


Clinical Practice Guideline for the Management of Overweight and Obesity in Adults in Saudi Arabia

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Abstract

Obesity and overweight are prevalent in Saudi Arabia (24.95% & 31.80%). Also, childhood obesity in the country is a challenge, with 6% - 10% of pre-school and school-age children. The burden of being overweight and obese is disastrous. Therefore, the Saudi Diabetes Scientific Society constituted a team to develop a guideline. The team reviewed the local Clinical Practice Guidelines for the Prevention and Management of Obesity in Saudi Arabia; and conducted a rigorous review of relevant evidence-based scientific literature. After a thorough assessment, a consensus was reached to use the Australian guideline as the main guideline to be adapted and localized to be suitable for the Saudi people. To avoid duplication of efforts, the team adopted the grading of evidence used by the Australian guideline. The updated version was

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presented in a workshop, and the recommendation of the participants was included. The final draft was distributed for review, and comments were included. This document presents the result of such an effort as a local guideline.

Keywords

Obesity, Overweight, Disease Burden, Management, Guideline, Saudi Arabia

1. Introduction

By 2030, one billion people will be obese worldwide, including one in five women and one in seven males, according to the World Obesity Atlas 2022. The prevalence of obesity worldwide has roughly tripled since 1975, according to the World Health Organization (WHO) fact sheets. Most people on the planet reside in regions where being overweight or obese kills more people than being underweight. In 2016, there were 41 million under five years old children who were overweight or obese. Also, there were approximately 340 million overweight or obese children and teenagers between the ages of 5 and 19. However, obesity is a disease that may be prevented [1] [2].

The prevalence of obesity in Saudi Arabia (KSA) was demonstrated in a recent systematic review and meta-analysis (2020), which investigated obesity and overweight among adults in Middle East Countries from 2000 to 2020. The prevalence of obesity in KSA was estimated to be 24.95% (95% CI: 21.02% - 29.61%), and for overweight, it was 31.80% (29.56% - 34.21%). According to the data from the World Atlas, KSA is the world's 14th most obese country, with an overall obesity rate of 35.4% [3] [4] [5]. These rates are less than what was forecasted by *Al-Quwaidhi et al.* to be 41% & 78% in men and women, respectively, by 2022 [6]. A serious challenge affecting the country is the rise in childhood obesity which is affecting approximately 6% - 10% of preschool and school-age children [7].

Obesity is considered an inheritance of societal modernization with faulty dietary habits, unhealthy food, less physical activity, and increased stress. These deviations are extreme in the last four decades because the daily per capita consumption was increased by 143.3% [5] [8]. Also, the escalation in the prevalence of obesity is directly contributed by environmental and behavioral factors, rather than biological factors. It is also influenced by ethnic diversity. Due to high-fat diets and more sedentary lives, people in metropolitan regions have higher obesity rates than those in rural areas [5].

Saudi Arabia has a serious obesity problem. An increase in obesity and overweight, which are key risk factors for various other diseases like hypertension, diabetes, obstructive sleep apnea, hyperlipidemia, and osteoarthritis, is indicated by previous studies on the prevalence of obesity in the KSA [8] [9] [10] [11].

Increased BMI is a significant risk factor for non-communicable diseases such as osteoarthritis, diabetes, cardiovascular disease, and several malignancies. Additionally, there is a link between childhood obesity and a higher risk of adult obesity, early mortality, and disability. Additionally, breathing issues, a higher incidence of fractures, hypertension, early indicators of cardiovascular disease, insulin resistance, and psychological consequences are all experienced by obese children [1].

The cost of being overweight and obese in KSA was calculated from a social perspective in the study by Malkin *et al.* (2022). Six major non-communicable illnesses' costs associated with being overweight or obese were assessed. The direct costs of overweight and obesity for these disorders are estimated to be \$3.8 billion, or 4.3 percent of KSA's overall healthcare expenditures in 2019. In 2019, it was predicted that overweight and obesity-related absenteeism and presenteeism would cost \$15.5 billion, or 0.9 percent of Gross domestic product (GDP). The results show that excess weight and obesity represent a considerable economic burden in KSA, even when the study is restricted to six disorders and a subset of all indirect expenses [12].

2. Guideline Development Process

Scope and objective: This guideline handles the following areas: Increase the awareness of society with the magnitude of the problem and its hazard; prevention using screening of high-risk individuals; management of lifestyle changes, drugs, and surgical interventions. The guideline aims to provide recommendations for the prevention and management of overweight/obesity based on current evidence for best practices that are suitable for our society, culture, and healthcare system. Clinical question to be answered is presented in **Table 1**.

Development process: The Saudi Diabetes Scientific Society constituted a team to develop the guideline. They reviewed the local Clinical Practice Guidelines for the Prevention and Management of Obesity in Saudi Arabia; and also conducted a rigorous review of relevant evidence-based scientific literature. After a thorough assessment, a consensus was reached to use the Australian guideline as the main guideline to be adapted and localized to be suitable for the Saudi people (**Table 2**). To avoid duplication of efforts, the team adopted the grading of evidence used by the Australian guideline used in this document. The updated version was presented in a workshop, and the recommendations of the participants were included. The final draft was distributed for review, and comments were included [14].

Update of the guidelines: Updating the guideline will be considered every three years.

3. Assessment for Overweight or Obesity

Key messages

- Assessing adults for overweight or obesity enables the identification of people who may benefit from weight management and/or intervention advice.

Table 1. Clinical question to be answered: Following PIPPOH tool was used before adaptation [13].

The P opulation concerned and disease condition:	The I nterventions of interest:
The target population includes all adult people from different gender and age groups.	<ul style="list-style-type: none"> - Screening the population for overweight and obesity. - Assessment of overweight and obesity. - Psychological, dietary and physical exercise interventions. - Different management options for people with overweight or obesity: pharmaceutical and surgical.
The P rofessionals to whom the guideline will be targeted:	The expected O utcome including patients, public and system outcome:
This guideline is intended for the use of healthcare experts at all levels, including physicians, nurses, dietitians, psychologists, and physiotherapists.	<p>To reduce the prevalence of overweight and obesity and their co-morbidities.</p> <p>To reduce the expenditure of the health system.</p> <p>To decrease the variations in clinical practice.</p>
The H health care setting and context in which the guidelines are to be implemented:	
Primary healthcare units and hospitals.	

Table 2. Evidence matrix [14].

Evidence matrix	Excellent [A]	Good [B]	Satisfactory [C]	Poor [D]
Evidence base	One or more level I studies with a low risk of bias or several level II studies with a low risk of bias.	One- or two-level II studies with a low risk of bias or a SR/several level III studies with a low risk of bias.	One- or two-level III studies with a low risk of bias, or level I or II studies with a moderate risk of bias.	Level IV studies, or level I to III studies/SRs with a high risk of bias.
Consistency	All studies consistent.	Most studies consistent and inconsistency may be explained.	Some inconsistency reflecting genuine uncertainty around clinical question.	Evidence is inconsistent.
Clinical impact	Very large	Substantial	Moderate	Slight or restricted

Continued

Generalizability	Population/s studied in body of evidence are the same as the target population for the guideline.	Population/s studied in the body of evidence are similar to the target population for the guideline.	Population/s studied in body of evidence differ to target population for guideline but it is clinically sensible to apply this evidence to target population.	Population/s studied in body of evidence differ to target population and hard to judge whether it is sensible to generalize to target population.
Applicability	Directly applicable to Saudi healthcare context	Applicable to Saudi healthcare context with few caveats	Probably applicable to Saudi healthcare context with some caveats	Not applicable to Saudi healthcare context

BMI = body mass index; kg/m² = kilograms per square meter.

- Routine BMI and waist circumference assessment is used to identify overweight and obesity.
- Assessing for the risk or presence of comorbidities that may be influenced by being overweight and obese allows for overall risk to be estimated and for conditions to be managed together.
- Asking about other contributors to weight gain (certain medications, quitting smoking) and weight history (including previous weight loss attempts) should also be part of the assessment of people who are overweight or obese.
- Discussing a person's readiness for behavioral change involves talking about the person's interest and confidence in making changes, as well as the benefits and difficulties of weight management.

The main objective of the assessment is to identify those with overweight and obesity among people.

1) Should we start by all individuals? Not everyone is willing to have their weight or obesity evaluated. There are numerous social or personal elements that have an impact on how people see weight evaluation. Any effective approach to a specific health issue must include awareness as a major element. Increasing awareness through various media platforms is a wise move [14].

