

New Trends Approach for Management of Obesity

Meena Kedar Prasad*

Department of Pharmaceutical Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, India

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ABSTRACT

Today, sociodemographic factors and lifestyle habits more affect body weight and body composition. Obesity is the imbalance of energy intake from food and energy expended through physical activity. Globally it affects ≥ 135 million people in India and in US 39.8% of adults and 18.5% of youth. Obesity exaggerates many major problems which is untreatable. Screening of obesity can be done by body mass index and other methods. Variates of medication are used in management of obesity. It has been already proved in various clinical trials that there are various drugs are used for treatment of obesity with some modification in life style, diet and behavioral modification. Orlistat has been found most desirable drug to manage obesity. In sever condition some time various surgical operation can be performed over patient to reduce morbidity. In this review we can see how to manage obesity by

pharmacological and non-pharmacologically because obesity is a global concern as it arises many health disasters and expected to accentuating in future, among rural and older individuals. Although in recent last years it has been clearly showed that being overweight puts high risk of dying from COVID-19 as it increases oxygen demand, ventilators etc. so it is a like a wakeup call to come in action by introducing new campaign. So, government, health workers, researcher have to take urgent steps regarding management and treatment in obesity.

Keywords: Obesity, Behavioral modification, Body mass index, Management, Diet

***Correspondence:** Meena Kedar Prasad, Department of Pharmaceutical Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, India, E-mail: meenapharmaceutics@rediffmail.com

INTRODUCTION

Obesity has become a worldwide problem related to major chronic public health issues and increases threat to the health of many people that affect the quality of life increases the risk of illness and health care cost. Obesity, a condition common nutritional disorder which is characterized by excess body fat (Pozza C and Isidori AM, 2018). It is gradually increases globally. It aggravates many health conditions such as, hypertension, dyslipidemia, type 2 diabetes, cardiovascular disease and sleep apnea, symptomatic heart burn, fatty liver, gall stones, abdominal wall hernias, post-operative problem, osteoarthritis, depression and psychotic problem etc. (Kyrou I, *et al.*, 2018). It has been reported that in US 2/3rd of the people (adults) and in 2003 to 2004 about 4.8% people were obsessed. India has acquired 3 places after US and china about 30% people were obsessed and 15% obsessed people live in India together with China. Standard data has been reported for obesity with comparison of south India 46% (women-47% and 43%-men) to USA 35%. Abdominal obesity has been found 47% to 51% in women with higher rates (women-56% and men 35%) and greater risk for developing type-II diabetes and heart related disorders (Ogden CL, *et al.*, 2015). Today obesity is only reason for heightens one or more than one health conditions such as type-2 diabetes, heart related disorders certain cancers which increases the severity of the obesity crisis. Development of insulin resistance type-2 diabetes mellitus are the major problems which occurs during obesity so it is considered that it is a major obstacle to maintain long term body glucose level (Calle EE, *et al.*, 2003; van Gaal LF, *et al.*, 2006). It has been seen that more than 90% people suffers from type-2 diabetes having obesity in various clinical trial study has been demonstrated that increase in 6-7 kg body weight has been increases the risk of type-2 diabetes by 50% while loss in 5 kg reduces the risk as similar. As a result, people having Body Mass Index (BMI) ≥ 40 kg/m² suffer from type-II diabetes (Mokdad AH, *et al.*, 2003). Several surgeries, non-pharmacological, pharmacological method has been used to control obesity. There is a strong evidence exist that bariatric surgery leads to greater loss in weight and has been seen positive effect on fasting blood sugar, hemoglobin A1c, lipid profiles (Gadde KM and Allison DB, 2009).

Researchers have found that there are several risk conditions which are associated with obesity are diabetes mellitus, coronary artery disease, hypertension, dyslipidemia, stroke, osteoarthritis, gall balder and several cancers etc. Therefore, it has been proved that obesity increase risk of morbidity (Jakobsen GS, *et al.*, 2018).

