



Review

Impact of weight loss predictors in severe-morbid obesity patients in the Saudi population

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ABSTRACT

Universally, obesity has been affected more than 650 million and converts as global health problem. Obesity is equally affecting starting from children to elder population. Obese subjects are converting into severe obese and then into morbid obesity. Body mass index is prone from 30 to 50 kg/m² in the adult population. Obesity is connected with the future complications of hypertension, type 2 diabetes mellitus, cardiovascular, stroke, osteoarthritis, obstructive sleep apnea and liver diseases. Loosing of body fat is the only option to avoid obesity and this could be achieved with routine physical activity and diet modifications. Obesity subjects may fail to achieve the daily routine activities or insufficient activity may be involved and finally fail to lose the body fat after the medical course. Then these severe or morbidity obese can be lose with the existing surgery. Currently, Bariatric Surgery (BS) has become the active treatment for long-term weight loss. Various types (Roux-en-Y gastric bypass, sleeve gastrectomy and duodenal switch and the jejunioileal bypass) of BS are performed on the gastrointestinal tract. Throughout the world population, BS has found to be safe in losing the weight and avoiding the future and long-term complications. The prevalence of overweight and obesity in Saudi Arabia is an issue in terms of incidence and health consequences. Maximum obesity studies involved in Saudi Arabia has proven to be develop the long-term complications in the future involving from child to morbid obesity. Limited bariatric studies carried out in the Saudi subjects confirmed as effective tool in lowering the body fat and avoiding the life-threatening complications of human diseases. So, this review recommends BS as effective and safe surgical treatment to lose body fat in the Saudi population. However, post-operative monitoring is mandatory to follow-up.

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1. Introduction

Obesity is the basic common problem for human diseases in developed and under-developed countries. Obesity is defined as the accumulation of excess weight deposited in the form of fats in various parts of the human body. As per World Health Organization (WHO) obesity is measured through body mass index (BMI) i.e., a person's weight is measured in kilogram (kg) and height is centimeters (cms) or in square meters (m²). Overweight and obesity are confirmed as the presence of fats will leads to the risk of health such as Type 2 Diabetes Mellitus (T2DM), Cardiovascular diseases (CVD) and cancers (Lamiquiz-Moneo et al., 2019). Obesity is known as the complex conditions with the implications of social, medical and physiological (Gramaglia et al., 2019). Overweight and obesity are known disorders of energy balance with storage of excess fat. Based on WHO reports, the prevalence of obesity has been raised more than two-folds since the last three decades ago. During the year 2014, overweight subjects were 1900 million over the age of 18 and 600 million were obesity (Leal-Ugarte et al., 2019). Since 1980, obesity has been tripled globally (Medina et al., 2019). The interchange between the environment changes and the genetic factors which leads to a significant growth in obesity prevalence globally and gene-environment interaction is defined as a response for environmental agent, a conditional to the genotype of the individual (Saber-Ayad et al., 2019). Severe obesity is known to be BMI with >35 kg/m²; consists of obese I-IV (Table 1). BMI is the only the tool used to evaluate frequencies of obesity in the adult-world population connected with health (Fairbrother et al., 2018). Obesity associated diseases and disorders are amongst the leading cause of morbidity and mortality throughout the world. Most of the GWAS studies have focused on BMI and obesity (Riveros-McKay et al., 2019).

Obesity is the only disease which has no symptoms; modifiable risk factor is weight loss. However, medical complications connected with obesity related health issues are hypertension (HTN), T2DM, pulmonary diseases, OA, metabolic syndrome, hypercholesterolemia, gall bladder disease, heart disease, stroke, fatty liver, sleep apnea, insulin resistance and CVD. Females are affected with gestational diabetes, infertility, polycystic ovary syndrome, menstrual irregularities and female cancers. Obesity is caused due to the Genetics, physical inactivity, age, stress, culture, gender, high protein meal, medical complications and physiological issues (Kinlen et al., 2017). Food habits i.e., high protein food or uncontrolled diet and western life-style will leads to weight gain

(obesity) and altered health conditions (Sivamaruthi et al., 2019). Aetiology of obesity is known as genetics, gender, familial, socio and physiological depression. Central or abdominal obesity resembles either apple or pear shaped obesity in which fat is stored at buttocks or hips. This fat distribution is varied in Waist: Hip ratio; indicates ratio of hip-waist circumferences. Central obesity accurately defines the spreading of body fat and envisages health related obesity issues in normal obesity by BMI. The combination of general and central obesity arises obesity-normal weight central obesity (NWCO) (Segula, 2014; Song et al., 2019). The normal weight subjects with central obesity might be at high risk of mortality due to excess abdominal fat accumulation. In general, people with normal BMI and central obesity are usually ignored in clinical guidelines (Sun et al., 2019).