2) Should we discuss hazards due to overweight or obesity? A very crucial point about obesity is its psychological and social impact on life. Overweight or obese people often have a history of dealing with frustrating problems and may have experienced social discrimination. Discussing the entire spectrum of hazards due to obesity, from physical to psychological and social health, is tremendously important because this will increase awareness of the problem and motivate people to seek medical help. Having a conversation about weight evaluation

with those who are at ease doing so utilizing effective communication techniques to build rapport with them and set the right tone. Do not pass judgment and acknowledge the impact of social context on health behaviors. Do not use words that are stigmatizing or discriminating. Describe how weight evaluation is a common practice. Inform them that measuring their height, waist, and weight is part of the process of determining their weight. Explain how BMI is calculated using a person's weight and height. Let them know that BMI and waist size are used to determine their risk of developing diabetes and heart disease. Obtain the subject's permission before taking a weight or height reading. Anytime you need to improve your communication, enlist the aid of other experts (such as interpreters or multicultural health workers). The World Health Organization and international obesity guidelines recommend BMI as the primary indicator [15] [16] [17] [18] [19]. The BMI cutoffs are the same for men and women. At the individual and population level, it is generally accepted practice to measure weight, height, and calculate BMI. The BMI calculator is one of the health tools that the Saudi Ministry of Health has issued [20].

Recommendation 1: Use BMI to classify overweight or obesity in adults. B Weight and height measurement

To measure the weight: Use a regularly calibrated scale on a hard, level surface. Ask the person to remove shoes and heavy outer garments (coat, jacket). Ask the person to stand centered on the scale with weight evenly on both feet. Record the weight. If the person weighs more than the scale can measure, note this and the upper limit of the scale.

To measure the height: Use a height rule taped vertically to a hard, flat wall, with the base at floor level. Ask the person to remove their shoes, heavy outer garments, and hair ornaments. Ask the person to stand with his or her back to the height rule. The back of the head, back, buttocks, calves, and heels should be touching the wall and the person's feet together. Ask the person to look straight ahead. Press hair flat and record height. If the person is taller than the measure, the measurer should use a platform to avoid parallax error [21].

Calculating the BMI: BMI is calculated by dividing weight (kg) by the square of height (m²).

Classifying the BMI: According to the WHO classifications, an adult's BMI can be categorized as being underweight, of normal weight, overweight or obese (3 subclasses) as shown in **Figure 1** [19].

Interpreting the BMI: When BMI exceeds 30 kg/m², increased mortality and a greater incidence of disease linked to increased fat mass are most pronounced at the community level. When determining healthy weight in specific populations where there is variability in muscle and fat mass, the BMI may occasionally be less accurate. We should consider the following factors: Individuals with the same BMI may have different ratios of body fat to lean mass. *Athletes* (high muscle mass) may have a lower proportion of body fat, so a higher BMI threshold can be considered. *Women* have more body fat than men at the same BMIs. *Elderly* people will have more body fat than younger ones at the same

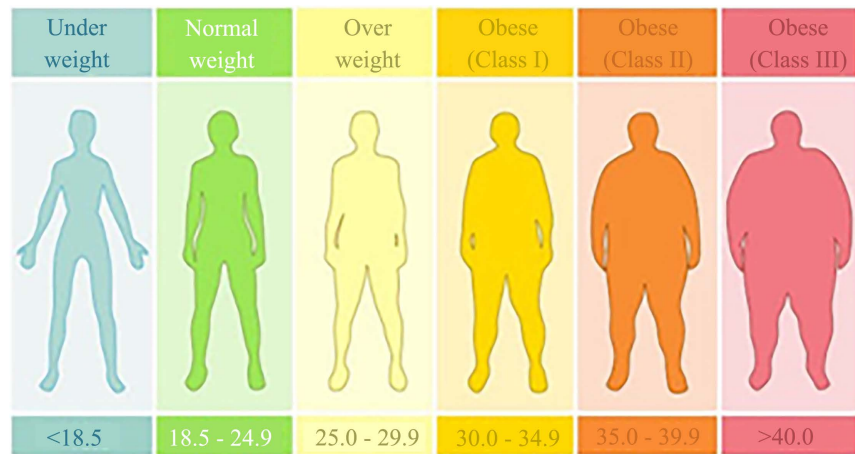


Figure 1. Obesity classes.

BMI. *South Asian, Chinese, and Japanese population groups* may have more body fat at lower weights and be at greater risk of ill-health than people from other population groups, so consider a lower BMI threshold (e.g., $>23 \text{ kg/m}^2$). *Central (or abdominal) fat distribution* increases health risks. Also, central deposition of fat and decreased muscle mass with age may lead to no overall change in weight or BMI but an increase in health risk [17] [22]-[27].

Waist circumference: It is a reliable indicator of visceral fat and a decent sign of total body fat. It is a more accurate predictor of cardiovascular risk, type 2 diabetes (in women but not in men), and metabolic syndrome when compared to BMI. According to current standards, measuring waist circumference is advised as part of the evaluation for absolute cardiovascular and type 2 diabetes risk in order to enhance the prognosis of some chronic conditions [28]-[37].

Recommendation 2: *Use waist circumference in addition to BMI to help adults better assess their risk of developing comorbidities associated with obesity. C*

How to measure an adult's waist circumference: Use a measuring tape that is checked monthly (replace if stretched). Request that they take off any heavy outerwear, take any belts off, and empty their pockets. As the person stands, ask them to evenly distribute their weight on both feet and to breathe properly while keeping their feet about 12 to 15 cm apart. Wrap the measuring tape horizontally at a level that is halfway between the lower rib edge and the iliac crest while maintaining a firm grip on it (approximately in line with the umbilicus). The finger should fit between the tape and the body if the tape is sufficiently loose. Keep track of the measurement made during an exhale.

Identifying risk level associated with waist circumference: In general, gender and ethnicity affect the cutoff point at which waist circumference indicates elevated or high disease risk:

Women's risk increases at 80 cm and reaches a peak at 88 cm, while men's risk increases at 94 cm and reaches a peak at 102 cm [38]. Thresholds of 90 cm for males and 80 cm for women are linked to a significantly higher risk of meta-

bolic problems in **South Asian, Chinese, and Japanese** individuals [33]. Waist circumference is not a reliable indicator of body fat in some circumstances (such as pregnancy or certain medical illnesses that cause abdominal distension).

Other factors in assessment of health risk in adults: It has been previously noted how genetic, familial, and life stage factors—which enhance the tendency to be overweight and obese—play a role. A person’s weight history, readiness to adopt new health behaviors and comorbidities that may be influenced by overweight and obesity are additional factors that are relevant to the assessment of health risk. Other factors also include dietary intake and physical activity, as well as factors that may influence these behaviors.

Current health behaviors: It might be difficult to evaluate how healthy behaviors affect weight. It is important to consider how an individual’s ability to follow health advice is influenced by their eating and physical activity patterns (such as being physically active but binge eating frequently), **Table 3**.

Risk or presence of physical comorbidities: Cardiovascular illnesses and their related risk factors (elevated blood pressure and lipids), type 2 diabetes, and various malignancies provide the biggest health hazards for people who are overweight or obese. The requirement for weight management is greater when comorbidities are present. Obesity is linked to a higher cardiovascular death rate. In addition to making a person’s chronic conditions, such as type 2 diabetes and arthritis, more difficult to manage, being overweight can also speed up the progression of existing conditions [39] [40] [41].

Assess cardiovascular risk and diabetes: In adults aged 35 years and over, assess for cardiovascular risk. In aged 35 and over, Screen for undiagnosed diabetes. Screen for undiagnosed diabetes in individuals at high risk [42]: People with impaired glucose tolerance or impaired fasting glucose. People aged 35 years and over with BMI ≥ 30 kg/m² or hypertension. Adults with clinical cardiovascular disease (myocardial infarction, angina, stroke, or peripheral vascular disease). Women with polycystic ovary syndrome who are obese. People on antipsychotic medications.

Assessment should also include other physical comorbidities associated with excess weight, including: 1) Symptoms of sleep apnea (snoring, frequent waking, daytime hypersomnolence), 2) Signs of arthritis, especially in the hip and knee joints, 3) Symptoms of gastroesophageal reflux disease (GERD), 4) Assessment of right-heart function for evidence of pulmonary hypertension or right-heart failure, and 5) Polycystic ovary syndrome.

Mental health comorbidities like depressive disorders and eating disorders are associated with being overweight and obese. If these disorders are suspected, referral to a psychologist for mental health assessment is advisable. **1) Depressive disorders:** symptoms of depression include: a) depressed mood most of the day, b) loss of interest or pleasure in usual activities, c) weight loss or gain (when unintended), d) insomnia or hypersomnia, e) slowed or agitated movements, f) fatigue or loss of energy, g) feelings of worthlessness or guilt, h) diminished ability to concentrate or indecisiveness, and i) recurrent thoughts of death, suicidal

Table 3. Inquiries to make when evaluating health-related behaviors.

