Scientific Research Publishing

International Journal of Clinical Medicine, 2025, 16(12), 569-589
https://www.scirp.org/journal/ijcm
ISSN Online: 2158-2882
ISSN Print: 2158-284X

Updates to the Clinical Practice Guidelines for the Management of Overweight and Obesity in Saudi Arabia: Year 2024

Abdulrahman Alshaikh[1], Ali A. Alshehri[2], Hussein Elbadawi[3], Mohammed Aldawish[4], Faisal Abalkhail[5], Fahad Alsabaan[6], Meshal Alaqeel[7], Metib Alotaibi[8], Fahad Aljuraibah[9], Abdullah Abdulaziz Al Wabel[10], Abdullah Fayez Badawi[4], Ahmad Mohammed Alsumaily[11], Khalid Kelis[12], Hussein S. Alamri[13], Lamya Alzubaidi[14], Ahmed Al-Jedai[15], Emad R. Issak[16*], Saud Alsifri[17]

[1]Department of Medicine and Endocrinology, King Abdulaziz University, Jeddah, Saudi Arabia
[2]Endocrinology Department, Obesity, Endocrine & Metabolism Center, King Fahad Medical City, Riyadh, Saudi Arabia
[3]Endocrinology Department, My Clinic, Jeddah, Saudi Arabia
[4]Endocrinology Department, Prince Sultan Military Medical City, Riyadh, Saudi Arabia
[5]Medicine Department, King Faisal Specialist Hospital & Research Center, Riyadh, Saudi Arabia
[6]Medicine Department, Security Forces Hospital, Riyadh, Saudi Arabia
[7]Department of Psychiatry, Ministry of the National Guard-Health Affairs, Riyadh, Saudi Arabia
[8]Endocrinology Department, King Saud University, Riyadh, Saudi Arabia
[9]Pediatrics Department, King Abdullah Specialized Children Hospital, Riyadh, Saudi Arabia
[10]Diabetes Center, University Diabetes Center, King Saud University Medical City, Riyadh, Saudi Arabia
[11]Department of Medicine and Endocrinology, King Abdulaziz Medical City, Riyadh, Saudi Arabia
[12]Endocrinology Department, Diryiah Hospital, Riyadh, Saudi Arabia
[13]Cardiology Department, Prince Sultan Cardiac Center, Riyadh, Saudi Arabia
[14]Department of Internal Medicine and Diabetology, Diabetes Centers, Ministry of Health, Riyadh, Saudi Arabia
[15]Colleges of Medicine and Pharmacy, Alfaisal University, Riyadh, Saudi Arabia
[16]Department of Internal Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[17]Endocrinology Department, Alhada Armed Forces Hospital, Taif, Saudi Arabia
Email: *dr.emad.r.h.issak@gmail.com, *emadroushdy@med.asu.edu.eg

How to cite this paper: Alshaikh, A., Alshehri, A.A., Elbadawi, H., Aldawish, M., Abalkhail, F., Alsabaan, F., Alaqeel, M., Alotaibi, M., Aljuraibah, F., Al Wabel, A.A., Badawi, A.F., Alsumaily, A.M., Kelis, K., Alamri, H.S., Alzubaidi, L., Al-Jedai, A., Issak, E.R. and Alsifri, S. (2025) Updates to the Clinical Practice Guidelines for the Management of Overweight and Obesity in Saudi Arabia: Year 2024. *International Journal of Clinical Medicine*, **16**, 569-589.
https://doi.org/10.4236/ijcm.2025.1612042

Abstract

The global obesity epidemic, fueled by lifestyle changes and declining physical activity, is a significant public health challenge. In Saudi Arabia, obesity rates are among the highest worldwide, with projections indicating a prevalence of 57% in adults and 38% in children by 2035. Obesity poses significant health risks, including diabetes, cardiovascular diseases, and Metabolic dysfunction-associated steatotic liver disease, and imposes a substantial economic burden, with direct and indirect costs exceeding $19 billion annually. Timely intervention is crucial. The updated Saudi Guidelines for Obesity prioritize early diag-

Received: November 17, 2025
Accepted: December 6, 2025
Published: December 9, 2025

nosis and management, emphasizing behaviour modifications, education, and the adoption of evidence-based pharmacologic and surgical options. Notable advancements in pharmacotherapy, such as GLP-1 receptor agonists like semaglutide, offer a ray of hope. They have been shown to not only reduce cardiovascular risk but also potentially benefit renal disease, halt the progression of MASLD, and improve mechanical complications related to obesity, particularly knee osteoarthritis, as well as numerous benefits beyond weight loss. The guidelines advocate for a multifaceted approach that incorporates public awareness campaigns, family-centered interventions, and advanced therapeutic strategies to mitigate the health and economic impacts of obesity. These comprehensive updates aim to improve population health and reduce obesity-related complications in Saudi Arabia.

Keywords

Obesity, Saudi Arabia, GLP-1 Receptor Agonists, Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD), Guidelines

1. Introduction

Scientific advancements have brought unprecedented convenience and comfort, but they have also contributed to a more sedentary lifestyle and reduced physical activity. While technology has improved the quality of life, it has also led to a rise in obesity, which has nearly tripled globally since 1975. Over this nearly 50-year period, scientific progress has coincided with a decline in physical activity, resulting in a global obesity epidemic [1] [2].

According to the World Obesity Atlas 2024, nearly 3.3 billion adults may be affected by high BMI by 2035, compared to 2.2 billion in 2020, an extra increase from 42% in 2020 to over 54% of adults by 2035. For children, the rise from 22% experiencing high BMI (430 million) to over 39% (770 million) by 2035, highlighting the urgent need for effective intervention [3].

In Saudi Arabia (KSA), obesity is a particularly pressing issue, with a systematic review estimating a prevalence rate of 24.95%, and the country ranking as the 14th globally [4]. However, by the year 2035 the prevalence of obesity in KSA in adults expected to be 57%, with an annual increase of 2.1%, and in children the expected prevalence will be 38% with an annual increase of 3.6% [5].

Obesity is a risk factor for various non-communicable diseases, including diabetes, cardiovascular diseases, and osteoarthritis, which further strains healthcare resources. Early intervention, proper management, and lifestyle modifications, such as improved dietary habits and increased physical activity, are crucial strategies in combating this growing epidemic [6]-[8]. Therefore, recognizing the importance of timely and effective obesity management, the Saudi Guidelines for Obesity have been updated to reflect the latest evidence and interventions. These

guidelines emphasize the importance of early diagnosis and proactive management approaches that can prevent the progression of obesity-related complications. Furthermore, addressing modifiable risk factors, improving public awareness, and promoting healthier lifestyles are key components of the updated strategy. These updates provide healthcare providers with a comprehensive framework to reduce obesity prevalence and improve overall public health in the Kingdom.

2. Methods

The Saudi Guidelines for Obesity were updated through a structured, evidence-based process consistent with international guideline development standards. A multidisciplinary expert panel consisting of 18 specialists—including endocrinologists, internal medicine physicians, bariatric surgeons, cardiologists, psychologists, clinical dietitians, family physicians, and public health experts—led the development process.

A comprehensive literature search was conducted in PubMed, Embase, Cochrane Library, and regional databases such as IMEMR for studies published between January 2018 and March 2024. Search terms included combinations of: "obesity", "overweight", "weight management", "anti-obesity medications", "bariatric surgery", "behavioral therapy", "CBT", "ACT", "Saudi Arabia", "Middle East", "clinical practice guidelines", and "metabolic diseases".

Priority was given to systematic reviews, meta-analyses, randomized controlled trials, landmark cohort studies, and major international guidelines (AACE, ADA, AHA/ACC, EASO).