In 1997 World Health Organization (WHO) was published the classification of adults on the basis of Body Mass Index (BMI). This classification has been proposed cut-of points for BMI. For low BMI it is <18.5 kg/m² and for high BMI it is >40.0 (for obesity stage III) (WHO, 2015; WHO, 1997) (Table 1).

Table 1: Classification of obesity by Body Mass Index (BMI) adapted from obesity, preventing and managing the global epidemic WHO 1997

Classification	BMI	Stage of obesity	People health description
Underweight	<18.5 kg/m ²	-	Thin
Normal	18.5-24 kg/m ²	-	Healthy/normal
Overweight	25-29.9 kg/m ²	-	Overweight
Obesity	30-34.9 kg/m ²	I	Obesity
	35-39.9 kg/m ²	II	Obesity
Extremely obesity	≥ 40.0 kg/m ²	III	Morbid obesity

Valuable information was provided by BMI Obesity classification, it talks about increasing body fatness and compared weight status between population and within population and also provides data of groups of individuals at risk of morbidity and mortality (Han TS, *et al.*, 2006).

Assessment of obesity

Obesity screening should be initiate with a determination of the BMI. It is just an indicator for health risk. A World Health Organization (WHO) classified overweight and obesity for both men and women. In 1997, classification made by WHO (Table

2). BMI have been defined as weight in kilogram divided by square of the height in meters (WHO, 2015; WHO, 1997). According to National, Heart, Lung and Blood Institute (NHLBI) physician also looks for another factor. Second assessment of obesity is waist circumference (NIH, 1998; ICSI, 2011) defined as measured in centimeter at midpoint between lower border of ribs and upper border of the pelvis and it also provide measurement for assessing upper fat deposition, neither provide precise estimates intra-abdominal visceral fat. Abdominal adiposity is important risk factor for Type 2 diabetes, cardiovascular disease, dyslipidemia, hypertension (Bray GA, 2013). It has been seen that having greater waist circumference have increase five-fold more chances of multiple disease, such as cardiovascular risk factor and others. It has been shown that patient having BMI 25 kg/m^2 or greater and waist circumference >35 (women) and >40 (men) have greater risk of blood pressure, lipid level, fasting glucose, coronary heart disease, atherosclerotic disease, type 2 diabetes (Ghandehari H, *et al.*, 2009; CDC, 2013; Westphal AB, *et al.*, 2010). Any of three or more risks factors confirms high morbid obesity. Another assessment skin fold thickness, defined as measurement of skin fold thickness in centimeter with calipers which provide a precise assessment if taken at multiple sites and it don't provide any information about abdominal and intra muscular fat (Kannieappan LM, *et al.*, 2013). Another assessment is bio impedance, defined as the lean mass conduct current better than fat mass because it was primarily an electrolyte solution. It also measured a resistance to a weak current (impedance). Applied across extremities and provide an estimation of a body fat by help of using empirically derived equation. Benefit of bio impedance is that the method used in measurement is very simple and practical but it never measured fats and nor predict biological outcomes (Tarnoki AD, *et al.*, 2014).

Table 2: Classification of obesity by waist circumference and associated diseases risk adapted from obesity preventing and managing the global epidemic WHO 1997

Classification	Obesity stage	Disease risk on the basis of waist circumference	Obesity
		Men<40 women <35	Men>40 women >35
Underweight	-	-	-
Normal	-	-	-
Overweight	-	Increases	High
Obesity	I	High	Very high
	II	Very high	Very high
Extremely obesity	III	Extremely high	Extremely high

MATERIALS AND METHODS

Epidemiology of obesity

Today the scenario is completely different in comparison to last few days. The number of people who are suffering from the obesity and obesity related disorder has nearly double. World health organization (WHO) estimated that from year 1980-2013 obesity rates have been increased by 47.1% and also found in 2014, approximately 41 million children under age of 5 year were affected by overweight and obesity (WHO, 2016). On national level studies of US children and adolescent obesity from age group 2-19 years were 17% in 2011-2014. But extreme obesity was found to be 5.8% (Ogden CL, *et al.*, 2016) according to NCHS (National Center for