Dietary behavior	
1) Does the person consume healthy foods (as per Saudi Dietary Guidelines)?	
2) Does the person consume high-energy foods or soft drinks?	
3) What are the person's eating patterns (regular meals, snacking, restriction, binge eating)?	
4) What is the person's attitude to dietary behavior?	
Physical activity	
1) What is the person's level of: a) Sedentary activity? b) Incidental activity? c) Moderate-intensity activity (frequency, duration)? d) Vigorous activity (frequency, duration)?	
2) What is the person's attitude towards physical activity?	
Social influences on health behaviors	
Cultural background	Are attitudes to health behaviors influenced by cultural values?
Access to healthy foods	Are healthy foods locally available and affordable? Does the person have the means to store foods appropriately?
Education	Does the person understand healthy behaviors (e.g. high-energy versus low-energy foods, recommended levels of activity)?
Opportunities for physical activity	Does the person have time and support (e.g. child care)? Does the local environment support physical activity (e.g. walking tracks)?
Psychosocial support	Are the person's family and/or friends supportive of healthy behaviors?
Physical and developmental factors	
Comorbidities	Is the person on medications associated with weight gain?
Fitness	Is fitness level sufficient for moderate-intensity activity?
Mobility	Is mobility impaired (e.g. due to age, obesity or comorbidities)?
Physical disability	Is activity impeded by disability?
Intellectual disability	Is lifestyle change impeded by disability?
Psychological factors	
Life stressors	Has the person experienced life stressors (e.g. abuse, trauma, grief)?
Mood disorders	Is the person experiencing symptoms of depression?
Disordered eating	Is the person experiencing or at risk of an eating disorder?
Serious mental illness	Is the person on medications associated with weight gain?
Lifestyle	Does the person wish to change other behaviors (e.g. smoking)?

thoughts [43]. **2) Eating disorders:** the following questions may assist in assessing if an adult has or is at high risk of an eating disorder: a) do you think you have an eating disorder? And b) do you worry about your shape and weight? Screen for eating disorders by the SCOFF questionnaire (**Table 4**) [44] [45].

Factors that may contribute to weight gain

Medications: Some medications may cause considerable amounts of weight gain in relatively short amounts of time (**Table 5**). Conversely, some medications that have been associated with weight gain—combined contraceptives and hormone replacement therapy—appear not to result in weight gain. When medications associated with weight gain are required to treat comorbidities, specific advice, and support for weight loss should be provided. Substitution with an alternative medication or a change in dosage can be considered [46] [47] [48].

Quitting smoking: People who quit smoking for at least one-year experience greater weight gain and increased waist circumference than those who continue to smoke. The amount of weight gain after smoking cessation may differ by age, social status, and certain behaviors. A Cochrane review of interventions to prevent weight gain after smoking cessation found that individualized interventions, very low-energy diets, and cognitive behavioral therapy may reduce weight gain associated with smoking cessation without affecting quit rates. Additionally, exercise interventions may be effective in the longer term (12 months). General advice to avoid weight gain has not been found to be effective and may reduce quit rates. The health benefits of smoking cessation are broad and are likely to outweigh the risks of weight gain [17] [38] [49] [50] [51].

Table 4. The SCOFF questions.

1) Do you make yourself S ick because you feel uncomfortably full?
2) Do you worry you have lost C ontrol over how much you eat?
3) Have you recently lost more than O ne stone (6 kg) in a 3-month period?
4) Do you believe yourself to be F at when others say you are too thin?
5) Would you say that F ood dominates your life?
*One point for every “yes”; a score of ≥ 2 indicates a likely case of anorexia nervosa or bulimia. A further two questions have been shown to indicate a high sensitivity and specificity for bulimia nervosa. These questions indicate a need for further questioning and discussion.
1) Are you satisfied with your eating patterns?
2) Do you ever eat in secret?

Table 5. Medications associated with weight gain at 12 weeks from commencement [46].

Atypical antipsychotics: (clozapine, olanzapine)—Lithium	Tricyclic antidepressants (amitriptyline)
Beta-adrenergic blockers, particularly propranolol	Pizotifen
Sodium valproate	Anabolic steroids
Sulphonylureas: (chlorpropamide, glibenclamide, gliclazide and glipizide)	Insulin Thiazolidinediones (pioglitazone)

Weight history: Advice on weight management will differ depending on the number of previous weight loss attempts and the degree of overweight or obesity. Weight history, including previous weight loss attempts, should be part of the assessment of people who are overweight or obese. Discuss the following relevant areas to assess weight history: 1) Age of onset of overweight or obesity? 2) Family history of obesity? 3) Any history of eating disorders, symptoms of eating disorders (e.g., binge eating), or unhealthy weight loss methods (e.g., misuse of laxatives, self-induced vomiting)? 4) Weight stability, and for how long has the person been at this present weight? 5) What have been the maximum and minimum weights? 6) What attempts at weight loss have been made in the past? Have any worked? 7) If not, why does the person think they were unsuccessful? 8) If so, what attempts were made to maintain the new lower weight? Did this work, and for how long? 9) What is the person's understanding of the reasons or triggers for weight gain/regain? 10) Has weight loss medication been tried? 11) Has the person had weight loss surgery? 12) Has the person seen other professionals or organizations for weight loss?

Weight cycling: The weight history may indicate previous weight cycling—that is, repeated intentional loss and subsequent regain of weight (usually around 4.5 kg). There is debate about whether weight cycling promotes obesity and/or increases cardiovascular risk. Concerns about the possible harms of weight cycling do not outweigh the benefits of losing weight. A focus on sustainable (rather than restrictive) changes in dietary behavior may support motivation and reduce the likelihood of continuing weight cycling and other potential health effects (e.g., eating disorders) [52] [53].

Readiness to change: Consider the person's willingness to undertake the behavioral change because it is required for effective weight management. Algorithms that attempt to stage readiness to change may be more effective if tied explicitly to the specific behaviors (Table 6). Rather than simply asking whether the person is ready to change health behaviors, it may be helpful to begin by assessing his or her interest and confidence in change [54] [55] [56]. This can be followed by a discussion of the benefits and difficulties of making lifestyle changes and whether the person is interested in looking at ways to improve health. Some sample questions that can be used to assist people in identifying their readiness to change are:

Recommendation 3: *For adults who are overweight or obese, discuss readiness to change lifestyle behaviors. D*

Readiness to change lifestyle behaviors may be identified during routine consultation—however, it is unclear whether available tools for assessing readiness to change are helpful in predicting change or weight loss. While health professionals make judgments based on an individual's answers to a series of questions, there may be time and cost implications from longer consultations. Active management of an individual who may not be ready to engage may also have cost and resource implications. While referral and follow-up appointments to discuss weight management options have cost implications for individuals, a

Table 6. Discussing readiness to change [57].

Intention to change	How important do you think it is for you to make changes at the moment?
Skills and self-confidence	How confident are you that you can change your eating patterns and increase your physical activity to improve health?
Obstacles to change	Are there any stressful events in your life now that might get in the way?
Positive feelings about change	Do you feel you can succeed in changing health behaviors, and how much do you believe it is worth the effort?
Self-image and group norms	Can you picture yourself changing health behaviors? How do you think your friends and family will react to your efforts?
Encouragement and support	Are there people who can support you to change health behaviors? Do you think they will help you in your efforts?

referral could be made directly to practice nurses or other providers if there are no additional perceived comorbidities. Techniques for motivational interviewing and discussing readiness to change could also be an identified training need for healthcare professionals.

4. Counselling for People with Overweight or Obesity

Key messages

- Even small amounts of weight loss bring health benefits, including lowered cardiovascular risk, prevention, delayed progression or improved control of type 2 diabetes, and improvements in other health conditions.
- Lifestyle change that includes reduced energy intake and increased physical activity has health benefits independent of weight loss.
- Overweight and obesity are associated with a wide range of other conditions, particularly cardiovascular disease, type 2 diabetes, and some cancers. The risk of comorbidity appears to rise with increasing BMI.

Explaining the benefits of lifestyle change and weight loss, even if modest, increases awareness and drive motivation in overweight and obese people. **These health benefits are:**

1) **Reduction of cardiovascular risk by:** Systolic blood pressure reduction with weight loss of at least 2 kg [A], small improvements in lipid profiles with sustained weight loss [A], and reduction of cardiovascular and all-cause mortality [C] [58]-[68].

2) **Prevention and improved control of type 2 diabetes** [A] [60] [64] [68]-[85]

3) **Improvements in other conditions:** Improvements in markers of chronic kidney disease [B] and reduction in obstructive sleep apnea [B] [86] [87] [88]

[89] [90].