Evidence quality and recommendation strength were assessed using the GRADE approach. Recommendations were then adapted to the Saudi context based on local epidemiology, healthcare system capacity, cultural considerations, and population-specific needs. Consensus on final recommendations was achieved through a modified Delphi process consisting of two voting rounds, followed by review and endorsement by national stakeholders and relevant professional societies. Potential conflicts of interest were declared and managed in accordance with international ethical standards.

3. The Impact of Obesity on Public Health, the Saudi Case

Keeping in mind that the prevalence of overweight and obesity has been steadily increasing, it has significant health and economic implications. While the health risks associated with excess weight are well-documented, the economic burden remains less explored. A recent study aimed to assess both the direct medical costs, and the indirect costs related to absenteeism and presenteeism attributable to overweight and obesity in the country. Using an epidemiologic approach and data from previous studies and secondary sources, the analysis focused on six major noncommunicable diseases. The results showed that the direct medical costs linked to overweight and obesity amounted to $3.8 billion, representing 4.3% of total health expenditures in Saudi Arabia in 2019. Additionally, the cost related to

absenteeism and reduced productivity (presenteeism) were estimated at $15.5 billion, equating to 0.9% of the country's GDP. These findings highlight the significant economic burden of overweight and obesity. The study recommended further research to develop strategies that reduce both the health and economic impacts of excess weight in Saudi Arabia [9].

4. The Call for Early Intervention

Early intervention in obesity prevents comorbidities like diabetes and cardiovascular diseases, reduces healthcare burdens, and enhances psychological well-being by mitigating stigma and boosting self-esteem. Adopting healthy lifestyles early improves metabolic health, mobility, and long-term outcomes while lowering severe complications and healthcare costs. It also enhances energy, sleep, and overall quality of life, reducing premature mortality and emphasizing the importance of proactive management [10]-[12].

Educational sessions for parents and young children on diet and exercise should become regular practice. This would minimize the amount of children starting school overweight or having obesity, as well as the associated difficulties [12].

Long-term follow-up studies have demonstrated that intensive parent-support interventions during early childhood lead to improved body weight outcomes over time, underscoring the importance of family involvement in early obesity treatment. Furthermore, recent research has shown that early treatment of childhood obesity is helpful in both the short and long term, encouraging the deployment of early intervention programs [11].

The American Academy of Pediatrics has revised its guidelines, advocating for urgent and early treatments, including medications and surgery, at younger ages, rather than a "watch and wait" strategy. This trend suggests an increasing awareness of the importance of taking timely action to control childhood obesity [10].

Recommendations:

Implement regular educational programs for parents and children: Healthcare systems and schools should collaborate to provide ongoing educational sessions for parents and young children focused on healthy eating and physical activity. These programs can help prevent childhood obesity by promoting healthier behaviors at an early age, reducing the number of children starting school overweight or obese. (Level of evidence B)

Promote family-centered interventions: Incorporate intensive parent-support interventions as part of early childhood obesity management programs. Research highlights the effectiveness of family participation in achieving better long-term weight outcomes, underscoring the need for strategies that actively involve caregivers in promoting healthy lifestyles within the home environment. (Level of evidence B)

Adopt timely therapeutic strategies: Align with updated guidelines by advocating for early therapeutic interventions, including pharmacologic treatments and surgery, when necessary, for severe cases. This proactive approach avoids de-

lays in treatment and maximizes the potential for successful long-term outcomes in obesity management. (Level of evidence C)

5. Obesity and Cardiovascular Risk

Obesity promotes pericardial, epicardial, and perivascular adipose tissue, with total fat around the heart being connected to CVD and subsequent events. Epicardial fat, a visceral obesity marker located between the myocardium and pericardium, is associated with preclinical atherosclerosis and coronary artery disease (CAD) [13]-[15].

While echocardiography measures epicardial fat thickness, CT imaging provides a more comprehensive assessment by distinguishing between epicardial and pericardial fat, quantifying perivascular adipose tissue, and offering metrics for coronary inflammation that have prognostic value for CVD, even in individuals without obesity. Emerging imaging tools, notably those for perivascular adipose tissue, have the potential to personalize CVD risk assessment; however, evidence for pericardial fat as a marker of metabolically dysfunctional adiposity is less robust [16] [17].

Obesity is causally connected to a variety of chronic illnesses, with CVD accounting for two-thirds of all obesity-related excess mortality. Despite its known link to a wide range of CVD manifestations, including atherosclerotic disease, heart failure, arrhythmias, and sudden cardiac death, obesity is underappreciated and undertreated when compared to other modifiable cardiovascular risk factors. Given the significant public health burden of obesity, the European Society of Cardiology emphasizes the need for both population-level and customized efforts to prevent and manage obesity from childhood to adulthood. Their clinical consensus statement stresses comprehensive weight loss therapies, which include lifestyle changes, interventional procedures, and anti-obesity drugs, with a focus on cardiometabolic risk and cardiovascular outcomes [18].

Pharmacotherapy of Obesity and Cardiovascular Risk

Among the different pharmacologic treatments for obesity, no major trials have examined CV outcomes with orlistat, and patients with CVD were not included in the major trials. Also, an RCT investigating the effects of naltrexone/bupropion on major adverse cardiovascular events (MACE) was terminated early. Due to uncertainties regarding long-term CV safety, this medication is currently under review by the European Medicines Agency (EMA), and caution is advised when prescribing to patients with CVD [18].

Liraglutide is approved for use in adults and children ≥12 years with obesity. It has shown some CV benefits in patients with type 2 diabetes (T2DM), but no specific trial has been conducted with the 3 mg dose (approved for obesity treatment). In a study with T2DM patients treated with liraglutide 1.8 mg/day (not the approved dose for obesity), MACE were reduced by 13% and CV death by 22% compared to placebo [19].

Semaglutide is also approved for obesity in adults and children ≥12 years. The 2.4 mg dose is used for obesity treatment. In a trial with T2DM patients at high CV risk, semaglutide 0.5 or 1.0 mg once weekly reduced MACE by 26% compared to placebo [20]. The SELECT Trial is the first dedicated RCT evaluating the effect on CV outcomes in patients with pre-existing CVD (but no diabetes) and obesity or overweight (BMI ≥27 kg/m^2). The trial found that semaglutide 2.4 mg once weekly was superior to placebo in reducing CV death, non-fatal myocardial infarction, or non-fatal stroke (HR 0.80) [21]. Oral semaglutide form (50 mg once daily) has shown a 12.7% placebo-corrected weight loss over 68 weeks in patients with overweight or obesity and CV risk, though it is not yet approved by EMA or FDA [22].

In patients with T2DM, subcutaneous tirzepatide resulted in higher weight loss and HbA1c reductions than semaglutide 1 mg once-weekly, but has not yet been tested against semaglutide 2.4 mg [23]. The SURMOUNT-MMO study is underway to assess the effect of tirzepatide on CV outcomes in individuals with obesity but no T2DM (NCT05556512) [24].

Currently, the only weight loss strategy with a demonstrated impact in patients with established CVD but no T2DM is semaglutide 2.4 mg/week. Tirzepatide shows promise as an effective option for weight loss and metabolic management in patients with T2DM, although its cardiovascular benefits in individuals with obesity without T2DM are still under investigation. While these therapies offer exciting potential, caution is advised with naltrexone/bupropion in patients with CVD, and orlistat lacks comprehensive data on its cardiovascular safety.

Recommendations:

Patients with overweight or obesity with T2DM should be given glucose-lowering drugs that promote weight loss, such as GLP-1 receptor agonists. (Level of evidence B) [25].

GLP-1 receptor agonists with demonstrated CV benefits (liraglutide, semaglutide subcutaneously, dulaglutide, and efpeglenatide) are recommended for patients with T2DM and atherosclerotic (CVD) to reduce CV events, regardless of baseline or target HbA1c or other concomitant glucose-lowering therapies (Level of evidence A) [25].