Health Statistics) data from CDC (Center for Disease Control) prevalence of obesity among US youth and adults was found to be 18.5% and 39.8% in 2015-2016 (Hales CM, *et al.*, 2017). It has been seen that the percentage of obesity in men age group between (40-59) are 40.8 and men age group of (20-30) are 34.8% and on the other hand women age (40-59) are 44.7% and women age group (20-39) are 36.5%. This data proves women are more affected by obesity. From most of the recent studies it was found in United States overall of 18.5% of youth and 20.6% of adolescent has been obese. About 18.4% of school aged children were affected by obesity with compare to pre schooled aged children (13.9%). further 20.4% of school aged boys are getting more effected then pre schooled aged boys (14.3%), same case was found in girls also. About 20.9% of adolescent girls were more affected by obesity then pre schooled aged girls (13.5%) (Hales CM, *et al.*, 2017) from (1999-2000) to (2015-2016) about 13.9% of obesity among youth between aged group (2-19) years has been increased to 18.5% (Hales CM, *et al.*, 2017).

According to National Health and Nutrition Examination survey in (US) on the basis of body mass index classification shows that there was a steady increment in prevalence of obesity in both children and adults. About 35.8% of adults and 18.5% of youth in 2015-2016 were obese (WHO, 2008) from 1980 to 2014 current scenario trends of obesity on worldwide prevalence of overweight and obesity has been become doubled and reached to 1.9 billion people were overweight and 600 million people were obesity (WHO, 2014).

Overall past three four decades obesity was gradually increased worldwide among adults in aged group 18 year about 11% of man and 15% of women were obese in 2014. In 2013 children under age of 5 years about more than 41 million children were overweight (IIPS, 2000).

In India it was observed from (1998-1999) to (2015-2016) the BMI was gradually increased from 20.3 kg/m^2 to 21.9 kg/m^2 which signify that from last decade obesity and overweight was roses. Mean BMI has increased in age group of (30-39) and (40-49) year of women. In comparison of community Muslim women were more affected by obesity than Hindu women (IIPS, 2009). If we study properly, it has been also showed that scheduled caste women were more affected by obesity and overweight. The mean BMI of schedule caste women in 2015-2016 were found to be 21.8 kg/m^2 but in 1998-1999 it was 20.1 kg/m^2 which indicate that this was significant changes. In other hand there was also significant change was observed in mean BMI of upper wealth quintiles women in 2015-2016. In total if we compare overall obesity in women, it has been doubled from (1998-1999) to (2015-2016). In (2015-216) 20% of women were obese whether in 1999 it was only 10.6% which shows gradually increment in obesity in last two decade (Devaux MG, *et al.*, 2017). If we talk about particular age 30-39 year age group women were more affected and it reaches to 27.7% in (2015-2016) from 7.3% in (1998-1999). On comparing married with non-married, married women were more affected by obesity among both rural and urban areas. Educating system also gave more powerful impact on obesity prevalence. It gives positive attributes to obesity. Higher increment in level of obesity was found among in illiterate women and up to primary school education. But now obesity trend was tripled from 1998-2016 among scheduled tribes, scheduled caste and other backward caste (Frech HE, *et al.*, 2014).

In current scenario, it has been shown that, more than one out of two adults and one out of six children were obese in OECD area/countries. To solve the obesity problem there are some strategies and planning are merged in label of foods to improve nutrient information by means of news media, social sites, etc. (especially by communication). It helps to empower people to makes better choices of food product. In 2000, according to health behavior in school aged children survey in OECD 15th year old children are gradually increases their weight in France and children age of (3-17) year were at stable rate but in England it was increases for boys and girls (Kaur S, *et al.*, 2005).

