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Obesity and weight gain causes and treatment: A Review

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Abstract

Obesity is popular, and is severe is associated with Many health issues like different types of cancer. The imbalance Comes up against eating food and spending energy, and it is powerful Genetic factors are affected. Losing weight has many Health benefits except for many diseases linked to obesity, such as cancer, the effect of Treating obesity has not been Cleared. Regrettably, Lost weight is difficult to maintain In certain cases, and managing obesity is not enough today. Fatty tissue and the digestive system Present important parts in regulating the entire energy balance of the body, and rehabilitation goals for obesity treatment can found inside these locations. Also, all members shall be responsible for mitigating the negative effects of obesity. Visceral fatty adipose, that is, the fat all over the intestine, are given special attention because it is extremely dangerous.

Keywords: Obesity; Metabolism; Overweight; Treatment

1. Introduction

Obesity is a chronic metabolic disease that increases body fat stores. It is a portal To ill health, and not only has it been one of the leading causes of disability and death expected for Adults but also kids and teens around the world, Obesity is a reality peak cancer hazard factor, Cardiovascular Illness, metabolism, and respiratory system [1]. Obesity worldwide As of 1975, it has almost tripled. lives in countries where over weight and obese people are killed more than underweight people. 40 million children under five were overweight or obese in 2018 [2]. Obesity has been widely known to increase body fat mass. Reliable amounts of the fat mass require complex tools that are not widely available (for example, Measurement of MRI or dual-energy X-ray absorption), which has hindered attempts to achieve a more precise concept. The highest concept of obesity, as it happens, is the body mass index (BMI), Expresses body weight (in kilograms) as an alternative indicator of body obesity as a result of body height (in meters) [3,4]. The BMI is the most useful indicator of the overweight and obesity level of the population as it is for adults of all sexes and all ages. However, this can be considered an informal guide because it does not contribute to the same degree and obesity in different individuals. [4]. The World Health Organization and the National Heart, Lung, and Blood Institute define gain in weight as a body index is equal to or exceeding 25 kg / m² and obesity as a body mass index Equivalent or exceeding 30 kg per m²[5, 6]. BMI standards are slightly different for Asia and for Oceania. The World Health Organization describes weight gain and obesity as having a BMI greater than overweight or equal to 30. For children, age must be taken into account when determining overweight and obesity. Excess weight is more than height than two standard deviations above the average WHO standards for child development; obesity is a weight versus height greater than 3 standard deviations above the median of a child's growth standards in WHO [4]. The prevalence of overweight and obesity among children and adolescents between the ages of 5 and 19 achieved significantly from only 4% in 1975, but just over 18% in 2016. The change was right between males and females: 18% of females and 19% of males were 2016 overweight [7].

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They use the problem of growing obesity with multiple diseases, including an increased risk of diabetes that causes blood pressure, Sleep apnea, heart disease and cancer. Obesity increase's handicap, decrease sufficiency, and shortens life expectancy. Such teachings are not successful in reducing obesity and increasing weight loss, while much emphasis is placed on diet and exercise. What's more, pharmacological development methods to treat obesity has faced weak effectiveness and serious side effects [8].

2. Epidemic of obesity

In several parts of the world obesity prevalence is high. Overall there is a increasing increase in the prevalence of obesity in adults with age. The average prevalence in most developed countries is about 50 to 60 years, and in many developing countries earlier at about 40 to 50 years [9]. The lack of a widely agreed standard definition and measurement of human obesity could be different epidemiological reports across countries with childhood obesity levels. Experience, Nation comparisons are arduous [10,11] In childhood and adolescence both body structure and body mass index change with age, Which may constitute an index of body mass for assessing overweight and obesity in adults but cannot be direct to children and adolescents [12]; Increased public health issues and economic consequences with the rise of the obesity epidemic. [13].