GLP-1 receptor agonist semaglutide 2.4 mg is recommended for patients with overweight or obesity and chronic coronary syndrome without diabetes to prevent CV mortality, myocardial infarction, or stroke (Level of evidence B) [26].

6. Management of Obesity and Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD)

Characterized by excessive liver fat in the absence of other causes, Metabolic dysfunction-associated steatotic liver disease (MASLD) is regarded as the hepatic manifestation of the metabolic syndrome and is strongly linked to obesity, insulin resistance, dyslipidemia, and T2DM. MASLD is a leading cause of advanced liver disease globally, including in the Gulf countries, where obesity and T2DMare

prevalent. MASLD cases are categorized into nonalcoholic fatty liver (NAFL) and nonalcoholic steatohepatitis (NASH). While MASLD involves steatosis alone, metabolic dysfunction-associated steatohepatitis (MASH) includes inflammation that can progress to fibrosis, cirrhosis, and hepatocellular carcinoma (HCC), with fibrosis being the key risk factor for severe outcomes, including liver-related mortality. MASH-related end-stage liver disease is increasingly becoming a leading indication for liver transplantation, underscoring the growing burden of metabolic liver diseases in the region [27].

Over the past two decades, MASH has become the leading cause of liver transplantation (LT) in Saudi Arabia, surpassing hepatitis C virus (HCV). From 2001 to 2010, HCV was the primary indication (41.9%), but by 2011-2019, NASH accounted for 29.7% of cases, reflecting the rising prevalence of obesity and metabolic disorders. Meanwhile, effective direct-acting antivirals (DAAs) significantly reduced HCV-related LT. This shift highlights an urgent need for public health measures to address metabolic conditions and reduce the growing burden of MASH on healthcare systems in Saudi Arabia [28].

Weight reduction through caloric restriction is the most effective and evidence-based strategy for improving MASLD across all stages, recommended as first-line treatment in clinical guidelines, emphasizing lifestyle changes such as dietary modifications, increased physical activity, behavioral training, and smoking cessation. While lifestyle interventions significantly reduce MASLD severity and cardiometabolic risk, no medications are currently approved for MASLD treatment. Promising medications, including GLP-1 receptor agonists (e.g., liraglutide, semaglutide), may improve liver health by reducing steatosis and inflammation, though their impact on fibrosis is under research in this area. Other medications like SGLT-2 inhibitors and farnesoid X receptor agonists also show potential for addressing MASLD and obesity despite lacking formal approval for these conditions [29]-[31].

The ESSENCE trial (NCT04822181) is a phase 3, randomized, multicenter study evaluating the efficacy of subcutaneous semaglutide 2.4 mg in participants with biopsy-confirmed MASH and fibrosis stages 2 or 3. The trial aimed to assess semaglutide impact on liver histology, with primary endpoints including resolution of MASH without worsening fibrosis and improvement in fibrosis without worsening MASH. Baseline data from the first 800 participants (mean age 56 years, 57.1% female, mean BMI 34.6 kg/m^2) showed 31.3% had fibrosis stage 2 and 68.8% had stage 3, with 55.5% having type 2 diabetes and >99% meeting at least one cardiometabolic criterion for metabolic dysfunction-associated steatotic liver disease (MASLD). The study highlights the significant cardiometabolic burden in this population [32].

Results from the part 1 of the trial were presented at the 75th American Association for the Study of Liver Diseases (AASLD)—The Liver Meeting® 2024, demonstrating that semaglutide 2.4 mg achieved statistically significant and superior improvements in people with MASH and moderate to advanced fibrosis (stages 2 or

3). The trial met both primary endpoints, with 62.9% of participants on semaglutide achieving resolution of MASH without worsening fibrosis (vs. 34.1% on placebo) and 37.0% showing improvement in liver fibrosis without worsening MASH (vs. 22.5% on placebo). Additionally, 32.8% of semaglutide-treated patients achieved both resolution of MASH and improvement in fibrosis (vs. 16.2% on placebo). Secondary endpoints revealed improvements in liver enzymes (ALT, AST, GGT) and the Enhanced Liver Fibrosis (ELF)™ test, reflecting histological benefits. Semaglutide 2.4 mg exhibited a safety profile consistent with previous trials. These results pave the way for regulatory approval for semaglutide 2.4 mg in MASH treatment [33].

Recommendations:

The treatment of MAFLD & MASH focuses on preserving liver function, preventing progression to end-stage liver disease, and reducing metabolic and cardiovascular complications. (Level of evidence B) [34].

Nutritional therapy should include the Mediterranean diet, aiming for healthy weight loss, limiting saturated fats, and reducing refined carbohydrates. Weight loss of 3% - 5% improves hepatic steatosis, while 7% - 10% is needed for NASH improvements. (Level of evidence B) [34].

Physical activity, including aerobic and resistance exercises, helps maintain a healthy weight, improves insulin sensitivity, and reduces fatty acid delivery to the liver. These benefits may be independent of weight loss. (Level of evidence B) [34].

For patients with pre-obesity or obesity, a weight reduction of 10% through nutrition and physical activity can improve MAFLD & MASH in a short period. (Level of evidence B) [34].

While no medications are specifically approved for MAFLD, vitamin E, pioglitazone, and GLP-1 receptor agonists like liraglutide and semaglutide may offer benefits in reducing liver fat and improving MASH. Leptin therapy can also help in lipodystrophy related MAFLD. The preliminary results of the ESSENCE trial showed the benefits of Semaglutide 2.4 mg in MASH (Level of evidence C) [34].

Bariatric surgery can improve diabetes, dyslipidemia, and liver histology, including MASH-related fibrosis, in patients with severe obesity (Level of evidence B) [34].

Patients with established MASH should avoid alcohol completely, though moderate alcohol consumption may be acceptable for those without advanced liver disease (Level of evidence B) [34].

7. Psychological and Mental Health Impact of Obesity

- **Psychological aspects of obesity**

Obesity is often influenced by psychological factors such as stress, depression, and anxiety, which can contribute to unhealthy eating behaviors and hinder weight loss efforts. Psychological barriers, including emotional eating and low self-esteem, can complicate the management of obesity [35].

A recent Saudi study examined the relationship between obesity, mental health, and quality of life among 480 adult participants. The survey, which included mental health assessments (GAD-2 and PHQ-9), found that 86% of participants believed obesity negatively affected mental health and quality of life, and 98.1% agreed that weight loss could improve both. The majority of participants were male (61.5%) and aged 18-40 years (77.3%). A significant association was observed between BMI and a previous history of psychiatric illness among females. Mental health screenings revealed that 31.5% had depression, with 31.1% experiencing mild depression, and 30.5% had anxiety, with 27.9% reporting mild anxiety and 27.9% moderate anxiety [36].

The study also highlighted the role of family history in the prevalence of mental health disorders, particularly in those with a familial history of psychiatric illness. These findings stress the need for targeted interventions to address obesity's impact on mental health, especially in individuals with a family history of psychiatric conditions. This highlights the importance of incorporating mental health considerations into obesity management to improve the overall well-being of affected individuals [36].

- **Role of cognitive behavioral therapy and psychotherapy**

The goal of a direct psychological intervention could be to help people think about what influences their eating habits. This could entail examining significant food-related narratives from their early years, determining the roles that food may have had in their lives, and detecting recurring patterns in their diet, lifestyle, emotions, and thought processes. Rather than concentrating only on weight loss, psychological therapy should encourage lifestyle changes. People having obesity may be able to adopt healthy behaviors if the focus is reframed more regularly and consciously from weight loss to self-care. Consequently, social support is incorporated into interventions, along with knowledge about how to boost motivation and take care of oneself [35].