OECD (organization for economic co-operation and development) is an intergovernmental economic organization with 36 member countries, founded in 1961 to stimulate economic progress and world trade (Palamar KL, *et al.*, 2006). According to OECD, in 2015 about 19.5% adult were obese. This data varies with countries. In Korea and Japan (<6% adult) and in countries like Hungary, New Zealand, Mexico and the United State (>30% adult) were obese. This range increases sharply in England, Mexico and United State since past (1990). In other seven OECD countries this rate has been slower than other countries which were described above. In countries, Canada, France, Mexico, Switzerland and the United State, obesity range increases and this rate constant in England, Italy, Korea, Spain. This shows that, there is no reduction in obesity rate (Frech HE, *et al.*, 2014). In India among (11-19) age, obesity has been found vary high (11%-29%). In rural area 4.7% of adolescence suffer from obesity but in urban's area it was found to be 11.6% so this prove urban area people were more suffer from obesity due to changes in life style, socioeconomic condition etc. according to recent data in Pune and Maharashtra, in the age group 10-15 year, total 1228 boys were overweight (20%) and 5.7% were obese (USDA, 2008). In 2002, survey was done on a school child of Ludhiana, Punjab total prevalence of overweight were 11%-14%, in age group 9-15 years. In other hand similar survey was done by nutrition foundation of India among 5000 private school children and 29% of 4 to 18 years age groups affected and overweight and a similar study was conducted in Chennai and founded 17% were over weighted and 3% were obese (USDA, 2008).

Management of obesity

Management of obesity is done by different method. It is classified as non-pharmacological and pharmacological method.

Non-pharmacology: It includes various strategies and planning to manage obesity.

Diet and Behavior modification: There are integrated Programmed regarding diet which include how much calorie intake, fat restriction, daily workout and life style. The goal of this integrated programmed is to reduce 5%-10% body weight (USDA, 2008). Sometime nutrition counselor may also help to plan a healthy diet which increases patient compliance in first year after drug therapy. Nutrition counselor must need to find out history of nutrition and physical activity of patient to helping out from overweight and to adapt healthier behavior on daily basis. Counselor provides a diet plan and daily calorie intake for an effective weight loss. The academy of nutrition and dietetics is an important resource for finding a registered dietitian (Potter MB, *et al.*, 2001; Bray GA, 2013).

For effective weight loss counselor provide low-carbohydrate and low-fat diet otherwise, best diet is only those patients will able to follow it constantly. According to National Heart, Lung and Blood Institute (NHLBI) guidelines to effective weight loss the amount of calorie intake should be reduce from 500-1000 kcal/day (LeBlanc ES, *et al.*, 2011). According to the dietary guidelines for Americans 2005, the person whose weight more than 154 pounds (70 kg) are burned more calorie/hour in comparison to person weight less than 154 pounds. For effective weight loss it is necessary to loss (1-2) pound/week and also reduce in 500-1000 by taking low calorie in a meal or increase energy expenditure (Potter MB, *et al.*, 2001). Physical activity is the only means of energy expenditure. According to USPSTF, 2010 6% decrement in weight has been observed by the behavioral treatment (Bray GA, 2013; LeBlanc ES, *et al.*, 2011). USPSTF developed 5A's approach to manage obesity and body weight for the patient who are not hesitating and ready to change in their life style (Figure 1). According to National Weight Control Registry, self-monitoring is key element for improving behavioral weight loss programmed. It includes food diaries, physical activity and weight records. In conjugation with dietary and drug therapy it is more effective for weight loss (Rao G, *et al.*, 2010; Searight HR, 2009).