In 2008, an estimated 1.46 billion adults (1.41-1.51 billion) worldwide had a BMI of 25 kg /m or more, 205 million of whom were men (193-217 million) and 297 million women (280-315 million) were obese . Globally, as of 1980, average body mass has increased. Trends have varied since 1980, with the average BMI population varying widely between countries in 2008 [14,15]. In most countries, interventions and policies are required that can restrict or reverse the rise, and mitigate the health effects of a high BMI by targeting metabolic mediators [16,17]. Within the United States, prevalence rates of generalized obesity (BMI> 30 kg / m 2), obesity (BMI> 40 kg /m 2), and central obesity continue to rise with the peak rates of obesity occurring in the fifth and seventh decades .Women have more general obesity but less centralized obesity than men, and obesity is disproportionately over American minorities. Of concern is the increase in obesity rates among young adults (ages 2 to 19) in the United States as well as around the world [18].

For most middle-income economies and part of middle-income low-income economies, Adult women's obesity is now a strong driver of health disparities and economic growth will extend to include a significant number of developing countries in this situation in the absence of concerted national public initiatives to reduce obesity [19]. As a chronic and multi factorial disease, obesity will for several years be close to the top of the global public health sector Women are similar to factors that affect the epidemics (national income, government policy, cultural norms, built environment, environmental and behavioral processes, food preferences, biological laws, and biological processes that regulate motivation for physical activity) that require a comprehensive package of actors, largest a keholder participation, and a long-term perspective [20].

3. Classification of obesity

Table 1 Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risks [23]

| Diagnosis | BMI (kg/m ²) | | Co morbidity Risk | Risk of T2D, HTN, CVD | |
|-----------------|--------------------------|-----------|------------------------|------------------------------------|------------------------------------|
| | Non-Asian | Asian | | WC < 102cm (men), < 88 cm (women)* | WC ≥ 102cm (men), ≥ 88 cm (women)* |
| Underweight | <18.5 | <17.5 | Low but other problems | | |
| Normal weight | 18.5–24.9 | 15.5–22.9 | Average | | |
| Overweight | 25–29.9 | 23.0–27.9 | Increased | Increased | High |
| Obese class I | 30–34.9 | >28 | Moderate | High | Very high |
| Obese class II | 35–39.9 | | Severe | Very high | Very high |
| Obese class III | ≥40 | | Very severe | Extremely high | Extremely high |

Abbreviations: BMI = index of body mass; CVD = cardiovascular disease; HTN = hypertension; T2D = type 2 diabetes; WC = circumference of waists.
*88cm= 35 inches; 102cm= 40 inches

During childhood or adolescence, the definition of obesity is more limited by the fact that the height is still that and the body shape is continuously changing. In addition, there are substantial international variations in the age of puberty and the individual differential levels of lipid accumulation [21]. The recommendations include the definition and measurement of obesity as a central component in health treatment. The assessment starts with a BMI rating, with excess weight and obesity defined as a BMI of 25 and 30 kg /m, respectively. If there is BMI High-Risk Patients groups, waist a weight-loss plan should start with circumference and relevant cardiovascular risk factors Measuring your waist circumference helps you examine the possible health risks that come with being overweight and obese [22]. This risk increases with a waist size greater than 35 inches for women or greater than 40 inches for men (Table 1) [23].

4. Metabolic and physiological

Obesity is a major contributor to poor metabolism that involves fats and glucose, but on a larger scale, as well as weakened organs that involve the functions of the heart, liver, intestines, lung, and endocrinologists [24]. Despite the worrying increase in the burden of obesity worldwide, body fat appears to be an organized physiological variable. Adipose regulation occurs through the traditional endocrine feedback loop, in which insulin hormone derived from beta cells and leptin hormone derived from adipocytes indicates the state of hypothalamic energy reserves [25]. Efforts however over the past many molecules have been known for decades which are apparently secreted from adipocytes in comparison to their tissues [26]. 1994 Mouse obesity gene clone may be the most well-known explanation why adipocytes are involved in controlling many body functions. This gene's product, leptin, has since been found in High leptin expression has been linked to an increase in microfilm density within the body, and can therefore be associated with hepatocellular carcinoma growth. Additionally, elevated leptin expression was an indicator of improved survival for hepatocellular carcinoma patients who were treated with Medroxy progesterone acetate after surgery [27].