Psychological intervention, such as motivational interviewing, can help an individual explore their readiness to change. It may also assist an individual in bridging the gap between having good attitudes about behavioral change and knowing what behaviors to modify, as well as implementing such behaviors. Psychological therapy can help a person assess the efficiency of their responses to internal experiences and identify alternative responses. For example, cognitive behavioral therapy (CBT) assists individuals in challenging negative views in order to encourage change in their ideas and feelings, which leads to changes in unhelpful behaviors. A CBT-trained expert can help with issues including body image, self-esteem, anxiety, and emotionally driven eating, among others. Learning more effective stress coping strategies and realizing this interplay may aid in developing a better knowledge of how to address the weight-loss issues connected with stress eating [37].

Third-wave cognitive behavioral therapy (CBT) approaches, such as Acceptance and Commitment Therapy (ACT), have shown benefits for individuals living with

obesity. ACT focuses on increasing awareness of internal experiences like thoughts, feelings, and physical sensations, as well as external cues that can lead to actions inconsistent with personal goals and values, such as eating unhealthy foods in response to cravings. By promoting the acceptance of challenging internal experiences, ACT encourages individuals to make choices aligned with their values, supporting long-term diet and lifestyle changes. Psychological factors are known to influence bariatric surgery outcomes, so integrating ACT and similar therapies into weight management services can improve their effectiveness [35].

Recommendations:

All patients with overweight or obesity should undergo routine mental health screening at baseline and during follow-up. Validated tools such as the PHQ-9 (for depression) and GAD-2 (for anxiety) should be incorporated into standard obesity care pathways in Saudi Arabia. (Level of evidence B)

Incorporate **cognitive behavioral therapy** (CBT) to help individuals address negative thoughts related to body image, emotional eating, and self-esteem. Encourage a shift in focus from weight loss to overall lifestyle change and self-care, promoting healthier behaviors that support long-term weight management. (Level of evidence B)

Utilize third-wave CBT approaches like **acceptance and commitment therapy** (ACT) to help individuals accept challenging emotions and align their behaviors with health goals. This can be especially effective in managing cravings and improving long-term dietary changes, including for those undergoing bariatric surgery. (Level of evidence B)

Reframe the goal from weight loss to self-care, focusing on sustainable lifestyle changes. Incorporate social support to enhance motivation, helping individuals stick to healthier behaviors and improve their quality of life. (Level of evidence B)

Collaborate across disciplines, including mental health professionals, dietitians, and medical providers, to create comprehensive and person-centered obesity management plans. (Level of evidence B)

8. Integration of New Pharmacotherapy Options and Future Directions

Pharmacotherapy for weight management is recommended for adults with a BMI $\geq$ 30 kg/m^2 or those with a BMI $\geq$ 27 kg/m^2 accompanied by adiposity-related complications. Medications should always be used as an adjunct to medical nutrition therapy, physical activity, and psychological interventions to optimize weight loss outcomes and maintenance [38].

For long-term obesity management in KSA, several medications are available and have demonstrated effectiveness in achieving significant weight reduction compared to placebo. These include liraglutide 3.0 mg (administered daily), semaglutide 2.4 mg (administered weekly), Tirzepatide 15 mg, naltrexone/bupropion combination tablets, and orlistat. The choice of medication should be based on individual clinical conditions, patient preferences, and tolerability. The FDA-ap-

proved medications for long-term treatment of obesity are shown in the following table (**Table 1**) [38] [39].

Table 1. FDA-approved medications for the long-term treatment of obesity [39].

	Indication	Dosing	Common adverse events
Semaglutide injection GLP-1 RA	As an adjunct to low-calorie diet and increased physical activity for chronic weight management in adults with an initial BMI ≥ 30 kg/m^2 or ≥ 27 kg/m^2 in the presence of ≥ 1 weight related comorbid condition. (eg, hypertension, T2D, dyslipidemia)	0.25 mg SC once weekly for 4 wk. to start, followed by dosage escalations as per package labeling to a maintenance dose of 2.4 mg SC once weekly give on the same day each week, at any time of day, with or without meals.	Nausea, diarrhea, vomiting, constipation, abdominal pain, headache, fatigue, dyspepsia, dizziness, abdominal distension, eructation, hypoglycemia in T2D, flatulence, gastroenteritis, GERD.
Liraglutide injection GLP-1 RA		0.6 mg SC for 1 wk to start, followed by dose escalations as per package labeling to a recommended dose of 3 mg SC once daily.	Nausea, diarrhea, constipation, vomiting, injection site reaction, headache, hypoglycemia in T2D, dyspepsia, fatigue, dizziness, abdominal pain, increased lipase, upper abdominal pain.
Trizepatide (dual GLP-1 & GIP RAs)	individuals with type 2 diabetes mellitus and obesity	Start by 5 mg, then escalate to 10 mg, and 15 mg	Nausea, diarrhea, vomiting, constipation, abdominal pain, headache, fatigue, dyspepsia, dizziness, abdominal distension, eructation, hypoglycemia in T2D, flatulence, gastroenteritis, GERD
Phentermine HCl and topiramate extended-release capsules (Combination sympathomimetic amine anorectic/ anti-epileptic analogue	As an adjunct to a reduced calorie diet and increased physical activity for chronic weight management in adults with an initial BMI ≥ 30 kg/m^2 or ≥ 27 kg/m^2 in the presence of ≥ 1 weight-related comorbidity (eg, hypertension, T2D, dyslipidemia)	One 3.75-mg phentermine HCl/2-mg topiramate extended-release cap PO once daily in the morning for 14 d to start. Continue on a dose escalation schedule based on BMI; give with or without food.	Paresthesia, dizziness, dysgeusia, insomnia, constipation, and dry mouth
Naltrexone HCl and bupropion HCl extended-release Tablets Combination opioid antagonist/ aminoketone antidepressant		One 8-mg naltrexone HCl /90-mg bupropion HCl extended-release tab PO once daily in the morning for 1 wk to start. Continue on a dose escalation schedule, up to 2 extended-release tabs PO twice daily.	Nausea, constipation, headache, vomiting, dizziness, insomnia
Orlistat Lipase inhibitor	Obesity management, including weight loss and weight maintenance when used with a reduced-calorie diet. Reduction of risk for weight regain after prior weight loss. For use in patients with an initial BMI ≥ 30 kg/m^2 or ≥ 27 kg/m^2 in the presence of other risk factors (eg, hypertension, T2D, dyslipidemia)	One 120-mg cap PO 3 times/d with each main meal containing fat (during or up to 1 h after the meal)	GI symptoms: • Oily spotting • Flatus with discharge • Fecal urgency • Fatty/oily stool • Oily evacuation • Increased defecation • Fecal incontinence

Adjunctive pharmacotherapy with liraglutide, semaglutide, or orlistat is specifically recommended for individuals with prediabetes and a BMI ≥ 27 kg/m^2 to delay or prevent the progression to type 2 diabetes. This approach should be coupled with comprehensive health behavior changes to maximize efficacy [38].

Liraglutide 3.0 mg and semaglutide 2.4 mg, both GLP-1 receptor agonists (GLP-1 RAs), are effective pharmacological options for obesity management. Semaglutide offers the advantage of once-weekly dosing compared to the daily administration required for liraglutide, alongside improved pharmacokinetics and superior efficacy. When prescribing GLP-1 RAs, gradual dose titration is essential to minimize gastrointestinal side effects. Patients should be counseled on potential adverse effects such as nausea, vomiting, and diarrhea, and treatment should be discontinued if pancreatitis is suspected. For liraglutide, caution is advised in patients with kidney disease to prevent acute kidney injury, especially during dose initiation or escalation [38].