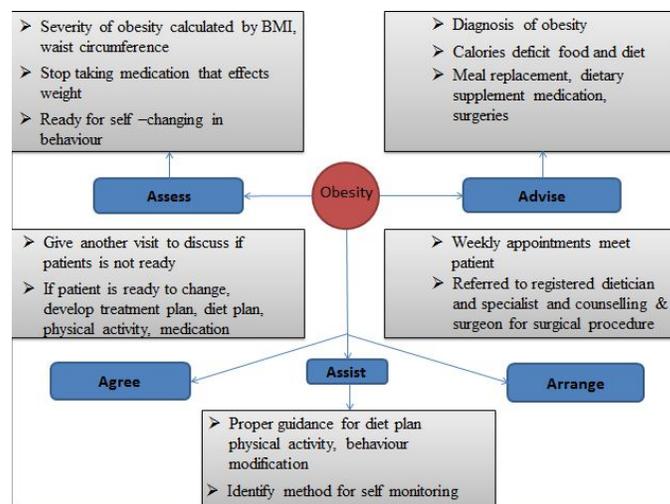


Figure 1: As approach to treat obesity

Motivational interviewing: Motivational interviewing is a focused, goal directed and counselling approach for behavioral change by helping patients to explore and resolve equivocation. It is best method for the people who willingly accept to reduce their body weight. Component of motivational interviewing include, agenda setting exploration about patient desire, patient ability, patient reasons, information, listening and summarizing and generating option and contracting etc. (Pollak KI, *et al.*, 2011; Janssen I and LeBlanc AG, 2010).

Physical activity: Physical activity is defined as energy expenditure by movement of skeletal muscles. It can be performed any time of day or night. It may be planned or unplanned, and repetitive process for the purpose of improving body fitness (Coleman KJ, *et al.*, 2012). Physical activity helps in to balance both physical and mental health and may prevent from risk factors for several diseases which may threat life. It also increases stamina, strength, builds healthy bones, muscles and reduces some mental stress. It may help to increase self-esteem in children and adolescent (ODPHP, 2013). NHLBI has been suggested, 30-45 min daily physical workout is necessary in 3-5 days in a week. Daily workout is also necessary in maintaining metabolic rate, which help to lowering blood pressure and cholesterol level (Potter MB, *et al.*, 2001). The American college of sports medicine has taken an initiative for assessment of physical activity to be considered as a vital step to remains fit in to daily routine for maintaining a healthy life. The physical activity guidelines for Americans (2008) set a parameter for adults to perform at least 150 min of moderate intensity or 75 minutes of vigorous intensity aerobics activity per week to remain fit in a daily life (Coleman KJ, *et al.*, 2012; ODPHP, 2013). In moderate physical activity include, hiking, light gardening, dancing, bicycling, walking, weight lifting, and stretching expanded 370 kcal, 330 kcal, 330 kcal, 290 kcal, 280 kcal, 220 kcal, and 180 kcal energy approximately per hour. But in case of vigorous physical activity daily calorie expended in bicycling, walking, aerobic are 590 kcal, 460 kcal, 480 kcal approximately (Potter MB, *et al.*, 2001).

Mental health and mood: The mental health of people is related to healthy behavior in which include eating pattern, and participation in type of physical activity. Mental health and mood behaviors gives powerful impact on weight and obesity it has been seen that people having greater BMI are more affected by depression, anxiety in comparison to a healthy people or children. In several researches it has been proved that reducing level of stress used as a potential factor to minimize obesity (Rofey DL, *et al.*, 2009; Anderson SE, *et al.*, 2007).

Sleep hygiene: About 17 million children in the age group 6-17 years af-

affected with obesity due to inadequate sleep and children up to 4 years of age increase 2 times more chances of obesity and overweight due to lack or short duration of night time. It also found that due to inadequate sleeping less than 7.75 hours/day in girls increases 4 times more risk of obesity and in boys 1.6 fold increases risk of obesity (Bell JF and Zimmerman FJ, 2010; Mcketta S and Rich M, 2011).

Media usage: According to recent study, it is found that children are spend more time on television, computers, videogames which increases more chance of obesity by increases body fatness, decrease energy expenditure, less physical activity etc. (Andrews RA and Lim RB, 2013).