Adipose tissue is an endocrine organ that produces adipokines including leptin, adiponectin, vesfatin ,risestin, abilene, etc, that alter Metabolism in the body. Since obesity increases with an increase in fat mass, these hormones are expected to be released at higher concentrations and may have Major effect on the metabolism of the macronutrients. Additionally, these adipokines can interfere with long-term energy changes like insulin (28). Fatty Tissue not only responds to signals from typical hormonal and central nervous systems, but also communicates stimuli that perform endocrine functions and secrete them. These include leptin, other cytokines, adiponectin, complementary constituents, plasminogen-1 activator receptor, renin-angiotensin network proteins, and ricetin. Fatty tissue also constitutes an essential site of sexual metabolism [29]. Excessive rodent feeding increases local Angiotensin II production due to increased angiotensin secretion from the adipocytes .While angiotensin II promotes adipocyte grow, increased adipocyte excretion of angiotensin also contributes directly to the close relationship between adipose tissue mass and blood pressure in mice [30].

Obesity is an important component of the development of metabolic syndrome and it has become increasingly evident that the central factor in this is the production of fat cells by biological materials directly related to insulin sensitivity and vascular injury [31]. The most pronounced form of metabolic syndrome is abdominal obesity. In Syndrome with Metabolism. Abdomen is an essential part of public health concern the median Metabolic syndrome is prevalent 31 per cent and is connected to a double Increasing the risk of coronary heart disease, cerebra vascular disease and a 1.5-fold rise in risk of coronary heart disease death for all causes [32]. Adipocytes have observed the secretion of complementary proteins and Interact to produce a signal that can encourage triglyceride called acetylene-stimulating protein [33].

5. Obesity treatment

The main methods used to treat obesity in adults are Interference in Lifestyle , drug therapy And a bariatric procedure. Lots of studies have shown that intense Interventions in behaviors that are typically view edindividually or in groups may be effective in causing clinically beneficial weight loss in many individuals [34]. Diet improvements and increased activity, combined with behavior therapy and therapeutic support, are first-line the rapes. An increase in cardiovascular risk factors and a lower prevalence Type 2 diabetes was associated with Loss of weight for overweight and obese participants between 0.05and 0.10 of primary Weight to the body in individuals at risk of infection. However, the impact size is very small A long-term weight loss of under 10 kg over time, and weight recovery is very normal overtime [35].

Changing Eating habits to help patients adopt the necessary lifestyle changes is essential to treat obesity. There are Most diets are tailored to the relative sum of other foods Like low-carbon diets, low-fat diets, high amounts of protein diets, and low-glucose diets; Hence the diet's Less composition essential than the Complete calories used[36]. One meta

analysis shows the impact of nutritional counsel in modest, with average reduction in about 0.1 monthly and subsequent BMI units restoration maintenance throughout [37]. Activity alone has a small effect on body weight but the application of physical exercise to dietary therapy improves the chances of continued weight loss in the long term [38,39]. Additionally, even a Moderate Heightened physical activity may lead to positive effects on cardiovascular fitness and this appears to eliminate many of the negative effects of obesity [40,41]. A low-calorie diet (LCD) is classified as a diet with an energy intake of less than 800 calories per day that contains enough protein, essential fatty acids, carbohydrates and prescribed daily vitamin and mineral allowances [42]. Standard food with 2-2.5 liters of non-energy fluids a day is supplemented with 3-5 LCD meals. Normal food is slowly brought back within 2-4 weeks after the end of the LCD era. LCD is mostly used for 12-16 weeks in medical care programs, resulting in an average weight loss of 1.5-2.5 kg/week [43,44].

Medication guidelines for obesity indicate that medications should start when the BMI is 30 kg/m² or higher or when the body mass index is between 27 kg/m² and 29.9 kg/m². Drug therapy's best outcomes can be predicted in the long term when medications are part of a comprehensive weight loss plan. At the moment just two drugs, sibutramine and orlistat, are currently approved in the United States Long-term Alimentary and Drug Administration [45]. Sibutramine reduces norepinephrine and serotonin absorption, and decreases appetite. Losing weight is encouraged by early satiety, and the start of the next meal is postponed. The suggested starting dose is 10 mg per day, with more reaction-based adjustment. We do not suggest doses greater than 15 mg/day. Sibutramine treatment combined with behavioral and dietary treatment is most effective in inducing weight loss [46].