Tirzepatide is initially approved for improving glycemic control in type 2 diabetes (T2DM). Clinical trials, such as SURMOUNT-1 and SURMOUNT-2, demonstrated dose-dependent weight reduction, with patients achieving 15% - 20.9% mean weight loss and 85% - 91% achieving at least a 5% reduction in weight. The three trials: SURMOUNT-2, SURMOUNT-3 and SURMOUNT-4 confirmed weight loss. However, SURMOUNT-4 highlighted weight regains after tirzepatide withdrawal, emphasizing the need for continued treatment. The most frequent adverse events are nausea, diarrhea, and vomiting, particularly at higher doses (10 mg and 15 mg). However, no real-world data in Saudi Arabia was carried out [40]-[43].

Orlistat can also be considered for adults with BMI ≥ 30 kg/m^2 or BMI ≥ 27 kg/m^2 with comorbidities. It should be prescribed alongside lifestyle interventions, taking into account individual preferences and potential side effects [38].

Real-world data from Saudi Arabia underscores the significant benefits of semaglutide in managing weight loss and glycemic control among individuals with uncontrolled type 2 diabetes mellitus (T2DM). The EVOLUTION study, conducted across 18 centers, demonstrated that semaglutide, administered subcutaneously or orally, significantly reduced glycated hemoglobin (HbA1c) levels and body mass index (BMI). At 12 months, the average HbA1c decreased by 3.17%, and BMI showed a notable reduction of 19.89%. Additionally, hypoglycemia events decreased markedly from 4.60 events in the three months before initiation to 0.80 events in the last three months of the study. These findings indicate that semaglutide provides both glycemic improvement and meaningful weight loss in routine clinical settings, alongside enhanced lipid profiles and blood pressure [44].

The REVOLUTION study further highlights the effectiveness of oral semaglutide specifically in Saudi patients under real-world conditions. Similar to the EVOLUTION study, significant reductions were observed in HbA1c (3.2%) and BMI (19.7%) at the 12-month follow-up. The frequency of hypoglycemia events declined significantly, from 4.4 events before treatment to just 0.7 events after 12

months. These improvements were accompanied by enhanced lipid profiles and blood pressure, demonstrating the dual benefits of glycemic and cardiovascular risk factor management. Together, these studies emphasize the value of semaglutide in achieving substantial clinical benefits in weight management and diabetes care within the Saudi population [45].

Real-world data from King Fahad Medical City in Saudi Arabia highlights the clinical effectiveness of Liraglutide 3.0 mg for weight loss and improving obesity-related comorbidities. In a retrospective cohort of 399 individuals with obesity, an average weight loss of 6.5 kg was observed over six months, with 52.6% achieving a ≥5% reduction in body weight and 27.8% achieving a ≥10% reduction. Furthermore, Liraglutide 3.0 mg significantly improved glycemic control, as evidenced by a 0.5% reduction in HbA1c ($p < 0.0001$). These findings demonstrate the efficacy of Liraglutide 3.0 mg in promoting meaningful weight loss and better managing diabetes in real-world clinical practice within Saudi Arabia [46].

Recommendations:

Pharmacotherapy is recommended for adults with a BMI ≥ 30 kg/m^2 or BMI ≥ 27 kg/m^2 with adiposity-related complications, alongside medical nutrition therapy, physical activity, and psychological interventions. (Level of evidence B)

Approved medications for long-term obesity management in KSA include liraglutide 3.0 mg (daily), semaglutide 2.4 mg (weekly), tirzepatide 15 mg (weekly), naltrexone/bupropion, and orlistat. Selection should be based on individual needs and clinical conditions. (Level of evidence C)

For individuals with prediabetes and BMI ≥ 27 kg/m^2, liraglutide, semaglutide, or orlistat is recommended to delay or prevent type 2 diabetes, combined with lifestyle changes. (Level of evidence B)

Liraglutide and semaglutide are effective GLP-1 RAs for obesity management, with semaglutide offering weekly dosing and greater efficacy. Dose titration is crucial to minimize gastrointestinal side effects, and caution is advised in patients with pancreatitis or kidney disease. (Level of evidence B)

Emerging therapies, including next-generation GLP-1 RAs and novel anti-obesity drugs, should be incorporated as they become available, tailored to patient-specific needs. (Level of evidence B)

Future research in Saudi Arabia should prioritize generating real-world evidence on the efficacy, safety, tolerability, and adherence patterns of newer anti-obesity medications including tirzepatide in diverse Saudi populations. (Level of evidence C)

9. Bariatric Surgery and Endoscopic Procedures

Bariatric surgery was recognized as an effective approach in the treatment of obesity, while recent advances in pharmacotherapy have restricted its use. Various approaches are utilized to stimulate weight loss in patients who have consistently failed to lose weight through other means. Bariatric surgery seeks to minimize intake by limiting gastric capacity and/or uptake by reducing exposure to the small

intestinal absorptive region [38].

The main goal of bariatric surgery is to achieve weight loss in people who have been unable to lose weight by non-surgical techniques. The most frequent bariatric surgical treatment is Roux-en-Y Gastric Bypass (RYGB), which involves cutting the stomach to create a gastric pouch with a capacity of about one ounce. Sleeve gastrectomy (SG) involves resecting around 80% of the stomach to form a tubular stomach. Other bariatric surgeries (Table 2) include biliopancreatic diversion with duodenal switch and implanted devices. Several studies in recent years have found that bariatric surgery produces better weight loss results. However, bariatric surgery has risks, like as surgical difficulties and dietary inadequacies [47]-[49].

Recommendations:

For adults with BMI > 40 kg/m^2 or adults with BMI > 35 kg/m^2 and comorbidities that may improve with weight loss, bariatric surgery may be considered, considering the individual situation. (Level of evidence A)

The choice of surgical technique should be individualized and involves a discussion between the surgeon and the person. (Level of evidence B)

When indicated, bariatric surgery should be included as part of an overall clinical pathway for adult weight management delivered by a multidisciplinary team (including surgeons, dietitians, nurses, psychologists, and physicians) and includes planning for continuing follow-up. (Level of evidence B)

Table 2. FDA-approved and/or ASMBS-endorsed procedures for weight-loss [50] [51].

Procedure	Target weight loss, %	Favorable aspects	Unfavorable aspects
Laparoscopic adjustable gastric banding	20% - 25%	No anatomic alteration Removable Adjustable Easy to perform	High explant rate Erosion Slip/prolapse
Sleeve gastrectomy	25% - 30%	No anastomosis Reproducible Few long-term complications Metabolic effects Versatile for challenging patient populations	Leaks difficult to manage. Little data beyond 5 yr 20% - 30% GERD
Roux-en-Y gastric bypass	30% - 35%	Strong metabolic effects Standardized techniques <5% major complication rate Effective for GERD Can be used as second stage after sleeve gastrectiomy	Few proven revisional options for weight regain Marginal ulcers Internal hernias possible Long-term micronutrient deficiencies
Biliopancreatic diversion with duodenal switch	35% - 45%	Very strong metabolic effects Durable weight loss Effective for patients with very high BMI Can be used as second stage after sleeve gastrectomy	Malabsorptive 3% - 5% protein-calorie malnutrition GERD Potential for hernias Duodenal dissection Technically challenging Higher rate of micronutrient deficiencies than roux-en-Y gastric bypass

Continued

Single anastomosis duodeno-ileal bypass with sleeve gastrectomy	35% - 45%	Single anastomosis Simpler to perform than bioliopancreatic diversion with duodenal switch Strong metabolic effects Low early complication rate	Little long-term data Nutritional and micronutrient deficiencies possible Duodenal dissection
Intragastric balloon	10% - 12%	Endoscopic or swallowed Good safety profile	Temporary (6 mo) therapy Temporary nausea/vomiting, pain Early removal rate of 10% - 19%
One-anastomosis gastric bypass	35% - 40%	Simpler to perform than Roux-en-Y gastric bypass More malabsorptive Strong metabolic effects No mesenteric defects	Potential for bile reflux Malabsorptive (long biliopancreatic limb) Little experience in the United States

ASMBS, American Society of Metabolic and Bariatric Surgery; BMI, body mass index; GERD, gastroesophageal reflux disease; mo, month; yr, year.