Surgical method: Bariatric surgery is one of the methods to manage sever condition of obesity particularly when there are several risk factors are associated and it may threat to life. Patients having more than 40 kg/m² body weight are more preferred for bariatric surgery (SAGES Guidelines Committee, 2009). Bariatric surgery has become an option when dietary, nutrients, physical workout, and medication have not produced suitable results. Bariatric surgery has been opted when patients with BMI 35 kg/m² or more with chances of sever disease such as diabetes, sleep apnea, joint diseases etc. (Sjöström L, *et al.*, 2007). The Swedish Obese Subjects study suggested, replacement of open surgery by laparoscopy resulting in 24% reduction in mortality because of reducing the chance of myocardial infarction and cancers. Weight loss surgery can be opted by two method gastric restrictions and malabsorption or both. It involved small change in digestive system by limiting amount of food (Shah K, *et al.*, 2016; Pucci A, *et al.*, 2018).

Roux-en-y: It is also known as gastric bypass, most common, non-reversible method in U.S. This type of surgery involved by limiting the amount of food and lowering absorption of nutrients. In this surgery makes a small cut on the top of stomach and sealed it and small portion of small intestine is bypassed resulting only ounce of food can be holed by stomach. And it also increases energy expenditure (Levine MS and Carucci LR, 2014). It leads to 60% to 70% weight are loss by patients in 9 to 14 months after surgery. But there are several disadvantages have been seen in this surgery. It requires more complex operation, and need to stay more time in hospital. After surgery it is required to take long time vitamin, mineral supplement because of deficiencies of vitamin B₁₂, iron, calcium etc. (Novikov AA, *et al.*, 2018; Goitein D, *et al.*, 2016).

Sleeve gastrectomy: In sleeve gastrectomy surgery about 80% of stomach has been removed only leaving a suitable pouch so that it can't hold much food resulting less amount of production of appetite regulating hormone ghrelin. This type of surgery is non-reversible and gives rapid and significant weight loss and no need to stay longer time in hospital. But after surgery long term of vitamin deficiencies has been seen (Lara MD, *et al.*, 2005; Puziferri N, *et al.*, 2014).

Adjustable band: It is most invasive method. This procedure is almost same as sleeve gastrectomy. Only difference is another one surgery has been done to connect the end portion of intestine to duodenum which limits amount of food and reduces absorption of nutrients and produces another risks factor like malnutrition and vitamin deficiencies. It is also known as biliopancreatic diversion with duodenal switch. This method of surgery gives greater weight loss in comparison to others method. Patients are allowed to eat normal diet and meals. This method is not effective in case of diabetic patients. Sometime this produces high complication rate and need to stay longer time in hospital (Snow V, *et al.*, 2005).

Laparoscopy surgery: Laparoscopy surgery is only applicable for sever condition of obesity. It involved special type of telescope which is known as laparoscope, to view the stomach. It is a simple operative procedure having low risk. This surgery required a small cut in stomach along its vertical axis, a plug of stomach has been removed from a distal part for creating a durable reinforced and rate-limiting stoma and from this hole propylene is placed and stapled to it-self. This method avoids large open incision leads

to fewer blood loss and pain (Leung WYS, *et al.*, 2003). This method required anesthesia during surgery and sometime may produces sore throat and nausea. After surgery it is necessary to monitor daily habits of patients. Patients should need to rest and take proper supplements. Daily walking and first liquid diet followed by solid food is more preferable for patients to fast recovery (Li MF and Cheung BMY, 2011).

RESULTS AND DISCUSSION

Obesity treatment by drugs

The treatment of obesity by means of medication has withdrawn kind attention from doctors and patients because of shown in improvement of insulin sensitivity, glucose level, lipid level and hypertension in obese patients (Kaplan LM, 2010). The main aim of obesity treatment and management has been to lowered the cardiovascular risk factors so that the overweight and obesity related morbidity and mortality can be reduced. So that use of different medication has given more benefits with reduced mortality and morbidity (Li MF and Cheung BMY, 2011). Anti-obesity drugs can be classified in to following categories: Drugs that reduce fat absorption; centrally acting drugs (anorectic drugs); drugs that increases energy expenditure; antidiabetic drugs and bulking agents (Hendricks EJ, 2017; Rebello CJ, *et al.*, 2018) (Figure 2).