The Orlistat (tetrahydrolipstatin) is an FDA-approved anti-obesity drug. It is a saturated derivative of local lip fat isolated from *Streptomyces toxytricini*. Orlistat certified FDA indicators include: Patients with obesity with a body mass index (BMI) over 30 kg/m² Patients with a body mass index greater than 27 kg/m² and the presence of risk factors including high blood pressure, diabetes and dyslipidemias [47]. At Recommended dosage of 120 mg with meal 3 times a day, orlistat inhibits approximately 30 per cent [48] of dietary fat absorption. A meta-analysis (duration 1-4 years) of clinical trials on the long-term impact of Anti-obesity medications have demonstrated weight loss results to be within the range of 3 kg for sibutramine and 4 kg for orlistat [49]. Although saving weight process sibutramine therapy after the Weight reduction original was shown to increase Progress rate [50], but similar research revealed challenges in managing weight regaining obesity and overall high dropout levels.

Bariatric surgery off-ers obese patients them outlasting weight loss [51]. Many surgical techniques are used. On average, the Obesity care results in a weight loss of 20-40 kg and a drop in of 10-15 kg/m² in the BMI [52,53]. Contemporary obesity Operations include gastric by-pass Roux-en-Y, shaping gastrectomy, flexible gastric belt and duodenal ring. The large majority of these operations are actually carried out using laparoscopy techniques, the Big benefits, are Quick Recovery [54]. The first treatment for the gastrointestinal bypass was identified as a bypass with an astomosis in one episode. This annular gastric bypass was subsequently changed to form Roux-en-Y to reduce gastritis caused by alkaline reflux, hence the term Roux-en-Y gastric bypass [55]. Gastric anastomosis Roux en Y (RYGB) is still the "gold standard" weight loss procedure and became the most popular obesity treatment worldwide [56]. RYGB works through several frameworks. The newly developed stomach bag is much smaller than the standard stomach, making less food and less calories easier to consume. In addition, there is some malabsorption which results in less calorie and nutrient absorption [57]. In the last two decades the safety of bariatric surgery has significantly improved. The death rate for obesity surgery in the late 1990s was 0.5-1.0 percent, which is considered high for Treatment for obesity (though lower than other colorectal operations) where the death rate is (1-3%). The high rate of obesity-related mortality continued in the early 2000s with the development and deployment of endoscopic technology for obesity surgery [58]. Comparing RYGB with Randomized Trial lifestyle intervention and medical intensive care to T2DM regulation, and hypertension hyperlipidemia, The researchers recorded 26.1% Reduction in total body weight (TBW) in the population of surgical procedures compared to a 7.9% reduction in TBW in the patient group. Doctor follow up twelve months after surgery [59]. In 2011, the IDF proposed Bariatric surgery as an appropriate treatment for T2DM and obesity patients (BMI approximately 35 kg/m²) That weren't effective. Suggested goals with medical treatments, Notably with others diseases associated with obesity [60].

Although medicinal and surgical therapies are available to treat obesity and treatment in an effective and safe manner, and there are new treatments on the horizon, there are many challenges that still Their widespread implementation is tight. First, the definition of obesity appears to be a divisive "illness," even among many healthcare professionals. Obese people are often viewed as lacking willpower or Restraint and because they have psychological problems which limit their eating capacity. The prevalent view is that eating less food and doing more would make the obese person healthy and have a good weight [60].

6. Conclusion

Creating healthy living conditions in our modern environment, including preventing obesity, is one of humanity's greatest challenges. Only practitioners, when caring for affected patients, cannot manage all path ways leading to the emergence of obesity but can proceed with the Knowledge that the treatment strategies discussed here would possibly help patients receiving them. Further steps should be made to avoid and treat obesity as a matter of Wide effort to monitor chronic disease epidemic. Obesity has a major impact on quality of life, even for over weight people. The cornerstones of obesity treatment are diet, physical activity, exercise and lifestyle changes, but medical care and obesity surgery are necessary.