10. Management of Obesity in Pediatric and Adolescent Age Groups

Childhood obesity has increased in Saudi Arabia over the last few decades, although the true impact remains unknown due to small sample size and prior studies' reliance on international growth benchmarks. A recent retrospective population-based study used the Saudi growth chart to measure obesity prevalence among 351,195 children and adolescents (96% Saudis) aged 2 to 19 years who visited National Guard Health System institutions between 2016 and 2021. Overall, 11.2% had overweight and 9.4% had obesity, with children aged 2 to 6 years having the highest obesity prevalence (12.3%) and boys (10.4%) compared to girls (8.3%). Obesity prevalence was highest in the Central and Eastern areas (9.9%) [52].

There are several factors behind the increased prevalence of overweigh and obesity among children in Saudi Arabia. Increased television viewing, consumption of energy-dense foods, and sugar-sweetened beverages all pose major health risks to Saudi school children. These unhealthy behaviors increase susceptibility to food deficiencies, potentially interfering with physiological development and growth. Similarly, college students are typically influenced by poor eating habits, such as midnight snacking, sleeping right after dinner, drinking energy drinks, and engaging in prolonged inactivity, such as excessive use of laptops, mobile phones, television, and video games. A study also found a significant concentration of fast-food restaurants near educational facilities in Riyadh, which has been connected to increased fast food consumption among students. These findings highlight the critical need for obesity prevention initiatives that target both children and parents [53]-[55].

Childhood obesity is a complex condition requiring a multifaceted approach to management, supported by evidence-based interventions.

Key recommendations include:

1) Behavioral Interventions

Engaging families in lifestyle changes, including meal planning, physical activities, and behavioral modifications, is the cornerstone of effective obesity management. (Level of evidence B)

Tools like food diaries and activity trackers can help children and families identify unhealthy patterns and set realistic goals. (Level of evidence B)

2) Dietary Modifications

Emphasis on fruits, vegetables, whole grains, lean proteins, and healthy fats while reducing sugar-sweetened beverages and energy-dense snacks. Educating children and families about appropriate portion sizes to avoid overconsumption. (Level of evidence B)

3) Physical Activity

At least 60 minutes of moderate to vigorous physical activity daily, including aerobic exercises, muscle-strengthening activities, and reduced sedentary time. (Level of evidence B)

Encouraging outdoor activities over screen time. (Level of evidence B)

4) Psychological Support

Cognitive behavioral therapy (CBT) helps address emotional eating, self-esteem issues, and motivation for long-term adherence to healthy behaviors. (Level of evidence B)

Parental involvement: Parents serve as role models, fostering a supportive environment for change. (Level of evidence B)

5) Clinical Interventions

Screening and monitoring: regular assessments of BMI, growth patterns, and comorbid conditions like hypertension, dyslipidemia, and type 2 diabetes. (Level of evidence B)

Medications like orlistat, liraglutide or semaglutide may be considered in adolescents with severe obesity when lifestyle modifications alone are insufficient, under strict medical supervision. (Level of evidence B)

6) Community and School-Based Programs

Healthy school environments: implementing policies to promote healthy meals, physical education, and restricted access to energy-dense foods in schools. (Level of evidence C)

Community engagement: public health campaigns and community activities aimed at raising awareness about healthy lifestyles. (Level of evidence B)

7) Bariatric Surgery

Reserved for adolescents with severe obesity and significant comorbidities who have not responded to other interventions. Surgical options must be carefully evaluated by a multidisciplinary team. (Level of evidence A)

8) Policy-Level Interventions

Regulations on food advertising: restricting marketing of unhealthy foods to children.

Taxation on sugar-sweetened beverages: evidence shows reduced consumption with taxation policies.

Urban planning: ensuring access to parks, recreational facilities, and walkable neighborhoods to encourage physical activity. (Level of evidence B)

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Alsulami, S., Baig, M., Ahmad, T., Althagafi, N., Hazzazi, E., Alsayed, R., *et al.* (2023) Obesity Prevalence, Physical Activity, and Dietary Practices among Adults in Saudi Arabia. *Frontiers in Public Health*, **11**, Article 1124051. https://doi.org/10.3389/fpubh.2023.1124051

[2] WHO (2024) Obesity and Overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

[3] World Obesity Federation Global Obesity Observatory (2024) World Obesity Day Atlases | Obesity Atlas 2024. https://data.worldobesity.org/publications/?cat=22

[4] Okati-Aliabad, H., Ansari-Moghaddam, A., Kargar, S. and Jabbari, N. (2022) Prevalence of Obesity and Overweight among Adults in the Middle East Countries from 2000 to 2020: A Systematic Review and Meta-Analysis. *Journal of Obesity*, **2022**, Article ID: 8074837. https://doi.org/10.1155/2022/8074837

[5] World Obesity Federation (2024) World Obesity Atlas 2023. https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2023

[6] Al-Jawaldeh, A. and Abbass, M.M.S. (2022) Unhealthy Dietary Habits and Obesity: The Major Risk Factors Beyond Non-Communicable Diseases in the Eastern Mediterranean Region. *Frontiers in Nutrition*, **9**, Article 817808. https://doi.org/10.3389/fnut.2022.817808

[7] Lin, X. and Li, H. (2021) Obesity: Epidemiology, Pathophysiology, and Therapeutics. *Frontiers in Endocrinology*, **12**, Article 706978. https://doi.org/10.3389/fendo.2021.706978

[8] Alshaikh, A., *et al.* (2024) Clinical Practice Guideline for the Management of Overweight and Obesity in Adults in Saudi Arabia. *International Journal of Clinical Medicine*, **13**, 590-649. https://www.scirp.org/journal/paperinformation?paperid=121881

[9] Malkin, J.D., Baid, D., Alsukait, R.F., Alghaith, T., Alluhidan, M., Alabdulkarim, H., *et al.* (2022) The Economic Burden of Overweight and Obesity in Saudi Arabia. *PLOS ONE*, **17**, e0264993. https://doi.org/10.1371/journal.pone.0264993

[10] Hampl, S.E., Hassink, S.G., Skinner, A.C., Armstrong, S.C., Barlow, S.E., Bolling, C.F., *et al.* (2023) Clinical Practice Guideline for the Evaluation and Treatment of Children and Adolescents with Obesity. *Pediatrics*, **151**, e2022060640. https://doi.org/10.1542/peds.2022-060640

[11] Ek, A., Brissman, M., Nordin, K., Eli, K. and Nowicka, P. (2023) A Long-Term Follow-Up of Treatment for Young Children with Obesity: A Randomized Controlled Trial. *International Journal of Obesity*, **47**, 1152-1160. https://doi.org/10.1038/s41366-023-01373-7

[12] Narzisi, K. and Simons, J. (2020) Interventions That Prevent or Reduce Obesity in Children from Birth to Five Years of Age: A Systematic Review. *Journal of Child Health Care*, **25**, 320-334. https://doi.org/10.1177/1367493520917863

[13] Iacobellis, G. (2022) Epicardial Adipose Tissue in Contemporary Cardiology. *Nature*