Figure 2: Obesity drug classification

Anorectic drugs reduce food intake by acting on central nervous system. It includes noradrenergic, adrenergic and serotonergic drugs bind with the GABA receptors or cannabinoids receptors. Noradrenergic drugs block the uptake of noradrenalin from presynaptic vesicles into neurons to decrease food intake by acting on beta adrenergic receptors. It includes diethylpropion, phentermine, amphetamine etc. but these drugs have been withdrawn from market due to increased hemorrhagic stroke and amphetamine produces addiction so that it is not in use (Bray GA, 1993). In combination of lifestyle modification phentermine gives insignificant results in weight loss about 3.6 kg in 6 months. In comparison of diethylpropion, phentermine gives better results. The combine effect of phentermine and topiramate was started in September 2012 gives synergistic effect with reduction in dose and produced less toxicity without loss in efficacy (Hennes S and Perry CM, 2006; Demos LL, *et al.*, 2006).

Drugs reduces intestinal fat absorption

Orlistat has been only weight-loss drug that only approved by the FDA. It is reversible gastrointestinal lipase inhibitor which inactivates hydroxylation of dietary fat and prevents absorption of dietary fats, which results in thirty percent reduction in fat absorption has been absorbed in the gut (Müller MJ and Geisler C, 2017). It has been used for long-term therapy. Orlistat has been taken in conjugation with reduced-calorie diet. Fats soluble multivitamin can be taken before 2 hours or after taking orlistat. Orlistat gave rare or low side effects on liver (Amori RE, *et al.*, 2007). In several randomized trials has been proved that orlistat with behavioral intervention gave better result in reduction of weight. It reduces 3 kg weight in comparison to placebo and behavioral intervention. According to (Xenical in the prevention of diabetes in obese subjects) trials it has been proved that orlistat with behavioral counseling leads to greater weight loss

in 4 years of therapy. Among 3,305 patients during randomized study to orlistat or placebo, it was found that the group of orlistat lost 10.6 kg in 1 year and maintained a weight loss of 5.8 kg at 4 years, in comparison to group placebo 6.2 kg in 1 years and 3.0 kg-maintained weight loss in 4 years respectively (Blonde L and Jones RD, 2009).

Clinical use

120 mg capsule with each main meal has been recommended dose of orlistat for adults but should be omitted if a meal was missed. The patients should take, balanced diet which contain 30% calorie from fat (Buse JB, et al., 2009). But there are some benefits, adverse effects of orlistat (Figure 3).

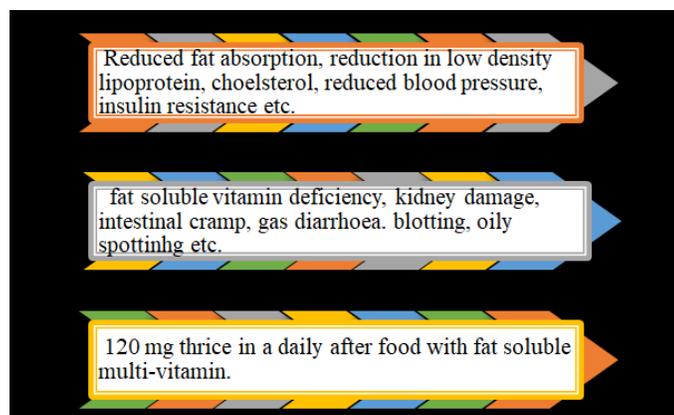


Figure 3: Benefits, adverse effects and dosing of Orlistat

Drug increases energy consumption

Ephedrine and caffeine are the example of drug which increases energy consumption. During long term placebo-controlled clinical trial it has

been showed that combination of these two drugs had more effects on obesity than when used alone. This substance has contained in some health supplements. But USFDA has not approved the combination of these two drugs for weight loss (Davies MJ, et al., 2015).