Compliance with ethical standards

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References

- [1] Yumuk V, Tsigos C, Fried M, Schindler K, Busetto L, Micic D, Toplak H. Obesity Management Task Force of the European Association for the Study of Obesity. *European Guidelines for Obesity Management in Adults*. *Obesity facts*. 2015; 8(6): 402–424.
- [2] World Health Organization: Obesity and Overweight. WHO 3 March 2020. Available at: 3- Centers for Disease Control and Prevention. Defining adult overweight and obesity. 2020.
- [3] Chung S. Body mass index and body composition scaling to height in children and adolescent. *Ann Pediatr Endocrinol Metab*. 2015; 20(3):125–129.
- [4] Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999–2008. *JAMA*. 2015; 303(3): 235–241.
- [5] Adom T, Kengne AP, De Villiers A, Puoane T. Prevalence of overweight and obesity among African primary school learners : a systematic review and meta analysis. *Obesity & Science and Practice*. 2019; 5(5): 487-502.
- [6] World Health Organization. Obesity and overweight. WHO Web site. Updated March. Accessed April 28. 2011.
- [7] Ahima RS. Digging deeper into obesity. *The Journal of clinical investigation*. 2011; 121(6): 2076-2079.
- [8] Low S, Chin MC, Deurenberg-Yap M. Review on Epidemic of Obesity. *Ann Acad Med Singapore*. 2009; 38: 57-65.
- [9] Deurenberg-Yap M, Niti M, Foo LL, Ng SA, Loke KY. Diagnostic accuracy of anthropometric indices for obesity screening among Asian adolescents. *Ann Acad Med Singapore*. 2009; 38(1): 3-6.
- [10] Lee YS. Consequences of childhood obesity. *Ann Acad Med Singapore*. 2009; 38:75-81.
- [11] Lee YS, So JB, Deurenberg-Yap M. Confronting the obesity epidemic: call to arms. *Annals Academy of Medicine*. 2009; 38(1): 1-2.
- [12] Stein CJ, Colditz GA. The epidemic of obesity. *The Journal of Clinical Endocrinology & Metabolism*. 2004; 89(6): 2522-2525.
- [13] Hurt RT, Kulisek C, Buchanan LA, McClave SA. The obesity epidemic: challenges, health initiatives, and implications for gastroenterologists. *Gastroenterol Hepatol (N Y)*. 2010; 6(12):780–792.
- [14] Popkin BM. The nutrition transition and its health implications in lower-income countries. *Public Health Nutr*. 1998; 1: 5– 21.
- [15] Muniesa PG, Martínez-González MA, Hu FB, Després JP, Matsuzawa Y, Loos RJJ, Moreno LA, Bray GA, Martínez JA. Obesity. *Nature Reviews Disease Primers*: 3. 2017.
- [16] Finucane MM, Stevens GA, Cowan MJ, Danaei G, Lin JK, Paciorek CJ, Singh GM, Gutierrez HR, Lu Y, Bahalim AN, Farzadfar F, Riley LM, Ezzati M. National, regional, and global trends in body- mass index since 1980: systematic

analysis of health examination surveys and epidemiological studies with 960 country-years and 9•1 million participants. *Lancet*. 2011; 377(9765): 557-67.