2. Obesity in Saudi Arabia

Presently, Saudi Arabia is facing a challenge to prevent obesity in present and future generations. Obesity has been adopted in Saudi Arabia since couple of decades through westernized pattern size. 7/10 people in the kingdom are experiencing the other complications such as diabetes, HTN, OA, obstructive sleep apnea and hyperlipidemia (Alqarni, 2016). Individuals with overweight is connected with substantial health benefits; active fitness and lowers the habit of eating disorders. The life-style of sedentary was documented with 45%(Al-Qahtani, 2019). Morbid obesity is defined as the >40 kg/m² or 35 kg/m² appears in co-morbidities (Gastrointestinal, Pulmonary, Physiological, Socio-economic and Cancer).

3. Child obesity in Saudi Arabia

The prevalence of child-hood obesity between 6 and 16 years of children and adolescents has been ripens from 12.7% to 18.2% since 2006–2015 (Al-Hussaini et al., 2019). The obesity in children is associated with effect of BMI adjusted for age and gender. The WHO recommends the CDCC use of BMI percentile for measuring the obesity in children which has been defined in Table2 (Kinlen et al., 2017).

Al Dhaifallah et al. (2015) studies warned the rising prevalence of obesity in the children growing for the future generations. Al-Raddadi et al. (2019) studies has warned the Saudi subjects with obesity may prone to ripens the future complications of risk of pre-diabetes, HTN, diabetes, dyslipidemia, obesity is converted into severe and then extreme or morbid obesity.

Table 1
Classification of BMI as per WHO criteria (Fairbrother et al., 2018).

BMI (Kg/m ²) range	Explanation
<18.5 kg/m ²	Under weight
18.5–24.9 kg/m ²	Normal weight
25.0–29.9 kg/m ²	Overweight
30.0–34.9 kg/m ²	Class-I Obesity (obese)
35.0–39.9 kg/m ²	Class-II Obesity (severe obese)
>40 kg/m ²	Class-III Obesity (morbid obese)
>50 kg/m ²	Class-III Obesity (super obese)

Table 2
Calculation of childhood obesity as per WHO (2017) and CDCC (2015) criteria's.

Cataloguing	BMI standard deviation (WHO)	BMI Percentile (CDCC)
Under weight	<2 SD below mean	<5th
Normal weight	2 SD below to 1 above mean	5th–8th
Overweight	>1 SD above mean	85th–95th
Obese	>2 SD above mean	>95th

4. Family history of obesity

Family history plays a major role in any of the disease in family pedigree and obesity history is a strong risk factor for converting the children into obese (95th percentile) and developing the CVD and metabolic disease particularly linked up with age of onset. Obesity children have a superior risk for carrying the short and terms complications in terms of BMI which is interrelated with body fat and risk factors of CVD (Corica et al., 2018).

5. Genetics

The twin and family studies indicates that genetic background is the essential for the onset of obesity (Silventoinen et al., 2010). Twin family and adoption studies indicates the heritability rate of BMI is high (i.e.;40–70%) indicating as genetic factors have the pivotal role in pathophysiology of obesity (Fu et al., 2019). Heritability in terms of parental obesity is found to be important risk factor for childhood and adolescent obesity (Danielzik et al., 2002). The heritability estimates for obesity and its associated disease traits are in between 40% and 70% (Herrera and Lindgren, 2010). The maternal BMI and other environmental conditions in utero are reported be determinant factors for programming the obesity of their offspring. The positive correlations between weight gain and genetic background of individuals as demonstrated by studies monozygotic (MZ) twins' dizygotic signals the familial aggregation for obesity (Feinleib et al., 1977). A comprehensive review of all the twin and adopted children studies has further confirmed the strong influence of genetic factors over the environmental factors on BMI trend in children, up to 18 years (Silventoinen et al., 2010). Differential prevalence of obesity among racial groups further asserts the importance of genetic component in obesity. For example, obesity is prevalent in around 35% of Caucasians or Asians compared >50% rate of Pima Indian in Mexico (Knowler et al., 1990). However, identifying the specific genotypes which causes obesity has become a challenging task, largely owing to the complicated molecular interactions which regulates adiposity. Population genetic substructure which is differentiated in ethnic clusters is an important factor for the development of obesity. This means that disease causative alleles are likely to be enriched or become specific to few ethnic groups, increasing their risk towards the disease. Other factors like economic background, diet, psychological stress and accessible medical care also influence the development of obesity (Jiao et al., 2015; McPherson et al., 2014; Nielsen et al., 2015; Nordang et al., 2017).