4) **Improves symptoms of some conditions.** Improvements in symptoms of gastro-esophageal reflux disorder [C]. Reduced stress incontinence in women [C]. Reduced knee pain with moderate weight loss (6 kg) in adults with osteoarthritis [C]. Improved functional mobility and physical performance in older people [B] [91]-[98].

5) **Improvements in quality of life, self-esteem and depression,** even if weight loss is not substantial. C [63] [97] [98] [99] [100] [101].

Not everyone is willing to have their weight or obesity evaluated. There are numerous social or personal elements that have an impact on how people see weight evaluation. As part of routine care, individuals who are overweight or obese should be told about the advantages of losing weight. For the patient and the healthcare professional, referral, the creation of treatment plans, and ongoing monitoring are likely to have cost and time implications.

Recommendation 4: *Adults who are overweight or obese can be strongly advised that modest weight loss reduces cardiovascular risk factors. A*

Recommendation 5: *Adults with prediabetes or diabetes can be strongly advised that the health benefits of modest weight loss include prevention, delayed progression, or improved control of type 2 diabetes. A*

Recommendation 6: *Adults with kidney disease or sleep apnea can be advised that improvements in these conditions are associated with a 5% weight loss. B*

Recommendation 7: *Adults with musculoskeletal problems, gastro-esophageal reflux, or urinary incontinence can be advised that weight loss of 5% or more may improve symptoms. C*

Recommendation 8: *Adults who are overweight or obese can be advised that quality of life, self-esteem, and depression may improve, even with small amounts of weight loss. C*

Explaining the health risks associated with overweight and obesity: Type 2 diabetes, cardiovascular disease, and various malignancies are the main illnesses for which obesity predicts greater mortality and/or morbidity. Additionally, musculoskeletal, reproductive, and mental health issues are all highly correlated with obesity (**Table 7**).

Life expectancy: Numerous studies suggest a connection between obesity and being overweight and a shorter life expectancy. People who were obese (BMI 30 - 35 kg/m²) died 2 - 4 years earlier than those who were at an optimal weight, according to a big study (n = 900,000). In comparison to the effects of lifelong smoking, a BMI of 40 - 45 kg/m² resulted in a loss of 8 - 10 years of life expectancy. Another study that estimated the impact of obesity on life expectancy (starting at age 40) discovered a mean loss of 7 years, which is comparable to the loss of life expectancy from smoking [102] [103] [104] [105] [106].

Comorbidities: There is mounting proof that being overweight or obese increases the risk of developing a number of comorbidities. Starting at BMIs of approximately 20 - 21 kg/m², the relationship between BMI and many of these

Table 7. Health risks associated with overweight and obesity in adults [39] [87] [107]-[132].

Cardiovascular	Gastrointestinal
1) Stroke	1) Gallbladder disease
2) Coronary heart disease	2) Gastro-esophageal reflux disease
3) Hypertension	3) Hepatic, biliary and pancreatic disease
	4) Cancers of the bowel, esophagus (adenocarcinoma), gall bladder and pancreas.
Endocrine	
Type 2 diabetes	
Genitourinary	Reproductive health
1) Chronic kidney disease	1) Menstrual disorders
2) End-stage renal disease	2) Miscarriage and poor pregnancy outcome
3) Kidney cancer	3) Infertility/subfertility
4) Glomerulopathy	4) Breast cancer (postmenopausal women)
5) Kidney stones	5) Endometrial cancer
6) Stress urinary incontinence (women)	6) Ovarian cancer
Pulmonary	Musculoskeletal
1) Obstructive sleep apnoea	1) Osteoarthritis
2) Asthma	2) Spinal disc disorders
	Lower back pain
	Disorders of soft-tissue structures such as tendons, fascia and cartilage
Mental health	3) Mobility disability (particularly in older adults)
1) Depression	4) Impaired immune function
2) Anxiety disorder	
3) Reduced health-related quality of life	
4) Disordered eating	

disorders appears to be constant. The increased risk of cardiovascular illness experienced by those who are overweight or obese is a result of the relationship between BMI and cardiovascular risk factors (blood pressure, lipids, type 2 diabetes) [18] [39].

5. Applying a Multi-Component Multi-Disciplinary Therapeutic Approach

Key messages

- Multicomponent interventions that address all three lifestyle areas related to overweight and obesity—nutrition, physical activity, and psychological approaches to behavioral change—are more effective than single-component interventions.
- Lifestyle approaches should focus on creating an energy deficit. This can be achieved through reducing energy intake, increasing energy expenditure, or both. Creating an energy deficit needs to be supported by measures to assist behavioral change.
- For many overweight and most obese adults, achieving a “healthy” weight is an unrealistic expectation—a weight loss of 5% is achievable and will result in health benefits. Treatment goals should focus on behavioral change and improved health.

- More intensive weight management interventions—such as very low-energy diets, weight loss medication, and bariatric surgery may need to be considered as adjuncts to lifestyle approaches, especially when a person is obese and/or has risk factors or comorbidities or has been unsuccessful reducing weight using lifestyle approaches. The decision to use intensive weight loss interventions is made based on the individual situation.
- Individuals should be well informed and supported in changing health behaviors and be assisted in managing overweight and obesity in partnership with one or more healthcare professionals. Interventions need to be individualized and supported by self-management principles and regular review by a healthcare professional.
- Influences on health behaviors (e.g., social, physical and psychological factors) should be considered when planning interventions with individuals.

Lifestyle interventions: Nutrition, physical activity, and behavioral change are the three main lifestyle factors associated with being overweight and obese. Interventions with several components—those that deal with all three areas—are more effective than those that merely deal with one or two of them. However, it is challenging to produce evidence to determine what sort and how many interventions should be included in a multi-component intervention for weight loss. Depending on the context, the person, and the implementation resources available, each component may have proof of its efficacy and be suitable for inclusion into a multi-component intervention. A lifestyle intervention may involve testing out several combinations of strategies to find the one that works best and is most sustainable for each person. The delivery of lifestyle-based interventions in primary healthcare is well-suited. In some circumstances, a referral to other services (such as a dietician, psychologist, or exercise physiologist) may be necessary. A change in lifestyle that includes less energy intake and more exercise has a number of advantages independent of weight loss. For instance, lifestyle adjustments may enhance the quality of life even if weight loss is not achieved. Also, increased physical activity without weight loss can reduce cardiovascular risk factors, improve functional mobility in older people and reduce glycated hemoglobin (HbA1c) by approximately 0.6% in adults with type 2 diabetes [62] [63] [82] [96] [97] [98] [133].

Recommendation 9: *For adults who are overweight or obese, strongly recommend lifestyle change—including reduced energy intake, increased physical activity, and measures to support behavioral change. A*

Healthy lifestyle options should be discussed routinely with individuals who are overweight or obese. Referral and continued monitoring are likely to have cost and time implications for the individual and healthcare professional. Specific lifestyle changes and plans can be discussed and developed with GPs, practice nurses, and other healthcare professionals. There may be cost implications, availability, and access issues associated with each. Monitoring of any comorbidities should continue to be done by the GP or a relevant member of a multidis-

ciplinary approach. Healthy life style is encouraged and demonstrated in details by the Saudi Ministry of Health (MOH). [134]

Reducing energy intake: Several dietary interventions can produce weight loss, including low-carbohydrate diets and low-fat diets. These Guidelines do not discuss specific dietary interventions, as the evidence of their effectiveness was not considered in the systematic literature review [3]. Healthy eating habits and Saudi healthy food proportions are demonstrated by the Saudi MOH [135].

Healthy dietary patterns: The Saudi Dietary Guidelines summarize the evidence underlying food, diet, and health relationships that improve public health outcomes and highlight dietary patterns that promote health and well-being as well as reduce the risk of chronic disease. Current Saudi Dietary Guidelines should be used as the basis of advice on nutrition for adults [136].

Dietary approaches to weight loss: Dietary interventions should be designed to create an energy deficit, suit the needs and preferences of individuals, and include a wide variety of nutritious foods as recommended in the current Saudi Dietary Guidelines. In some situations (e.g., when comorbidities are present), referral to a dietitian may be needed for guidance on developing an eating plan that is suitable to the individual's needs [136].

***Recommendation 10:** Design dietary interventions for weight loss in individuals who are overweight or obese to result in a 2500 kilojoule energy deficit per day, and customize programs to the individual's dietary preferences. A*

While general practitioners (GPs) can suggest broad dietary adjustments, the creation of a customized program to induce an energy deficit may be more economically advantageous if provided by an accredited practicing dietitian. It is recognized that some places may have restricted access to certified dietitians. Greater access to dietitian services might be made possible by methods like teleconferencing or videoconferencing. Specific tools, such as Life scripts, can help with management and referral. The cost of referral alternatives and the availability of particular service providers may have an impact on the individual. Additionally, finding the right foods for the person and family may provide problems with cost, equity, and access [137].