- [17] Purnell JQ. Definitions, Classification, and Epidemiology of Obesity. In: Feingold KR; Anawalt B.; Boyce A; editors. *Endotext* [Internet]. South Dartmouth (MA): MDText.com, Inc. 2018.
- [18] Monteiro CA, Conde WL, Lu B, Popkin BM. Obesity and inequities in health in the developing world. *International Journal of Obesity*. 2004; 28:1181–1186.
- [19] Wirtz VJ. Obesity. Priority Medicines for Europe and the World "A Public Health Approach to Innovation" Update on 2004 Background Paper, BP 6.18 Obesity. 2004.
- [20] Güngör NK. Overweight and obesity in children and adolescents. *J Clin Res Pediatr Endocrinol*. 2014; 6(3): 129–143.
- [21] Aronne LJ. Classification of obesity and assessment of obesity-related health risks. *Journal Obesity research*. 2002; 10 (Suppl 2): 105-115.
- [22] Garvey WT, Mechanick JI, Brett EM, Garber AJ, Hurley DL, Jastre Boff AM, Pessah NK, Pollack R, Plodkowski R. American Association of Clinical Endocrinologists and American College of Endocrinology comprehensive clinical practice guidelines for medical care of patients with obesity. *Endocr Pract*. 2016; 22 (suppl 3): 1-203.
- [23] Redinger RN. The pathophysiology of obesity and its clinical manifestations. *Gastroenterology & hepatology*. 2007; 3(11): 856–863.
- [24] Niswender KD, Baskin DG, Schwartz MW. Insulin and its evolving partnership with leptin in the hypothalamic control of energy homeostasis. *Trends Endocrinol Metab*. 2004; 15(8): 362–369.
- [25] Miner JL. The adipocyte as an endocrine cell. *Journal of Animal Science*. 2004; 82(3): 935–941.
- [26] Wang SN, Yeh YT, Yang SF, Chai CY, Lee KT. Potential role of leptin expression in hepatocellular carcinoma. *Journal of clinical pathology*. 2006; 59(9): 930–934.
- [27] Singla P, Bardoloi A, Parkash AA. Metabolic effects of obesity: A review. *World journal of diabetes*. 2010; 1(3): 76–88.
- [28] Kershaw EE, Flier JS. Adipose tissue as an endocrine organ. *The Journal of Clinical Endocrinology & Metabolism*. 2004; 89(6):2548–2556.
- [29] Engeli S, Schling P, Gorzelniak K, Boschmann M, Janke J, Ailhaud G, Teboul M, Massiéra F, Sharma AM. The adipose-tissue renin-angiotensin-aldosterone system: role in the metabolic syndrome? *The international journal of biochemistry & cell biology*. 2003; 35(6): 807–825.
- [30] Hutley L, Prins JB. Fat as an endocrine organ: relationship to the metabolic syndrome. *The American journal of the medical sciences*. 2005; 330(6): 280-289.
- [31] Engin A. The Definition and Prevalence of Obesity and Metabolic Syndrome. *Adv Exp Med Biol*. 2017; 960:1-17.
- [32] Meier U, Gressner AM. Endocrine regulation of energy metabolism: review of pathobiochemical and clinical chemical aspects of leptin, ghrelin, adiponectin, and resistin. *Clinical chemistry*. 2004; 50(9): 1511- 1525.
- [33] Miner JL. The adipocyte as an endocrine cell. *Journal of animal science*. 2004; 82(3): 935-941.
- [34] Zhang Y, Liu J, Yao J, Ji G, Qian L, Wang J, Zhang G, Tian J, Nie Y, Zhang YE, Gold MS, Liu Y. Obesity: pathophysiology and intervention. *Nutrients*. 2014; 186(11):5153-83.
- [35] Goetz-Perry C. Diets with different targets for intake of fat, protein, and carbohydrates achieved similar weight loss in obese adults Commentary. *Evidence-based nursing*. 2009; 12(4): 109-109.
- [36] Dansinger ML, Tatsioni A, Wong JB, Chung M, Balk EM. Meta-analysis: the effect of dietary counseling for weight loss. *Annals of internal medicine*. 2007; 147(1): 41-50.
- [37] Miller WC, Koceja DM, Hamilton EJ. A meta-analysis of the past 25 years of weight loss research using diet, exercise or diet plus exercise intervention. *Int J Obes Relat Metab Disord*. 1997; 21: 941-947.
- [38] Catenacci VA, Wyatt HR. The role of physical activity in producing and maintaining weight loss. *Nat Clin Pract Endocrinol Metab*. 2007; 3:518-529.