6. Mendelian forms of obesity

Mendelian form of obesity, which occurs in approximately 5% of the population, is caused by molecular alterations in single gene. Single gene forms of obesity are often characterized by its extreme disease phenotype and early onset. Familial obesity studies have been proven very instrumental in discovering obesity causal mutations. Approximately 200 single gene mutations belonging to 10 genes (*PCSK1*, *POMC*, *BDNF*, *MC4R*, *LEP*, *LEPR*, *SIM1* and *NTRK2*) are found to cause autosomal recessive and dominant forms of extreme obesity in 10% of the cases. Most of these genes play important role in regulating energy metabolism through leptin-melanocortin signaling pathway (Farooqi and O'Rahilly, 2005; González-Jiménez et al., 2012; Saeed et al., 2012).

7. Genetics of metabolomics differences in obesity

Metabolomics, the molecular monitoring of metabolites is proposed as an alternate method to diagnose the obesity in contrast,

to standard BMI formula. Human metabolomics refers to the measurement of changes in amino acids, sugars and fatty acids etc in response to the complex interaction between genetic factors and environment. Metabolomics is poised to become an important section of precision medicine, along with other fields like genomics, proteomics and microbiome. Few studies have previously tried to identify metabolic signatures of like amino acid levels, glycerol, and choline derivatives in obesity patients (Chen et al., 2015; Menni et al., 2017; Piening et al., 2018). However, their work has focused limited types of metabolites in certain types of obesity phenotypes. However, the specific influence of different genetic backgrounds on metabolomes of diverse obesity phenotypes is not clearly known. A recent study found no evidence of strong association between polygenic score of known GWAS markers or MC4R carrier status and single metabolite than BMI itself (Cirulli et al., 2018). However, it is well known that genetic components are strong predictors of metabolite levels, and most of the metabolic disturbances which occur in obese condition are a consequence of obesity.

8. How to avoid obesity

The obesity can be avoided by losing the body weight. The weight loss diminishes long-and short-terms of genetic diseases in future complications. Between 5 and 10% of reducing the weight leads to decrease in mortality. Regular physical fitness, protein diet, medications and healthy sleep for 8-hours are the treatment. If the person fails to reduce the weight then they should opt the drug therapies; if this does also fail then they should opt the surgery; if the person is either severe or morbid obesity. Only surgery has recognized effective treatment for long term endure in severe or morbid obesity patients. The national institutes of health, American association of family practitioners, American medical association and national institute of diabetes and digestive and kidney diseases have approved the surgery as treatment in severe or morbid obesity (Abdelaal et al., 2017; Atkinson et al., 2003; Institute of Medicine, 2003).

9. Eligible persons electing the surgery for weight loss

The age ranges for morbid obesity is in between 18 and 60 years. The inclusion criteria were BMI > 35 kg/m² with attempted numerous fails in losing the weight, the patient is acceptable for surgical risk for weight loss by bariatric surgery. The exclusion criteria were obesity is associated with endocrine and metabolic disorder, pregnant women, high risk contraindicated surgery and family history with unsolved psychiatric diseases (Paulus et al., 2015; Williams, 2012).

10. Bariatric surgery

Bariatric (Baros indicates heaviness) surgery (BS) is defined as medical study of obesity causes for prevention and treatment. This surgery is known to be an effective treatment specifically for severe obesity that leads to the improvement of remission of numerous obesity-related comorbidities and constant weight loss over time, betterment in quality of life for protracted survival (Nguyen and Varela, 2017). This surgical intervention was established by national institute of health consensus panel in 1991 (Kuczmarski and Flegal, 2000; Wolfe et al., 2016). BS is also known as a therapeutic intervention to understand and treat the cause and sequelae of morbid obesity. Numerous surgical opportunities are perceptible with continuous evolving, influenced with prior results of literature, specific local conditions and surgical staff experience in their certain countries (Angrisani et al., 2015). BS is an accurate treatment of subjects with diagnosed T2DM and obesity; are failed