Reviews Cardiology, **19**, 593-606. https://doi.org/10.1038/s41569-022-00679-9

[14] Shah, R.V., Anderson, A., Ding, J., Budoff, M., Rider, O., Petersen, S.E., *et al.* (2017) Pericardial, but Not Hepatic, Fat by CT Is Associated with CV Outcomes and Structure: The Multi-Ethnic Study of Atherosclerosis. *JACC*: *Cardiovascular Imaging*, **10**, 1016-1027. https://doi.org/10.1016/j.jcmg.2016.10.024

[15] Antoniades, C., Tousoulis, D., Vavlukis, M., Fleming, I., Duncker, D.J., Eringa, E., *et al.* (2023) Perivascular Adipose Tissue as a Source of Therapeutic Targets and Clinical Biomarkers. *European Heart Journal*, **44**, 3827-3844. https://doi.org/10.1093/eurheartj/ehad484

[16] Oikonomou, E.K., *et al.* (2021) Standardized Measurement of Coronary Inflammation Using Cardiovascular Computed Tomography: Integration in Clinical Care as a Prognostic Medical Device. *Cardiovascular Research*, **117**, 2677-2690. https://pubmed.ncbi.nlm.nih.gov/34450625/

[17] Oikonomou, E.K., Marwan, M., Desai, M.Y., Mancio, J., Alashi, A., Hutt Centeno, E., *et al.* (2018) Non-Invasive Detection of Coronary Inflammation Using Computed Tomography and Prediction of Residual Cardiovascular Risk (the CRISP CT Study): A Post-Hoc Analysis of Prospective Outcome Data. *The Lancet*, **392**, 929-939. https://doi.org/10.1016/s0140-6736(18)31114-0

[18] Koskinas, K.C., Van Craenenbroeck, E.M., Antoniades, C., Blüher, M., Gorter, T.M., Hanssen, H., *et al.* (2024) Obesity and Cardiovascular Disease: An ESC Clinical Consensus Statement. *European Heart Journal*, **45**, 4063-4098.

[19] Marso, S.P., *et al.* (2016) Liraglutide and Cardiovascular Outcomes in Type 2 Diabetes. *The New England Journal of Medicine*, **375**, 311-322. https://pubmed.ncbi.nlm.nih.gov/27295427/

[20] Marso, S.P., Bain, S.C., Consoli, A., Eliaschewitz, F.G., Jódar, E., Leiter, L.A., *et al.* (2016) Semaglutide and Cardiovascular Outcomes in Patients with Type 2 Diabetes. *New England Journal of Medicine*, **375**, 1834-1844. https://doi.org/10.1056/nejmoa1607141

[21] Lincoff, A.M., Brown-Frandsen, K., Colhoun, H.M., Deanfield, J., Emerson, S.S., Esbjerg, S., *et al.* (2023) Semaglutide and Cardiovascular Outcomes in Obesity without Diabetes. *New England Journal of Medicine*, **389**, 2221-2232. https://doi.org/10.1056/nejmoa2307563

[22] Knop, F.K., Aroda, V.R., do Vale, R.D., Holst-Hansen, T., Laursen, P.N., Rosenstock, J., *et al.* (2023) Oral Semaglutide 50 mg Taken Once per Day in Adults with Overweight or Obesity (OASIS 1): A Randomised, Double-Blind, Placebo-Controlled, Phase 3 Trial. *The Lancet*, **402**, 705-719. https://doi.org/10.1016/s0140-6736(23)01185-6

[23] Frías, J.P., Davies, M.J., Rosenstock, J., Pérez Manghi, F.C., Fernández Landó, L., Bergman, B.K., *et al.* (2021) Tirzepatide versus Semaglutide Once Weekly in Patients with Type 2 Diabetes. *New England Journal of Medicine*, **385**, 503-515. https://doi.org/10.1056/nejmoa2107519

[24] (2022) A Phase 3, Randomized, Double-blind, Placebo-Controlled Study to Investigate the Effect of Tirzepatide on the Reduction of Morbidity and Mortality in Adults with Obesity. https://clinicaltrials.gov/study/NCT05556512

[25] Marx, N., Federici, M., Schütt, K., Müller-Wieland, D., Ajjan, R.A., Antunes, M.J., *et al.* (2023) 2023 ESC Guidelines for the Management of Cardiovascular Disease in Patients with Diabetes. *European Heart Journal*, **44**, 4043-4140.

[26] Vrints, C., Andreotti, F., Koskinas, K.C., Rossello, X., Adamo, M., Ainslie, J., *et al.* (2024) 2024 ESC Guidelines for the Management of Chronic Coronary Syndromes:

Developed by the Task Force for the Management of Chronic Coronary Syndromes of the European Society of Cardiology (ESC) Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS). *European Heart Journal*, **45**, 3415-3537. https://doi.org/10.1093/eurheartj/ehae177

[27] Alswat, K., Aljumah, A.A., Sanai, F.M., Abaalkhail, F., Alghamdi, M., Al Hamoudi, W.K., *et al.* (2018) Nonalcoholic Fatty Liver Disease Burden—Saudi Arabia and United Arab Emirates, 2017-2030. *Saudi Journal of Gastroenterology*, **24**, 211-219. https://doi.org/10.4103/sjg.sjg_122_18

[28] Alqahtani, S.A., Broering, D.C., Alghamdi, S.A., Bzeizi, K.I., Alhusseini, N., Alabbad, S.I., *et al.* (2021) Changing Trends in Liver Transplantation Indications in Saudi Arabia: From Hepatitis C Virus Infection to Nonalcoholic Fatty Liver Disease. *BMC Gastroenterology*, **21**, Article No. 245. https://doi.org/10.1186/s12876-021-01828-z

[29] Polyzos, S.A., Goulis, D.G., Giouleme, O., Germanidis, G.S. and Goulas, A. (2022) Anti-obesity Medications for the Management of Nonalcoholic Fatty Liver Disease. *Current Obesity Reports*, **11**, 166-179. https://doi.org/10.1007/s13679-022-00474-0

[30] Nevola, R., Epifani, R., Imbriani, S., Tortorella, G., Aprea, C., Galiero, R., *et al.* (2023) GLP-1 Receptor Agonists in Non-Alcoholic Fatty Liver Disease: Current Evidence and Future Perspectives. *International Journal of Molecular Sciences*, **24**, Article 1703. https://doi.org/10.3390/ijms24021703

[31] Zelber-Sagi, S. and Moore, J.B. (2024) Practical Lifestyle Management of Nonalcoholic Fatty Liver Disease for Busy Clinicians. *Diabetes Spectrum*, **37**, 39-47. https://doi.org/10.2337/dsi23-0009

[32] Newsome, P.N., Sanyal, A.J., Engebretsen, K.A., Kliers, I., Østergaard, L., Vanni, D., *et al.* (2024) Semaglutide 2.4 mg in Participants with Metabolic Dysfunction-Associated Steatohepatitis: Baseline Characteristics and Design of the Phase 3 Essence Trial. *Alimentary Pharmacology & Therapeutics*, **60**, 1525-1533. https://doi.org/10.1111/apt.18331

[33] Newsome, S.A., Kliers, I., *et al.* (2024) Phase 3 ESSENCE Trial: Semaglutide in MetaBolic Dysfunction-Associated Steatohepatitis (MASH). Presented at the Liver Meeting®, American Association for the Study of Liver Diseases. https://www.prnewswire.com/news-releases/essence-phase-3-trial-results-demonstrating-statistically-significant-and-superior-improvements-with-semaglutide-2-4-mg-in-people-with-mash-presented-at-aasld-2024--the-liver-meeting-302310474.html

[34] Karjoo, S., Auriemma, A., Fraker, T. and Bays, H.E. (2022) Nonalcoholic Fatty Liver Disease and Obesity: An Obesity Medicine Association (OMA) Clinical Practice Statement (CPS) 2022. *Obesity Pillars*, **3**, Article ID: 100027. https://doi.org/10.1016/j.obpill.2022.100027

[35] Dandgey, S. and Patten, E. (2023) Psychological Considerations for the Holistic Management of Obesity. *Clinical Medicine*, **23**, 318-322. https://doi.org/10.7861/clinmed.2023-0146

[36] Al Nasser, K.A., Alsaffar, Y.K. and Al Hazmi, A.N. (2024) Correlation between Obesity and Mental Health Status in Riyadh, Saudi Arabia. *Cureus*, **16**, e53976.

