factorial condition that is frequently linked to a number of other serious illnesses, including diabetes, hypertension, and other cardiovascular disorders, osteoarthritis, and some malignancies. Obesity management will thus necessitate a wide range of interventions aimed at both individuals who already have weight problems and those who are at high risk of becoming obese. As a result, childhood obesity prevention should be prioritised, as there is a danger of obesity persisting into adulthood. This article discusses numerous obesity prevention and treatment options, with a focus on the most recent study findings [8].

Anand Anbarasu discussed obesity in which he explained how Obesity is caused by a complex interaction of environmental and genetic variables, and it is linked to high morbidity and death rates. Obesity has a number of negative health consequences, including metabolic syndrome, cardiovascular disease, diabetes, cancer, and high blood pressure. Obesity causes a build-up of metabolic and physical stress, which has negative health implications. Obesity is also defined by a large quantity of bodily fat, often known as adipose tissue. Obesity causes aberrant alterations in secretory factors/adipokines produced from these adipose tissues, resulting in a range of inflammatory diseases. Understanding the genetics of obesity will progressively assist in medication development and improved therapeutic targeting to individual patients, as inherited genetic variation is a major risk factor for obesity. This article discusses the variables that contribute to obesity, how to measure obesity, and the importance of recognising its prevalence. Topics such as therapy and creating successful pharmaceutical methods are also covered[9].

G. A. Bray et al discussed that the science of obesity management in which they discussed how Obesity, as measured by BMI, has reached dangerously high levels in both men and women in the United States and across the world, with serious health consequences. Obesity is influenced by genetic, environmental, and behavioural variables, and people who suffer from it are stigmatised by both the general public and health experts. Obesity has been linked to and contributes to a shorter life span, type 2 diabetes, cardiovascular disease, certain malignancies, renal disease, obstructive sleep apnea, gout, osteoarthritis, and hepatobiliary disease, to name a few. All of these illnesses are reduced by weight reduction in a dose-dependent manner— the more weight removed, the better the outcome. The phenotype of "medically healthy obesity" appears to be a transitory condition that leads to an unhealthy phenotype over time, particularly in children and adolescents. Reduced calorie intake and increased energy expenditure are the greatest ways to lose weight. Peer-reviewed and approved lifestyle modification programmes, diets, commercial weight-loss programmes,

exercise programmes, medicines, and surgery are all beneficial for weight loss. There is little data, if any, on the efficacy or safety of over-the-counter herbal medicines that some patients take to treat obesity, and there are minimal regulatory requirements. Weight gain is common in all patients, particularly when therapy is stopped. In addition to BMI, physicians should evaluate body fat distribution and individual health concerns while making treatment recommendations[10].

3. DISCUSSION

Obesity and its accompanying comorbidities are on the rise in both children and adults across the world. The role of adipose tissue as an active participant in controlling the body's physiologic and pathologic processes has seen a dramatic increase in research as epidemiologic evidence of the rising burden of obesity and associated pathologies has led to a dramatic increase in research on the role of adipose tissue as an active participant in controlling the body's physiologic and pathologic processes. Adipose tissue is now thought to function as an active secretory organ, transmitting and receiving signals that control hunger, energy expenditure, and insulin sensitivity, the endocrine and reproductive systems, bone metabolism, inflammation, and immunity. Obesity inheritance patterns also point to a complicated mechanism of inheritance involving several genes. Linkage studies are the most effective means of mapping genes with unexpected effects on the obesity phenotype, and this work will improve the power and simplify replication of current linkages in the future. Pharmacological anti-obesity medications that limit food intake, enhance energy expenditure, and pharmaceuticals that impact nutritional partitioning or metabolism have also been evaluated. All of these pharmaceutical treatments have the potential to be effective, but they all have major drawbacks. To address this restriction, the quest for new drugs for the treatment of juvenile and teenage obesity is both laudable and essential. The goal of universal obesity prevention is to maintain the population's level of obesity, minimise the incidence of new cases, and, eventually, diminish the prevalence of obesity.

4. CONCLUSION

Obesity is not a societal problem; it is a sickness that is spreading rapidly. Obesity cannot be seen only as a result of overeating and a lack of willpower; it must be recognised as a significant hereditary aetiology changed by the environment, and it must be treated aggressively in the same way that other diseases are currently. Obesity is commonly defined as a disorder characterised by abnormal or excessive fat build up in adipose tissue to the point that one's health is jeopardised. It is also a chronic and stigmatising medical disease that, because to its great prevalence, causative connection with significant medical conditions, and economic effect, has become a major health concern in most developed nations. A greater knowledge of the aetiological factors in individual patients will lay the groundwork for more reasonable action to address this stubborn public health issue. With increased awareness and continuous research in this field, there is cause to be optimistic that improved therapy for obese people will be available in the future years.

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