- [39] Church TS, Earnest CP, Skinner JS, Blair SN. Effects of different doses of physical activity on cardiorespiratory fitness among sedentary, overweight or obese postmenopausal women with elevated blood pressure: a randomized controlled trial. *JAMA*. 2007; 297(19): 2081-2091.
- [40] Sui X, LaMonte MJ, Laditka JN, Hardin JW, Chase N, Hooker SP, Blair SN. Cardiorespiratory fitness and adiposity as mortality predictors in older adults. *Jama*. 2007; 298(21): 2507-2516.
- [41] Rössner S, Torgerson JS. VLCD a safe and simple treatment of obesity. *Lakartidningen*. 2000; 97(36): 3876-3879.
- [42] Tsai AG, Wadden TA. The evolution of very-low-calorie diets: an update and meta-analysis. *Obesity (Silver Spring)*. 2006; 14(8):1283–1293.
- [43] Saris WH. Very- low- calorie diets and sustained weight loss. *Obesity research*. 2001; 9(S11): 295S- 301S.
- [44] Mahgerefteh B, Vigue M, Freestone Z, Silver S, Nguyen Q. New drug therapies for the treatment of overweight and obese patients. *Am Health Drug Benefits*. 2013; 6(7): 423–430.
- [45] Li M, Cheung BM. Pharmacotherapy for obesity. *Br J Clin Pharmacol*. 2009; 68(6): 804–810.
- [46] Bansal AB, Orlistat AKY. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing. 2020.
- [47] Heck AM, Yanovski JA, Calis KA. Orlistat, a new lipase inhibitor for the management of obesity. *Pharmacotherapy*. 2000; 20(3): 270–279.
- [48] Rucker D, Padwal R, Li SK, Curioni C, Lau DC. Long term pharmacotherapy for obesity and overweight: updated meta-analysis. *Bmj*. 2007; 335(7631): 1194-1199.
- [49] James WP, Astrup A, Finer N, Hilsted J, Kopelman P, Rössner S, Saris WH, Van Gaal LF. Effect of sibutramine on weight maintenance after weight loss: a randomised trial. *STORM Study Group. Sibutramine Trial of Obesity Reduction and Maintenance. Lancet*. 2000; 356(9248): 2119-2125.
- [50] Sjöström L. Surgical intervention as a strategy for treatment of obesity. *Endocrine*. 2000; 13(2): 213- 230.
- [51] Melinda AM, Lisa RS, Marika S, Margaret M, Harvey JS, Ninh TN, Zhaoping L, Walter AM, Lara H, Shannon R, Sally CM, Paul GS. Meta-analysis: surgical treatment of obesity. *Annals of internal medicine*. 2005; 142(7): 547-559.
- [52] Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, Fahrbach K, Schoelles K. Bariatric surgery: a systematic review and meta-analysis. *Jama*. 2004; 292(14): 1724-1737.
- [53] Stefater MA, Wilson-Pérez HE, Chambers AP, Sandoval DA, Seeley RJ. All bariatric surgeries are not created equal: insights from mechanistic comparisons. *Endocr Rev*. 2012; 33(4): 595–622.
- [54] Seeras K, Lopez PP. Roux-en-Y Gastric Bypass Chronic Complications. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2019.
- [55] Buchwald H, Oien DM. Revision Roux-en-Y Gastric Bypass to Biliopancreatic Long-Limb Gastric Bypass for Inadequate Weight Response: Case Series and Analysis. *Obes Surg*. 2017; 27(9): 2293– 2302.
- [56] Lutz TA, Bueter M. The physiology underlying Roux-en-Y gastric bypass: a status report. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*. 2014; 307(11): R1275–R1291.
- [57] Lim RB, Blackburn GL, Jones DB. Benchmarking best practices in weight loss surgery. *Curr Probl Surg*. 2010; 47(2):79–174.
- [58] Singh AK, Singh R, Kota SK. Bariatric surgery and diabetes remission: Who would have thought it? *Indian J Endocrinol Metab*. 2015; 19(5):563–576.
- [59] Dixon JB, Zimmet P, Alberti KG, Rubino F. International Diabetes Federation Taskforce on Epidemiology and Prevention. Bariatric surgery: an IDF statement for obese Type 2 diabetes. *Diabet Med*. 2011; 28(6):628–642.
- [60] Puhl RM, Heuer CA. Obesity stigma: important considerations for public health. *Am J Public Health*. 2010; 100(6): 1019–1028.