[37] Castelnuovo, G., Pietrabissa, G., Manzoni, G.M., Cattivelli, R., Rossi, A., Novelli, M., *et al.* (2017) Cognitive Behavioral Therapy to Aid Weight Loss in Obese Patients: Current Perspectives. *Psychology Research and Behavior Management*, **10**, 165-173. https://doi.org/10.2147/prbm.s113278

[38] Alshaikh, A., Aljedai, A., Alfadda, A., Alrobayan, A., Bawahab, A., Ouf, S.A., *et al.* (2022) Clinical Practice Guideline for the Management of Overweight and Obesity in

Adults in Saudi Arabia. *International Journal of Clinical Medicine*, **13**, 590-649. https://doi.org/10.4236/ijcm.2022.1312045

[39] Cornier, M.A. (2022) A Review of Current Guidelines for the Treatment of Obesity. https://www.ajmc.com/view/review-of-current-guidelines-for-the-treatment-of-obesity

[40] Alhabeeb, W., Kinsara, A.J., Bakhsh, A., Tash, A., Alshammary, A., Almasood, A., *et al.* (2024) A Saudi Heart Association Position Statement on Obesity and Cardiovascular Disease. *Journal of the Saudi Heart Association*, **36**, 263-300. https://doi.org/10.37616/2212-5043.1391

[41] Aronne, L.J., Sattar, N., Horn, D.B., Bays, H.E., Wharton, S., Lin, W.Y., *et al.* (2024) Continued Treatment with Tirzepatide for Maintenance of Weight Reduction in Adults with Obesity: The Surmount-4 Randomized Clinical Trial. *JAMA*, **331**, 38-48.

[42] Wadden, T.A., Chao, A.M., Machineni, S., Kushner, R., Ard, J., Srivastava, G., *et al.* (2023) Tirzepatide after Intensive Lifestyle Intervention in Adults with Overweight or Obesity: The SURMOUNT-3 Phase 3 Trial. *Nature Medicine*, **29**, 2909-2918. https://doi.org/10.1038/s41591-023-02597-w

[43] Garvey, W.T., Frias, J.P., Jastreboff, A.M., Le Roux, C.W., Sattar, N., Aizenberg, D., *et al.* (2023) Tirzepatide Once Weekly for the Treatment of Obesity in People with Type 2 Diabetes (SURMOUNT-2): A Double-Blind, Randomised, Multi-Centre, Placebo-Controlled, Phase 3 Trial. *Lancet*, **402**, 613-626.

[44] Alsheikh, A., Alshehri, A., Alzahrani, S., Jammah, A.A., Alqahtani, F., Alotaibi, M., *et al.* (2023) Evaluating the Clinical Effectiveness and Safety of Semaglutide in Individuals with Uncontrolled Type 2 Diabetes. Real-World Evidence from Saudi Arabia: The Observational, Multicenter, 15-Month EVOLUTION Study. *Diabetes Therapy*, **15**, 473-485. https://doi.org/10.1007/s13300-023-01516-z

[45] Alsheikh, A., Alshehri, A., Alzahrani, S., AlJammah, A., Alqahtani, F., Alotaibi, M., *et al.* (2024) Oral Semaglutide Effectiveness and Safety in Real World Practice; the Revolution Study. *Diabetes Epidemiology and Management*, **14**, Article ID: 100209. https://doi.org/10.1016/j.deman.2024.100209

[46] Alshehri, A., AlFaris, N., Al Qahtani, A.M., Shams, M. and Yahia, M. (2023) Clinical Effectiveness of Liraglutide 3.0 Mg and Impact of Weight Loss in Improving Obesity-related Comorbid Conditions in King Fahad Medical City, Kingdom of Saudi Arabia: A Real-World Experience. *Clinical Obesity*, **13**, e12594. https://doi.org/10.1111/cob.12594

[47] Lim, R., Beekley, A., Johnson, D.C. and Davis, K.A. (2018) Early and Late Complications of Bariatric Operation. *Trauma Surgery & Acute Care Open*, **3**, e000219. https://doi.org/10.1136/tsaco-2018-000219

[48] Ding, L., Fan, Y., Li, H., Zhang, Y., Qi, D., Tang, S., *et al.* (2020) Comparative Effectiveness of Bariatric Surgeries in Patients with Obesity and Type 2 Diabetes Mellitus: A Network Meta-Analysis of Randomized Controlled Trials. *Obesity Reviews*, **21**, e13030. https://doi.org/10.1111/obr.13030

[49] Roomy, M.A., Hussain, K., Behbehani, H.M., Abu-Farha, J., Al-Harris, R., Ambi, A.M., *et al.* (2024) Therapeutic Advances in Obesity Management: An Overview of the Therapeutic Interventions. *Frontiers in Endocrinology*, **15**, Article 1364503. https://doi.org/10.3389/fendo.2024.1364503

[50] American Society for Metabolic and Bariatric Surgery (2019) ASMBS Endorsed Procedures and FDA Approved Devices. https://asmbs.org/resources/endorsed-procedures-and-devices/

[51] Mechanick, J.I., Apovian, C., Brethauer, S., Garvey, W.T., Joffe, A.M., Kim, J., *et al.*

(2019) Clinical Practice Guidelines for the Perioperative Nutrition, Metabolic, and Nonsurgical Support of Patients Undergoing Bariatric Procedures—2019 Update: Cosponsored by American Association of Clinical Endocrinologists/American College of Endocrinology, the Obesity Society, American Society for Metabolic & Bariatric Surgery, Obesity Medicine Association, and American Society of Anesthesiologists. *Endocrine Practice*, **25**, 1-75. https://doi.org/10.4158/gl-2019-0406

[52] AlEnazi, S., AlAjlan, R., AlKhalaf, H., Abolfotouh, M., Alharbi, O., Alfawaz, R., *et al.* (2023) Prevalence of Obesity among Children and Adolescents in Saudi Arabia: A Multicenter Population-Based Study. *Saudi Journal of Medicine & Medical Sciences*, **11**, 19-25. https://doi.org/10.4103/sjmms.sjmms_417_22

[53] AlQurashi, A.A., Kusuma, D., AlJishi, H., AlFaiz, A. and AlSaad, A. (2021) Density of Fast Food Outlets around Educational Facilities in Riyadh, Saudi Arabia: Geospatial Analysis. *International Journal of Environmental Research and Public Health*, **18**, Article 6502. https://doi.org/10.3390/ijerph18126502

[54] Syed, N.K., Syed, M.H., Meraya, A.M., Albarraq, A.A., Al-kasim, M.A., Alqahtani, S., *et al.* (2020) The Association of Dietary Behaviors and Practices with Overweight and Obesity Parameters among Saudi University Students. *PLOS ONE*, **15**, e0238458. https://doi.org/10.1371/journal.pone.0238458

[55] Alghadir, A.H., Gabr, S.A. and Iqbal, Z.A. (2015) Television Watching, Diet and Body Mass Index of School Children in Saudi Arabia. *Pediatrics International*, **58**, 290-294. https://doi.org/10.1111/ped.12834