Discussing dietary approaches to weight loss: When discussing and recommending a particular approach, consider the individual context, including: 1) A degree of overweight or obesity (e.g., if there is a need for rapid weight loss, a very low-energy diet may be appropriate), 2) Dietary preferences of the individual and their family, 3) Their food supply (taking into account availability, affordability and capacity for appropriate storage of healthy foods), 4) Benefits of finding an eating plan that can be sustained (e.g., gradually changing eating habits), and 5) History of or current eating disorder.

People who are making changes to dietary behaviors as part of a weight management program may benefit from advice on healthy foods and eating patterns. Areas for discussion: **Practical information to support healthy eating include:** 1) General advice on healthy eating as outlined in the Saudi Dietary Guidelines, 2) The energy content of commonly eaten foods and drinks (e.g., books or web-

sites that list kilojoule content), 3) Recommended portion sizes, and strategies for controlling or reducing them (e.g., use smaller plates), 4) The need to reduce (rather than restrict) intake of foods that are high in energy (e.g., fats, sugar) and increase intake of foods that are low in energy but rich in other nutrients (e.g., vegetables, fruit), 5) Benefits of starting with small changes and avoiding situations that encourage unhealthy behaviors, 6) Examples of healthy foods that are affordable and familiar, or suitable alternatives, 7) Ways to identify and manage triggers for emotional eating, and 8) The importance of regular eating patterns and mindful eating [136].

Increasing physical activity: Physical activity is any bodily movement produced by skeletal muscles that expend energy. This includes activities that use one or more large muscle groups for movement in the following domains (**Table 8**): 1) Occupation, including paid and unpaid work, 2) Leisure, including organized activities such as sports, as well as exercise and recreational activities; and 3) Transport—for example walking, cycling or skating to get to or from places.

Different intensities of physical activity:

Physical activity recommendation of the Saudi MOH can be considered as a guidance for types of physical exercises that can be done [138]. Recommend moderate-intensity and vigorous activities that provide health benefits for adults aged 18 - 64 years. More recent evidence suggests that in most cases, the relationship between physical activity and health benefits is direct and curvilinear, with the greatest benefit seen in those who change from doing the least or no physical activity to doing more. The repeated physiological and metabolic adaptations, and energy expenditure associated with daily physical activity, make it likely that frequent activity is more beneficial than activity on only one or two days each week. Health benefits are achieved with around 150 - 300 minutes of moderate-intensity activity or 75 - 150 minutes of vigorous activity (or a combination of moderate-intensity and vigorous activity) each week [139]. Physical

Table 8. Levels of intensity of physical activity [18] [137].

Intensity	Description	Example
Sedentary	Activities that involve sitting or lying down, with little energy expenditure.	Occupational (e.g., sitting at work) Leisure (watching TV, reading, sewing, computer use for games, social networking) Transport (e.g., sitting in a car, train or bus).
Light	Activities that require standing up and moving around, in the home, workplace or community.	Housework (hanging out washing, ironing, dusting) Working at a standing workstation.
Moderate	Activities that requires some effort, but allow a conversation to be held.	Brisk walking, gentle swimming, social tennis.
Vigorous	Activities that lead to harder breathing, or puffing and panting (depending on fitness).	Aerobics, jogging and some competitive sports.

activity at the upper end of this range is required for the prevention of weight gain and to reduce the risk of breast and colon cancer. Muscle-strengthening activities are important for metabolic and musculoskeletal health (including maintaining bone density) and for maintaining functional status and the ability to conduct activities of daily living in older age, with significant benefits from muscle-strengthening activities twice weekly on nonconsecutive days. Prolonged sitting time is associated with an increased risk of premature death and a range of chronic health problems [140] [141] [142] [143] [144].

Physical activity: Although it is accepted that physical activity is integral to weight management, the evidence for a specified duration and intensity of exercise is unclear, given high individual variability in baseline levels of activity, eating patterns, medication use, and other lifestyle factors and comorbidities. Studies that focus on the association between physical activity and weight loss have found that increasing physical activity has a range of health benefits even if no weight is lost. Physical activity has little effect on weight unless it is combined with dietary changes. A dose-response exists between amounts of activity and weight loss. Maintaining high levels of physical activity (approximately 60 minutes per day) combined with other behavioral strategies may reduce weight regain. Gradually increasing activity levels are associated with fewer injuries in inactive adults [62] [63] [64] [65] [141]-[146]. The degree of overweight or obesity, fitness level, comorbidities and age are other considerations in prescribing physical activity. Accredited exercise physiologists can provide screening and stratify risks to ensure the safety and appropriateness of physical activity interventions.

Recommendation 11: *For adults who are overweight or obese, prescribe approximately 300 minutes of moderate-intensity activity, 150 minutes of vigorous activity, or an equivalent combination of moderate-intensity and vigorous activities each week combined with reduced dietary intake. Consensus-based*

Brief advice on physical activity, delivered through primary health care in person, or by phone or mail, for sedentary people at risk of developing disease has a small beneficial effect and has been shown to be cost-effective. While tools such as **Life scripts** can help with physical activity assessment and prescription, exercise referral schemes may also provide a cost-effective option if no in-house program is available. Costs to the individual will vary depending on the selection of physical activity type that is appropriate, accessible, and likely to be sustainable. If functional mobility is an issue, referral to an exercise physiologist or physiotherapist may also incur costs to the individual and healthcare system. For adults who are overweight or obese, particularly those who are older than 40 years, there should be an individualized approach to increasing physical activity [147] [148].

Discussing physical activity: When discussing changes in physical activity, consider the following: 1) The health benefits of an active lifestyle, many of which are independent of weight loss, 2) The counterbalance of reducing sedentary activities (e.g. watching television, using computers), 3) the importance of avoiding prolonged periods of sitting (e.g. taking breaks from desk-based activi-

ties by standing or walking when on the telephone), 4) Appropriate forms of moderate-intensity activity for the person's current mobility (e.g. hydrotherapy may be more suitable for people experiencing weight-related joint pain), 5) Increasing incidental activity also contributes to health and weight management, 6) Clear and realistic goals, and relevant support mechanisms to increase the likelihood of activity being maintained on a long-term basis (e.g. regular interactions with appropriately trained professionals, the opportunity to participate in group sessions, and support from family members and others undertaking the exercise program), 7) The person's current fitness level and comorbidities (e.g. cardiovascular fitness may need to be improved before muscle-strengthening exercises are attempted, or a rehabilitation approach may be needed for people whose mobility is impeded), and 8) Initial weight gain is associated with muscle-strengthening exercises as muscles increase in size.

People who are making changes to their health behaviors may benefit from advice on ways to introduce and sustain increased physical activity. The following points are practical information to support weight management through physical activity. They can assist in identifying activities that are suitable and acceptable to the individual: 1) Ideas for increasing the amount of incidental activity (e.g. choosing the stairs, walking to do errands), 2) Ideas for low-impact/low-risk exercise options (e.g. brisk walking, swimming), 3) Ideas for exercising with others (e.g. bike riding with the children, joining a sports team), 4) Relative benefits of different types of exercise intensity (e.g. doing a vigorous activity in addition to regular moderate-intensity activity provides additional health benefits), 5) Practical ideas for maintaining motivation to exercise (e.g. starting with small changes in activity and avoiding situations that encourage long periods of sitting), 6) Suggestions for how to get involved in physical events and groups (e.g. joining local walking groups), 7) Advice on reducing sedentary activities (e.g. commuting by bicycle rather than car), and 8) Affordable approaches to physical activity (e.g. walking or jogging rather than joining a gym).

Supporting behavioral change: Education regarding weight loss and lifestyle change, including specific weight management strategies, can support behavioral change if it is combined with other interventions. Information may be delivered face to face, individually or within groups, and should be reinforced by resources (e.g., written, web-based, or audiovisual materials). Initial approaches include discussing techniques to support behavioral change, which can be supported in primary health care [71] [74] [81] [83] [149] [150] [151]. The following techniques (**Table 9**) can be used:

Psychological therapies: In the context of overweight and obesity, psychological therapies aim to assist individuals in making long-term changes to their lifestyle. A range of psychological interventions (e.g., behavioral therapy and cognitive-behavioral therapy) can facilitate weight loss and have been shown to have a more beneficial effect when combined with other lifestyle approaches. Individual or group-based psychological interventions may improve the success of weight management programs. Psychological and behavioral therapies should be

Table 9. Examples of techniques to support behavioral change.

