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THE BURDEN OF OBESITY: UNDERSTANDING THE COMPLEXITIES AND CONSEQUENCES OBESITY AND TREATMENT

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ABSTRACT

Obesity, characterized by abnormal accumulation of adipose tissue, poses a significant threat to global health, increasing the risk of cardiovascular disease, type 2 diabetes, hypertension, and hyperlipidemia. With a marked rise in prevalence over the past five decades, obesity has become a major public health challenge, ranking as the second most common preventable cause of death after smoking. The multifaceted causes of obesity necessitate a comprehensive, long-term approach to treatment. Achieving a modest 5-10% body weight reduction can lead to substantial improvements in individual health, quality of life, and economic impact, benefiting both personal and national healthcare systems. This highlights the need for a deeper understanding of obesity's complexities and consequences, as well as the development of effective strategies for prevention, treatment, and management.

Keywords: Obesity, Hyperlipidemia, Calories, Diet

INTRODUCTION:

Obesity is characterized by an abnormal or excessive accumulation of fat, or adipose tissue, in the body. This condition is linked to a heightened risk of developing various health issues, including cardiovascular disease, type 2 diabetes, hypertension, and

hyperlipidemia. As a significant public health challenge, the prevalence of obesity has increased markedly over the past five decades. The causes of obesity are complex and multifactorial, and it ranks as the second most common preventable cause of death, following smoking. Effective obesity treatment requires a comprehensive, long-term approach. Achieving a modest reduction in body weight, approximately five to ten percent, can lead to substantial improvements in individual health, quality of life, and economic impact, benefiting both personal and national healthcare systems **[1-5]**.

Manifestations of Obesity in Adults:

According to the American Medical Association, obesity is a disease in and of itself that requires diagnosis and treatment **[6]**.

Most common manifestations of Obesity in Adults include **[7]:**

- Excessive body fat in general, around the waist in particular.
- SOB
- Over profuse sweating
- Night snoring
- Difficulty in sleep pattern
- Dermatological issues, majorly skin folds and breaks
- Difficulty in performing daily simple activities
- Mild to extreme Fatigue **[8]**
- Arthralgia
- Socio-psychological issues like depression, lack of self-esteem, isolation **[9]**.

Manifestations of Obesity in Children:

According to the CDC, in the past 50 years, the prevalence of childhood obesity in the US has tripled **[10]**. Nearly 20% of American toddlers and teenagers (ages 2 to 19) were anticipated to be obese in 2020 **[11]**.

Most common manifestations of Obesity in children include**: [12]**

- Fatty tissue accumulation (in breast region majorly)
- Stretch marks on hips and back region
- Acanthosis nigricans (darkish velvety skin around the neck and other regions of the body)
- SOB during physical activities
- Obstructive sleep apnea (OSA)
- Constipation
- GERD (Gastro-oesophageal Reflux disorder)
- Poor self-esteem amongst peers
- Early puberty in Females and Delayed puberty in males due to hormonal imbalances
- Flat feet, dislocated hips etc

The prevalence of childhood obesity varies throughout populations.

Childhood Obesity Rate	
Asian	9%
White	16.6%

Childhood Obesity Rate	
Black	24.8%
Hispanic	26.2%

Manifestations of Morbid Obesity:

The prevalence of morbid obesity is rising, especially in the United States and other developed nations.

If a person weighs more than 100 pounds over their ideal weight and has a BMI of 40 or more, they may be diagnosed with morbid obesity.

• If an individual has type 2 diabetes, high blood pressure, and a BMI of 35. Excessive obesity or category III obesity are other names for morbid obesity. It may become difficult for the person to breathe and walk. It raises the risk of many serious health conditions **[13]**.

Aetiology of Obesity:

There are numerous things that might contribute to or cause obesity in an individual.

Genetic disorders: Children who have rare genetic disorders may gain weight quickly. These diseases are brought on by genes that are important regulators of hunger and energy expenditure.

The following conditions and their consequences include:

• Obesity due to insufficient pro-opio melanocortin (POMC): signs and symptoms include early onset obesity, hormonal problems, and extreme appetite (hyperphagia) starting in infancy.