Anti-diabetic drugs

Liraglutide is glucagon-like peptide receptor agonist. It is a hormone secreted by intestinal cells. It stimulates the release of insulin and suppresses glucagon levels. It also reduces appetite and delays gastric emptying time. It has long half-life 13 hours. So, allowing given once daily. It has been approved by FDA for long term use (Ruifrok NAE, et al., 2009). Liraglutide at doses 1.2 mg and 1.8 mg daily reduces weight by 2.5 kg to 4 kg, but at dose 3.0 mg daily it has been approved for chronic weight management (Ruifrok NAE, et al., 2009). In the 56 week scale diabetes trials at dose 3.0 mg leads to reduction in 6 percent weight loss. Liraglutide also helps in improvement of fasting, post prandial glucose levels and fasting glucagon levels. It also reduces risk of cardiovascular problems. So, it is a greater choice of medicine patients having obesity, diabetes mellitus and cardiovascular diseases. This drug is best use with diet and proper exercise. Metformin, it is another example of anti-diabetic drug, insulin sensitizing agent from biguanide class. It works by increase in insulin sensitivity in peripheral tissue, reduces glucose production from liver. It also reduces glucose absorption from intestine and it does not increase insulin release. The half-life of metformin is 18 hours. At first prescribed at low dose and gradually increased to reach at optimal effect. Lactic acidosis was found to be a rare problem but it mainly occurs in diabetic patients having renal insufficiency. There are some research studies that prove it does not lead to much weight loss but significant weight loss has been observed. There are some other drugs used for long term medication approved by FDA (Tables 3 and 4).

Table 3: FDA approved drugs for treatment of obesity

Drugs	Mechanism of action	Dose	Side effects	Weight loss
Lorcaserin	Activate serotonin5-HT2c receptor	10 mg two times in a day	Headache, fatigue, constipation, diabetes, hypoglycemia, backpain	3.2 kg in 1 year
Liraglutide	Activate GLP1 receptor	3 mg subcutaneously one times in a day	Nausea, vomiting, lipid level increases	3-4 kg in 1 year
Phentermine-topiramate	Act on norepinephrine and GABA release	Phentermine 3.75 mg/Topiramate 23 mg once daily (loading dose) Phentermine 7.5 mg/Topiramate 46 mg once daily (maintenance dose)	Insomnia, paresthesia, dizziness, dysgeusia	3.6 kg in 6 months
Naltrexone- bupropion	Inhibit Dopamine norepinephrine reuptake, block opioid receptor	1 tab (bupropion 90 mg/naltrexone 8 mg) daily (loading dose and 2 tab (bupropion 180 mg/naltrexone 16 mg) 2 times daily (maintenance dose)	Nausea, constipation, insomnia, drymouth diarrhea	3.4 kg in 1 year
Diethylpropion	Act on central norepinephrine release	25 mg 3 times in a day and 75 mg one time daily	Headache, insomnia, palpitation	3 kg in 6 months

Table 4: List of banned drugs for obesity

Drug	Year	Reason for banned
Dinitrophenol	1938	Dermatitis, neuropathy, agranulocytosis, visual impairment
Aminorex	1968	Chronic pulmonary hypertension
Amphetamine	1971	Addiction, hypertension, myocardial toxicity
Phenylpropanolamine	2000	Hemorrhagic stroke
Rimonabant	2009	Psychiatric disorders, depression, suicidal attempt
Sibutramine	2010	Risk of major cardiovascular events

CONCLUSION

The major step to improve the global health risk is awareness in people regarding obesity, its risk factors and how it can be reduced and management by several behavioral programmes such as physical activity diet plan, life style modification, and medicine. In early stage not only people but doctors play an important role in preventing obesity because in many rural areas and urban areas people concentrate more on doctor's words. So, all physicians and family doctors should start promoting programs between patients to create a healthy country.

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