Core strategies	Additional strategies
Goal setting	Assertiveness training
Self-monitoring of behavior and progress	Slowing the rate of eating
Stimulus control (e.g. recognizing and avoiding triggers that prompt unplanned eating)	Reinforcing changes
Cognitive restructuring (modifying unhelpful thoughts or thinking patterns)	Relapse prevention
Problem solving	

tailored to the individual, and his or her situation, such as: 1) Psychological therapies that can be delivered in primary health care by healthcare professionals trained in their use may significantly increase weight loss, and 2) More intensive psychological intervention may be required if a person has difficulty achieving behavioral change, or has mental health comorbidities and referral to mental health specialists with relevant expertise may be required [152].

Other supports for behavioral change: Lifestyle interventions can also be augmented by measures to reinforce behavioral aspects of care or provide incentives for adherence. Internet-based information and programs are increasingly popular. Delivery of evidence-based weight management programs via the internet should be considered part of a range of options for people with overweight and obese.

Effect of interventions to augment lifestyle interventions in adults: Internet-based information, goal setting, reminders, and text messages, in combination with internet lifestyle diaries or pedometers, are successfully used but not a replacement for face-to-face healthcare delivery. On using the financial rewards paid for the achievement of program goals, weight loss has remained the same, but the trend towards increasing effectiveness as the size of the reward increases [153] [154] [155] [156].

Complementary therapies and nutritional supplements: There is little evidence to support their use in assisting weight loss [157]-[165].

Intensive interventions:

Intensive interventions to support weight loss include very low-energy diets, weight-loss medication, and bariatric surgery. These may be considered as an adjunct to lifestyle approaches, especially when an adult: 1) has a BMI > 30 kg/m² or a BMI > 27 kg/m² with risk factors and/or comorbidities, 2) has been unsuccessful in reducing weight or preventing weight regain using lifestyle approaches. The choice of intervention will depend on the individual situation, including the urgency and aims of intervention, accessibility, and affordability.

For example, 1) The rapid weight loss associated with medically supervised very low-energy diets may encourage people to continue with a lifestyle change towards longer-term weight loss goals, reduce obesity-related comorbidities, and

may also be necessary when bariatric surgery is conditional on weight loss (e.g., prognosis after surgery is worse if BMI > 50 kg/m²), 2) Weight loss medications may be helpful to both in producing initial weight loss and in preventing weight regain in longer-term management, 3) The significant weight loss associated with bariatric surgery provides improvements in some cardiovascular and metabolic risk factors, and type 2 diabetes. These interventions are likely to be used sequentially—for example, starting with a very low-energy diet to achieve weight loss, then using medications to help counter the hormone changes and increased hunger that follow weight loss. Bariatric surgery is not generally an immediate consideration unless other interventions have not been successful, other interventions are contraindicated, and a person's BMI is >50 kg/m².

New weight loss medications are being developed and trialed. In the future, combining a very low-energy diet followed by pharmacotherapy may be a reasonable alternative to bariatric surgical procedures. The role of primary health care in intensive weight management interventions depends on the severity of health risks and the expertise of the healthcare professional involved. Contraindications, adverse effects, treatment duration, and requirements for follow-up should be discussed with adults to ensure informed decision-making.

Very low-energy diets: Very low-energy diets involve replacing one or more meals each day with foods or formulas providing a specified number of kilojoules (e.g., 1675 - 3350 kilojoules). ***Meal replacements*** are defined as a single food or prepackaged selection of foods sold as a replacement for one or more daily meals but not as a total diet replacement. They are primarily protein-based and contain essential fatty acids, vitamins, and minerals but minimal carbohydrates. They reduce portion size and, consequently, energy intake. Health benefits of very low-energy diets include the motivating effect of rapid weight loss and a mild ketosis that may suppress hunger. Low-energy diets have been associated with weight loss, sleep apnoea improvements, and glycemic control in adults with type 2 diabetes. They are commonly used in medically supervised weight reduction programs for people with BMI > 30 kg/m² or >27 kg/m² with obesity-related comorbidities) or for whom rapid weight loss is necessary. Costs are associated with the use of very low-energy diets. Purchasing very low-energy diet items to replace meals may be costly for individuals, and their use requires frequent monitoring by healthcare professionals. The relevant healthcare professional to monitor use may be a GP, dietitian, or specialist nurse, depending on access to the type of provider [78] [79] [90] [166] [167].

Very low-energy diets are a helpful intensive medical therapy in supporting weight loss when used under medical supervision. Considering the individual situation, they may be a consideration in adults with BMI > 30 kg/m² or with BMI > 27 kg/m² and obesity-related comorbidities.

Contraindications for very low-energy diets: 1) Pregnancy or advanced age, 2) History of severe psychological disturbance, alcohol misuse or drug abuse, and 3) Porphyria, recent myocardial infarction, or unstable angina. A relative contraindication is insulin or hypoglycemic (except metformin), but it may be

used if medication dosage is adjusted appropriately [16] [17]. **Adverse effects** include cold intolerance, dry skin, hair loss, constipation, headaches, fatigue, and dizziness. Other potential effects are gallstones, increased serum uric acid levels and precipitation of gout, and reduced bone mineral density. Although restrictive eating has been strongly associated with the onset of binge eating, there is insufficient evidence of an association between medically supervised, very low-energy diets and new-onset eating disorders [167]. **Treatment length** varies but is usually 8 - 16 weeks. There is evidence that in specific obese individuals and under close medical supervision, very low-energy diets may be used safely for 12 months [167]. **Careful monitoring** of people on very low-energy diets is required. Tests to be carried out when beginning a very low-energy diet include liver function tests, lipid profile measurements, a complete blood count, iron studies, electrolytes, creatinine, and uric acid levels. Electrolyte and creatinine levels should be checked about six weeks after starting the diet or earlier if more careful monitoring is required (e.g., in people who have renal impairment or are using diuretics). A review of medications is also necessary (e.g., for people taking diabetes medication/insulin or warfarin). Psychological well-being should also be monitored during and after the very low-energy diet. There must be a nutrition education program and support for long-term weight management (e.g., delivered in primary health care or through referral to a dietitian) [167].

Discussion of very low-energy diets should cover: 1) Options in the food replacement regime (e.g. replace all three meals, or replace two meals and have one meal of protein, non-starchy vegetables and salad), 2) The need to select a nutritionally “complete product”, 3) The importance of reading the instructions carefully, 4) The importance of achieving ketosis to suppress hunger and of testing for ketosis, 5) The importance of avoiding carbohydrate supplementation—non-starchy vegetables or protein can be eaten when hungry, 6) The need for a small quantity of fat each day (e.g. 1 tablespoon olive oil on salad or vegetables) to contract the gall bladder and prevent gallstones, 7) The need to drink when thirsty, 8) The need for fiber supplementation, 9) The need for follow-up by healthcare professionals during the period of the diet (about 12 weeks) and gradual weaning off the diet (over a period of around 8 weeks), 10) The fact that it is not necessary to achieve the goal weight with one period of diet use (there may be repeated periods of very low-energy diets separated by periods of weight maintenance), 11) Costs associated with very low-energy diets, and 12) The need for continuing weight maintenance program to reduce weight regain [166]. Written materials explaining the diet and supporting adherence (e.g., giving examples of carbohydrates) should also be provided.

Pharmacotherapy: weight loss medications

- The use of weight loss medications, in addition to lifestyle approaches, has been found to increase weight reduction in adults who are overweight or obese [107].
- We recommend adjunctive pharmacotherapy for weight loss and weight-loss maintenance for individuals with BMI ≥ 30 kg/m² or BMI ≥ 27 kg/m² with

adiposity-related complications to support medical nutrition therapy, physical activity, and psychological interventions [168].

- There are three medications indicated for chronic obesity management in KSA in addition to health behavior changes: liraglutide 3.0 mg, naltrexone/bupropion in a combination tablet, and orlistat. All three medications have been shown to be effective in producing weight loss greater than placebo for duration of at least one year. Semaglutide also has been known for its weight reduction [169].
- Pharmacotherapy for weight loss can be used for individuals with BMI ≥ 30 kg/m² or BMI ≥ 27 kg/m² with adiposity-related complications in conjunction with medical nutrition therapy, physical activity, and psychological interventions (liraglutide 3.0 mg, naltrexone/bupropion combination, orlistat and semaglutide [168].
- We recommend pharmacotherapy in conjunction with health behavior changes for people living with prediabetes and overweight or obese (BMI > 27 kg/m²) to delay or prevent type 2 diabetes. (Liraglutide 3.0 mg); orlistat or semaglutide [168].