• Hypo gonado tropic hypogonadism (when the testicles or ovaries release little to no sex hormones), hyperphagia, and chronic early-onset obesity are the hallmarks of leptin receptor (LEPR) deficient obesity.

• Bardet-Biedl syndrome (BBS): This condition is marked by hyperphagia, early onset obesity, visual impairment, polydactyly (an extra finger or toe), and renal complications.

Socio-economic and Lifestyle Factors:

These can be risk factors for obesity. They are **[14]**

- Inadequate physical exercise
- Poor sleep patterns
- Unhealthy diet habits
- Stress-full lifestyle

Some Medical disorders or Health conditions may precipitate Obesity. They include:

- Hypothyroidism
- Pregnancy
- PCOS (Poly Cystic Ovarian Syndrome)
- Cushing's syndrome
- Metabolic syndrome
- Prader-Will syndrome

Some Medical disorders or Health conditions may precipitate Obesity. They include:

- Anti-psychotics
- Beta-blockers
- OCP's
- Insulin analogues

- Glucocorticoids
- Anti-depressants

Obesity-Associated Complications:

Type-2 Diabetes Mellitus:

As the risk of type 2 diabetes rises with body mass index, "diabesity" refers to the epidemic of obesity and T2DM that has coexisted over the past few decades. A BMI of 30-35 kg/m2 was linked to a five-fold increased risk of type 2 diabetes (T2DM), while a BMI of 40–45 km/m^2 was linked to a 12-fold increased risk, according to a large population study including 2.8 million citizens of UK between the year 2000 and 2018 **[15] [16]**.

Cardio-Vascular Disorders:

Every year, CVD is responsible for deaths of around 17.9 million individuals, making up 31% of all the global fatalities. Globally, ischaemic heart disease and stroke stood as the two pioneer causes of death.**[17]**

Stroke:

The link between obesity and ischemic stroke is mediated by conventional modifiable risk factors for cardiovascular disease as well as specific mechanisms tied to increased levels of proinflammatory cytokines, lower adiponectin levels, and a prothrombotic state, which includes hyperfibrinogenemia and elevated blood viscosity. These factors collectively worsen atherosclerosis and impair endothelial cell function, further increasing stroke risk **[18], [19]**.

Gastro-Intestinal complications:

Obesity leads to a wide number of hepatobiliaryand gastrointestinal complications, many of which are prevalent and are likely to manifest priortocardiometabolic illnesses **[20]**. Thus, a standard procedure for early weight loss intervention in individuals with gastrointestinal and hepatobiliary diseases should be screening for obesity.

Cancer:

In the UK, obesity ranks as the second most avoidable cause of cancer after smoking, and keeping a normal weight might avert 22,800 cases per year.**[21]** BMI was linked to 17 malignancies, according to a population-based prospective cohort study that used data from 5.24 million persons in the UK **[22] [23]**.

Obesity associated cognition:

Cardiovascular risk factors, which augment the risk of posing Alzheimer's disease and dementia, include hypertension, dyslipidaemia, and type 2 diabetes **[24]**.

Genito-urinary complications:

Obesity is a vital preventable risk factor for the development CKD as it has been associated with primary CKD risk factors like hypertension and diabetes mellitus **[25]**.

Muscular-Skeletal related complications:

Obesity is well-established risk factor for the onset and advancement of osteoarthritis in

weight-bearing joints, particularly the knee, is obesity **[26] [27]**.

Gout:

Serum uric acid levels are high in both gout and obesity, and weight loss is linked to a lower prevalence of hyperuricaemia and gout attacks **[28]**.