to attain recommended treatment targets with prevailing medical therapies majorly for co-morbidities. The prevalence of BS procedures has been increased because of multiple factors; (i) escalating rate of obesity has led to more individuals seeking treatment, (ii) obesity related morbidities and co-morbidities is known as the second factor which has led to increase the obese patients for bariatric surgery, (iii) utilization of BS for treatment of obesity is the lack of long-term effectiveness among non-surgical treatment and other factors includes advanced technology (Elder and Wolfe, 2007). There are different techniques of bariatric surgeries are existing; (i) Roux-en-Y gastric bypass, is commonly known to be performed procedure in which stomach is transected creating a gastric pouch of randomly 1-ounce capacity, (ii) sleeve gastrectomy; stomach will be separated from the body i.e., resected, will be creating a tubular stomach as per the lesser curvature of the stomach. This surgery majorly decreases the stomach size, laparoscopically achieved and is non-reversible and (iii) duodenal switch and the jejunoileal bypass is known to be more complex procedure with the involvement of sleeve gastrectomy is done (Wolfe et al., 2016; Cañete et al., 2018). In 1954, the first BS was performed in Minnesota and Jejunio-ileal bypass was the procedure (Kremen et al., 1954). Later on, in 1966, gastric bypass was introduced as a surgical procedure for weight loss at Iowa university (Mason and Ito, 1996). Griffen et al. (Griffen et al., 1977) reported the initial Roux-en-Y gastric bypass. Next in 1980, surgeons updated and documented as vertical banded gastroplasty. The restrictive procedure lowers the size of stomach and malabsorptive procedure reduces the calorie absorption in the small intestine (Faria, 2017).

11. Complications

Future complications with BS may be vomiting, nausea, abdominal pain, intestinal obstruction and diarrhea, which ensues after the surgery has many potential causes majorly small bowel bacterial overgrowth and food intolerance. Nutritional deficiencies may be rare complication develops in future (Khan et al., 2016; Livingston, 2010). Bleeding, infection, leakage, dehydration and death are common complications of Roux-en-Y gastric bypass and duodenal switch surgeries (Homan et al., 2015).

12. Post-operative surgery

Post-operative monitoring in BS individuals are highly recommended because of weight loss/weight gain, medical, nutritional monitoring and surgical complications (Breznikar and Dinevski, 2009). Post-operative of BS will not support the body fat until and unless patient is committed with regular physical activity and diet. The healthy nutrition diet such as adequate intake of fluid, mineral and multivitamins. The patients must quit the rich protein fat (supper syndrome). Lower sugar levels and liquid diet are recommended after the surgery. Complete liquid diet is recommended for the patient once they are settled from the hospital. Later on, after 4 weeks of the surgery, patients are suggested for semi-solid food diet. Patients should avoid the high fat fast-foods, rice, sugary and caffeinated beverages (Kim et al., 2018). Post-operative BS patients will lower up to 80% of their excess body fat <2 years. Quick improvement in the severe side effects in T2DM, HTN, sleep apnea, obesity and HDL-c levels (Neff and le Roux, 2013). Both observational studies and randomized controlled trails have confirmed BS is apt for treating diabetes and improves the glycemic controls and lowers the risk factors of CVD (Schauer et al., 2017).

13. Bariatric surgery in Saudi obese subjects

Till now limited studies were enrolled with bariatric surgeries in the Saudi population. Severe or morbid obesity subjects will

undergo (i) laparoscopic Roux-en-Y gastric bypass, (ii) laparoscopic sleeve gastrectomy and (iii) laparoscopic adjustable gastric banding in BS in Saudi Arabia. Al-Kadi et al. (Al Kadi et al., 2017) studies confirmed BS as a useful tool to reduce the excess weight in the Saudi subjects. Hamdi et al. (2018) concluded from his study as BS has improved the knee function. However, from Alqahtani et al. (2014) studies concluded as sleeve gastrectomy and other bariatric procedures are safe in Saudi children in managing monogenic and syndromic forms of obesity. BS provides the improved the quality of life and proper follow-up is required to avoid the long-term complications. However, all these studies are required to evaluate long-term follow up with proper diet and minimum of brisk walking.

14. Conclusion

Combination of other risk factors including obesity are now emerging problem in the society. The prevalence of obesity is rising from infant to adults, were affected with various non-communicable diseases. Long term complications are constantly lowering the positive results. The clinicians are recommending bariatric surgery to cutoff the future complications like T2DM, CVD, HTN and coronary artery disease. This review suggests BS is found to be safe to lose the weight and gain a life for a decade. The patients must opt the precise surgery depends on their body weight, self and family history as per the advice by the surgeons. However, post-operative monitoring is mandatory to follow-up with surgeons.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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