Orlistat: Orlistat is currently the only medication registered for use in treating overweight (with comorbidities) and obesity that has been evaluated for long-term safety. Health benefits Orlistat reduces the absorption of energy-dense fat by inhibiting pancreatic and gastric lipases. In conjunction with lifestyle intervention, orlistat: is associated with modest additional reductions in body weight in adults (2.6 - 3.7 kg) and slight reductions in systolic and diastolic blood pressure. It increases weight loss in adults with comorbidities, including metabolic syndrome, hypertension, and type 2 diabetes. It is associated with slight decreases in blood pressure, no adverse effects on lipid profile, and slight improvements in glycemic control in adults with type 2 diabetes. Cost-effectiveness studies of orlistat use show that it is not cost-effective for population-based outcomes, but other data suggest that it is more cost-effective in individuals who have numerous comorbidities (type 2 diabetes, hypertension, hypercholesterolemia) [66] [80] [84] [137] [170]-[175].

Recommendation 12: *For adults with BMI ≥ 30 kg/m² or BMI ≥ 27 kg/m² and comorbidities, orlistat may be considered as an adjunct to lifestyle interventions, considering the individual situation. A*

Orlistat is contraindicated in pregnant or breastfeeding women and adults with malabsorption or hypersensitivity to orlistat. Reduced gallbladder function (e.g., after cholecystectomy) is a relative contraindication, and caution is advised when there is obstructed bile duct, impaired liver function, or pancreatic disease [176]. **Adverse effects:** Gastrointestinal side effects are common with orlistat use and include: 1) Steatorrhea (oily, loose stools with excessive flatus due to unabsorbed fats reaching the large intestine), 2) Fatty fecal incontinence and 3) Frequent or urgent bowel movements. These effects can be controlled by adhering to a low-fat diet. Concentrations of fat-soluble vitamins (e.g., vitamins A, D, E, and K) are reduced with orlistat use. While they remain in the normal range,

supplementation may be required if long-term use is contemplated (supplement taken at night before bed). Orlistat interacts with some medications, and monitoring is required for people taking: Warfarin, as absorption of vitamin K, may be reduced, and the international normalized ratio (INR) increased. Fat-soluble immunosuppressive medications (e.g., cyclosporine), as absorption may be reduced. There is insufficient data regarding long-term orlistat use to determine its association with cardiovascular events and cardiovascular or all-cause mortality [66] [177] [178] [179] [180].

Treatment duration: Therapy with orlistat should be continued beyond 12 weeks only if at least 5% of initial body weight has been lost since starting medication. Therapy should be continued for as long as there are clinical benefits (e.g., preventing significant weight regain). Continuing risks and benefits should be discussed [38]. If the use of orlistat is considered, **the discussion should cover:** 1) The fact that orlistat is not a substitute for a lifestyle change, 2) The need for continuous monitoring of the effect of treatment, and 3) The likelihood of weight being regained when medication is stopped. Information about dietary intake during treatment should also be provided. People who are considering taking orlistat should be advised that: 1) Taking orlistat results in gastrointestinal side effects if a low-fat diet is not followed, 2) The low intake of fat should be distributed over three main meals, and 3) Foods associated with an episode of diarrhea or fat leakage should be avoided—this will lead to a change towards the healthier dietary intake [178].

GLP1-RA: Liraglutide and semaglutide

GLP-1 agonism with current GLP-1 RA and emerging novel combined anti-obesity compounds represents a benchmark for future pharmacological anti-obesity treatment. The first drug for weight management approved by the Food and Drug Administration (FDA) and European Medicine Agency (EMA) is GLP-1 RA **liraglutide** 3.0 mg with once-daily administration [181].

The next-generation GLP-1 RA **semaglutide** 2.4 mg is the latest anti-obesity medication, approved by the FDA in June 2021. Compared with liraglutide, semaglutide has been subjected to some minor structural changes that resulted in greater efficacy and gained pharmacokinetic properties that allow once weekly dosing of semaglutide vs. once-daily administration of liraglutide [181] [182].

Recommendation 13: *For obese adults with BMI ≥ 30 kg/m² or more and with or without comorbidities, liraglutide 3 mg or semaglutide 2.4 mg can be used in addition to lifestyle interventions after considering the individual condition. A*

Recommendation 14: *Certain precautions should be taken when prescribing GLP-RA (Liraglutide 3 mg or semaglutide 2.4 mg): Dose titration is needed and should be smooth.*

Counselling for gastrointestinal side effects. Discontinue if pancreatitis is suspected. For liraglutide, use caution in patients with kidney disease when initiating or increasing dose due to potential risk of acute kidney injury. A

Treatments for comorbidities with an effect on weight: Many medications

for treating other conditions have been found to affect weight (e.g., fluoxetine, topiramate, metformin, glucagon-like peptide agonists). These medications may also be beneficial for weight management when relevant comorbidities are present.

Bariatric surgery: Bariatric surgery (weight loss surgery) is an evolving subspecialty of gastrointestinal surgery. Various techniques are used to induce weight loss in people who have emphatically failed to achieve weight loss by other measures. Bariatric surgery aims to reduce intake by restricting gastric capacity and/or reducing the uptake by reducing exposure to the small bowel absorptive area. Procedures currently considered standard practice include the following: 1) **Laparoscopic adjustable gastric banding (LAGB)** involves placing a band around the stomach near its upper end to create a small pouch. This restricts the intake of food. The band can be tightened or loosened over time to change the extent of restriction. 2) **Sleeve gastrectomy** involves removing the more significant portion of the fundus and body of the stomach, reducing its volume from up to 2.5 L to about 200 mL. This procedure provides fixed restrictions and does not require adjustments like LAGB. 3) **Roux-en-Y gastric bypass (RYGB)** is a combination procedure in which a small stomach pouch is created to restrict food intake. The lower stomach, duodenum, and first portion of the jejunum are bypassed to produce modest malabsorption of nutrients and, thereby, kilojoule intake. 4) **Biliopancreatic diversion** is also a combination procedure involving removing the stomach's lower part and bypassing the duodenum and jejunum to produce significant malabsorption. This procedure tends to be performed in subspecialty centers. The choice of surgical technique is individualized and involves a discussion between the surgeon and the person. Newer procedures, including endoscopic techniques like ballooning and sleeving, are evolving. **The choice of procedure considers factors** such as age, access to services for follow-up and monitoring, preparedness to commit to frequent follow-up and continuing lifestyle interventions, previous interventions, and risk profile. For various reasons, different specialists offer some procedures but not others. There is consensus that better outcomes are achieved when a multidisciplinary team (e.g., including a bariatric physician, bariatric nurse, dietitian, exercise physiologist, and psychologist) is involved. Bariatric surgery is more effective than nonsurgical interventions. The degree of weight loss—approximately 20% - 30% of body weight in people with a BMI > 35 kg/m²—is high. The type of surgery influences reductions in BMI in adults. They are greater after combination procedures (BMI reduction of 9.0 - 11.4 kg/m²) than following purely restrictive procedures (BMI reduction of 2.4 - 10.1 kg/m²). Weight loss trajectories over time also differ depending on the procedure. In the Swedish Obese Subjects (SOS) study, gastric bypass surgery produced the most significant long-term weight loss (25% ± 11%), followed by vertical banded gastropasty (17% ± 11%) and fixed or variable banding procedures (13% ± 13%) [72] [75] [183]-[189].

Numerous studies have reported that bariatric surgery is a cost-effective weight

loss intervention compared with nonsurgical treatment. However, the variability in estimates of costs and outcomes is significant. Surgery has been shown to be a cost-effective option in people with newly diagnosed type 2 diabetes compared to those with established diabetes [101] [137] [189] [190]. Services for bariatric surgery and necessary follow-up may be more limited in rural and remote areas. The additional cost and resource implications for the individual and the health system include frequent follow-up and monitoring, transport issues in urban and rural areas, and accessibility to services and providers. The sustained lifestyle changes and additional intensive interventions that may be required to ensure the effectiveness of surgery should also be factored into individual and health system costs. Subsequent surgical procedures (for weight loss, complications, or cosmetic procedures) should also be considered a significant cost implication to the individual and health system.

Recommendation 15: *For adults with BMI > 40 kg/m² or adults with BMI > 35 kg/m² and comorbidities that may improve with weight loss, bariatric surgery may be considered, considering the individual situation. A*

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.