Therapeutic Approach

Anti-Obesity Medications:

Table 1: FDA Approved Anti-Obesity medications

Brand Name/Trade Name	Approved Year	Mode of Action	Average placebo-subtracted weight loss (%)	Achieved ≥5% Weight Loss, Intervention vs. placebo (%)
*Drugs approved for Short-term usage**				
Phentermine (Adipex, Lomaira) [29]	1959	Sympathomimetic / Appetite suppressor	4.4 at 28 weeks	49 vs. 16.0 at 28 weeks
Diethylpropion[30]	1979	Sympathomimetic / Appetite suppressor	6.6 at a period of 6 months	67.6 vs. 25
*Drugs approved for Long-term usage**				
Orlistat (Alli, Xenical) [31]	1999	Intestinal lipase inhibitor / Fat absorption minimizer upto 30%	3.8	50.5 vs. 30.7
Phentermine-topiramate (Qsymia) [32]	2012	Combination sympathomimetic and carbonic anhydrase inhibitor / Appetite and craving suppressor	8.6	70 vs. 21
Bupropion-naltrexone (Contrave) [33]	2014	Combination of a dopamine and norepinephrine re-uptake inhibitor and mu-opioid receptor antagonist / Appetite and craving suppressor	4.8	48 vs. 16
Liraglutide 3.0mg (Saxenda) [34]	2014	GLP-1 receptor agonist / Satiety enhance, Appetite suppressor	5.4	63.2 vs. 27.1
Gelesis100 (Plenity) [35]	2019	Superabsorbent hydrogel particles of a cellulose-citric acid matrix / satiety enhancer. It is considered a medical device but functions as a medication.	2.0 at period of 6 months	58.6 vs. 42.2
Tirzepatide (Zepbound) [35]	2023	GLP-1 and GIP receptor agonist/ Satiety enhance, Appetite suppressor	17.8	91 vs. 35

Bariatric surgery:

Bariatric surgery is the therapy of choice when all other therapies have failed. When compared to non-surgical therapies, bariatric surgery has superior results on weight loss and related co-morbidities despite the type of procedure used **[36]**.

Dietary Therapy:

Net calorie deficit intake (energy units) of kilocalories can reduce obesity. An adult's estimated energy requirement is 22 kcal per Kg of body weight **[37]**. There are several ways to reduce intake in order to create a net energy deficit, some of which are enlisted below.

Table 2: An Overview of Dietary interventions for weight-loss programme

Type of the Diet	Major Principle	Mode of action	Other Alternatives
Low calories diet	800-1600kcal/day	Negative energy balance	Cambridge diet Weight Watchers Nutrisystems diet Intermittent Fasting Biggest Loser SlimFast Jenny Craig
Very low calories diet	200-800kcal/day		
Low calories diet meal replacement	Pre-cooked low calories meals		
Low fat diet	Fat accounts for <30% of energy intake	Negative energy balance achieved by reduction of dietary fat	Learn Ornish rosemary Conley
High protein diet	Protein accounts for >30%ofenergy consumptions	Reduced passive overconsumption of other macronutrients because of increased fullness leads to a lower energy balance.	

Intake of Macro-nutrient composition:

Since fat is the macronutrient with the highest calorie density, easiest absorption rate, and least satiating effect, it is the most desirable target for weight loss interventions. When compared to baseline intake (-5.41 kg), a recent meta-analysis of low-fat diets reveals considerable weight loss; however, this effect is not seen when comparing low-fat diets to other dietary interventions, such as high-fat diets **[38]**.

Calorie Restriction:

Actively cutting calories is another way to create a net energy deficit. Diets classified as low or very low calorie (LCD and VLCD) limit daily energy intake to approximately 800 kcal and 1600 kcal, respectively **[39]**.

Modification of Dietary styles:

Originating in the olive-growing regions of the Mediterranean, the Mediterranean-style diet (MSD) is regionally specific. A diet rich in fruits, vegetables, and grains, moderate in fat (mostly from monounsaturated fats) and dairy (mainly from cheese), and low in meat (preferring fish and chicken over red meat) are some of the basic tenants. This is less restrictive than other diets and can lead to significant weight loss (-4.1 kg to -10.1 kg over 12 months) as well as favourable effects on a number of cardiovascular risk factors **[40]**.

Diet Modification:

Restricting calories continues to be the most common strategy for weight loss, independent of the macronutrient makeup, despite the lack of a clear dominant diet as of yet. This is dependent on following the diet, especially since the advantages of diets on weight loss eventually plateau as a result of corrective adaptation. Treating obesity is encouraged by the most recent National

Institute of Health and Care Excellence (NICE) guidelines **[41]**.

• Suggests diet that uses less energy than it produces.

To accomplish long-term weight loss, experts urge.

• A 600 kcal/day (via LCD or LFD) deficit combined with close monitoring

• Optimize LCD intake to 800-1600 kcal/day while keeping nutritional balance.

• Diets containing 200–800 kcal per day are not advised unless they are clinically required for rapid weight loss.

Challenges in tackling Obesity:

Due to its complicated aetiology, obesity necessitates a multimodal approach to both population-wide prevention and individual treatment.**[42]**The social ecology model serves as a framework to explore the human and environmental factors that contribute to obesity and to help develop interventions **[43]**. In fact, collaboration and input from diversified of entities, including the policymakers, government bodies, legislative bodies, autonomic bodies, and other departments under the roof of healthcare system, are essential for primary as well as secondary obesity prevention. An overview of a few interventions that have been used in various nations is shown in Figure:1**,** which shows where they stand on a modified social ecology model. Till date, No nation has yet adopted and successfully implemented a sustainable population-level strategy to curb the rising prevalence of obesity **[44]**.

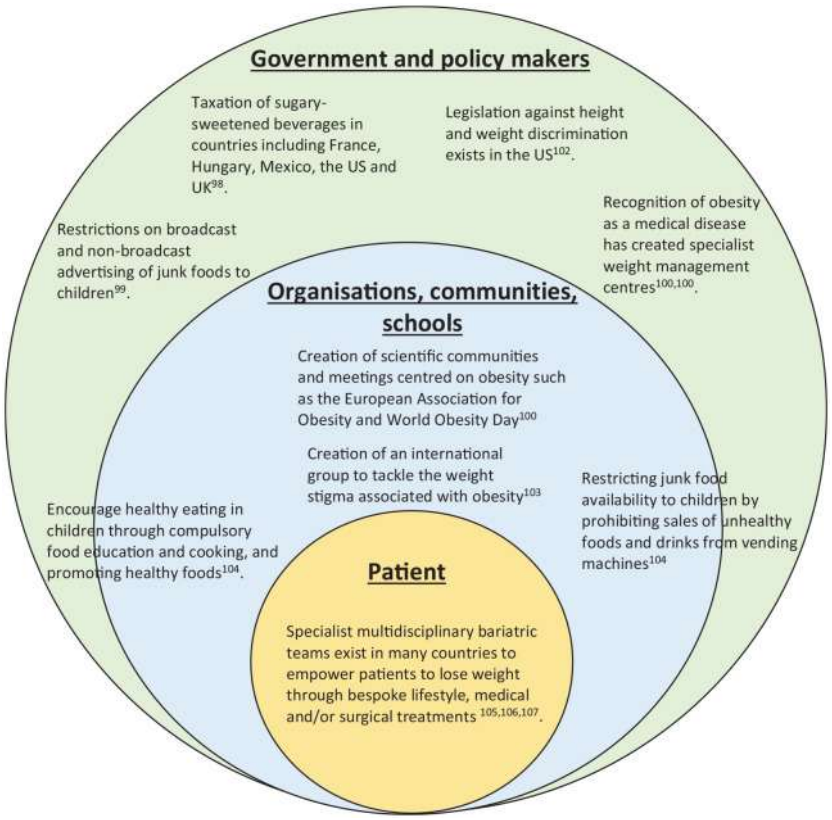

Figure 1: https://www.researchgate.net/figure/Examples-of-selected-interventions-used-by-different-countries-to-prevent-and-treat_fig1_342359235

Final Conclusion:

The risk of the most prominent non-communicable chronic conditions of the 21st century is increased by obesity, a multisystem illness **[45, 46]**. People have begun to become obese at an earlier age, and this means that they will probably experience morbidity for a longer period of time **[47-49]**. Clinicians will find this difficult since, in the absence of prompt care, the disease load and symptoms associated with multi-organ impairment may become everlasting. Prompt treatments to prevent morbidity and the related healthcare and financial costs must prioritise the early identification of obese persons by basic anthropometric measurements. It takes a whole systems approach to combat obesity.

Governments and policymakers, possess the authority to change the food environment by regulations, levies, and restrictions on adult access to processed foods high in calorie intake.

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