Health benefits of bariatric surgery are significant short-term improvements in some cardiovascular and metabolic risk factors and short-term resolution of metabolic syndrome and newly developed (<2 years since diagnosis) type 2 diabetes. Data from long-term follow-up (*i.e.*, >10 years) suggest that most (but not all) health benefits are maintained in the long term [189]. It is associated with reductions in hypertension and lipid profiles. In the SOS study: 1) The incidence of high triglycerides was lower and the recovery rate greater among participants in the surgical arm after 2 and 10 years, 2) The incidence of low levels of high-density lipoprotein (HDL) (<2.17 mmol/L) was lower in the surgical group at two years but not after ten years, 3) There was no significant difference between groups in the incidence of elevated total cholesterol at either 2 or 10 years, 4) After ten years, participants in the SOS study who had gastric bypass had more significant reductions in triglycerides (28.0% vs. 18.0%) and total cholesterol (12.6% vs. 5.0%) and more significant increases in HDL levels (47.5% vs. 20.4%) compared to those who had gastric banding. The SOS study also found that compared with usual care, bariatric surgery was associated with a reduced number of cardiovascular deaths and a lower incidence of cardiovascular events in adults who were obese [101] [189] [191].

Type 2 diabetes: There is growing evidence that bariatric surgery is a possible treatment for some people with type 2 diabetes. Studies have demonstrated improved glycemic control and medication use or the resolution of type 2 diabetes in many people who receive bariatric surgery. The International Diabetes Federation recommends consideration of bariatric surgery for people who have type 2 diabetes and a BMI > 35 kg/m² and for those with a BMI 30 - 35 kg/m² when an

optimal medical regimen cannot adequately control diabetes, especially in the presence of other cardiovascular disease risk factors. Bariatric surgery may be a consideration for people with a BMI > 30 kg/m² who have poorly controlled type 2 diabetes and are at increased cardiovascular risk, considering the individual situation. *The effect of surgery on glycemic control and resolution of type 2 diabetes varies with the stage of diabetes, bariatric procedure, and amount of weight lost.* For example: 1) Bariatric surgery (gastric bypass or biliopancreatic diversion) resulted in better glucose control at 2 years than conventional medical therapy, 2) 12 months of medical therapy plus bariatric surgery achieved glycemic control in significantly more obese adults with uncontrolled type 2 diabetes than medical therapy alone, 3) Sleeve gastrectomy in adults with type 2 diabetes improved glycemic control and comorbidities (sleep apnoea, hypertension, dyslipidemia) more than medical therapy, 4) Diabetes may be dramatically improved in adults with metabolic syndrome one year after bariatric surgery, but an adverse 90-day outcome is expected, 5) Improvements in HbA1c in mean blood glucose and insulin values at 10 years were more significant following gastric bypass than they are following gastric banding, 6) People with the shortest duration (<5 years) and the mildest form (diet-controlled) of type 2 diabetes had the greatest likelihood of resolution of diabetes, and 7) Resolution was more likely following procedures that combine restriction and malabsorption. *After the placement of an adjustable gastric band, improvements in glycemic control are dependent on weight loss,* and appreciable improvements in glycemic control may not be evident for some time. In contrast, people who receive RYGB may experience improved glycemic control before any weight loss occurs. When bariatric surgery results in the resolution of type 2 diabetes, it is unclear what the duration of effectiveness is or what monitoring, if any, should be performed for the recurrence of type 2 diabetes in people who have experienced disease resolution [72] [75] [189] [192]-[198].

The effect of bariatric surgery on long-term mortality is favorable, with lower rates of mortality among people who are obese who have had the surgery compared to those who have not had the surgery. However, some caution is needed in interpreting results as outcomes from the general medical community may not be equal to those of surgical centers of excellence. [67] [199] [200].

Indicators of abnormal renal function in adults with chronic kidney disease improve following bariatric surgery. There are generally improvements in symptoms of gastro-oesophageal reflux disease (GORD), although the nature of some surgical interventions can affect its resolution. There is some evidence that markers of liver function and inflammation improve in obese adults with diagnosed nonalcoholic steatohepatitis [86] [87] [91] [92] [200] [201].

Long-term weight loss: The mechanisms of long-term weight loss following bariatric surgery are yet to be determined. Evidence suggests that surgical manipulations (*i.e.*, the small gastric pouch with or without bypass of the duodenum and proximal jejunum) are insufficient to account for the resulting body weight loss alone. In fact, for some surgical procedures, post-operative changes in me-

tabolic profile have been shown to occur before losing weight. Changes in eating behavior and appetite may be more related to altered responses to gut hormones than the anatomical changes the surgery creates. Therefore, it is difficult to establish whether improvement in comorbid conditions with bariatric surgery is due to the weight loss or the changes in hormone balance, metabolism, pressure dynamics, and mechanics that each type of bariatric surgery produces [202] [203] [204] [205].

Suitability for surgery. Bariatric surgery in adults is most effective and safest in younger men with lower BMIs. Appropriate monitoring is required to maximize the safety and effectiveness of bariatric surgery in women, people older than 45 years, and those with higher BMIs. Bariatric surgery should not be performed during pregnancy [206].

Medical comorbidities. Medical contraindications include severe gastrointestinal disease, active cancer, unstable heart or lung disease, advanced liver disease with portal hypertension, uncontrolled obstructive sleep apnea with pulmonary hypertension, and severe blood or autoimmune disorders. While there are no contraindications, careful monitoring of people with hypertension and a high risk of pulmonary thromboembolism and diabetes is required [207].

Psychological comorbidities. The effectiveness of bariatric surgery does not appear to be influenced by the presence of depression or increased psychological dysfunction, dysfunctional eating behavior, binge-eating disorder, or a history of intervention for substance misuse. These comorbidities are, therefore, not considered absolute contraindications for surgery but should be assessed and treatment started before surgery where possible [208]-[217].

Ability to give informed consent. People must be able to give fully informed consent to bariatric surgery, so it may be contraindicated if the person is unable to understand the nature of the intervention and the need to commit to post-operative care plans.

Adverse events. While bariatric surgery can achieve long-term weight loss, the surgery is not always successful and may require revision or reversal of bariatric procedures depending on the type of surgery. Complications affect a significant proportion of people who have bariatric surgery. The Longitudinal Assessment of Bariatric Surgery 1 study 5 (n = 4776) reported rates of major complications at 30 days (4.1%) and mortality (0.3%) following primary bariatric surgery—death, serious complications, re-intervention or prolonged hospitalization were reported following LAGB (1.0%), laparoscopic gastric bypass (4.8%) and open gastric bypass (7.8%). A systematic review reported operative re-intervention (13%), laparoscopic revision (10%), port infection (2.6%), and acute cholecystitis (2.6%) as the main complications affecting people following LAGB. The SOS study reported perioperative complications (13%), pulmonary symptoms (6.2%), infection (2.1%), thromboembolism (0.8%), bleeding (0.9%), and operative death (0.25%) [183] [189] [218].

Discussing bariatric surgery. Information that should be highlighted in dis-

cussing bariatric surgery includes the types of procedure available, the associated health benefits and risks (e.g., adverse events), a reasonable period before surgery can take place, requirements before surgery (e.g., weight loss to reduce risk of adverse events, smoking cessation), follow-up requirements for the various procedures, cost of the procedure and follow-up care, potential for re-operation to be required at some stage, including the removal of the silicone band or the removal of the port with adjustable gastric banding, need for strict eating plans and physical activity regimes to be continued, need for lifelong vitamin and mineral supplementations to prevent nutritional deficiencies following procedures that reduce uptake, likelihood that some weight will eventually be regained, potential psychological effects of surgery, and need for continuing intervention to prevent additional weight gain.

Follow-up post-surgery: Complications may occur following bariatric surgery and may differ depending on the type of procedure used. Appropriate assessment is, therefore, necessary regularly. If complications occur, they must be followed up by the appropriate specialist team or surgeon. The appropriate specialist team or surgeon should determine individual monitoring and follow-up protocols in consultation with the primary care health professionals involved. The role of primary care health professionals is to monitor the individual based on the specialist team or surgeon's advice, check on compliance where appropriate and refer as appropriate. Primary healthcare professionals have a continuing role in the care of people who have had bariatric surgery, including monitoring and treating comorbidities, including psychological distress and risk of suicide; continuing to promote the benefits of physical activity and healthy eating; assessing nutritional status, including for micronutrient and vitamin deficiencies that might develop over time, providing support for behavioral change (e.g., brief intervention, referral for psychological therapy), providing support for healthy nutrition (e.g., developing an eating plan or providing a referral to a dietician) and sustained levels of physical activity (e.g., referral to an exercise program), and arranging reassessment and re-intervention as required (e.g., regular review of laparoscopic adjustable gastric bands by a bariatric clinician is necessary for the reassessment of the stability and integrity of the prosthesis) [219] [220] [221]. Eventual weight regains after bariatric surgery occurs regardless of the bariatric surgical type. Achieving long-term weight loss, therefore, requires weight management strategies to be continued after bariatric surgery has been performed. Also, the resolution of comorbidities may not be sustained in the longer term, and continuous monitoring of these is required.

Developing an appropriate weight management program:

When planning a weight management program with an individual, consideration is given to the person's age, weight history, background, comorbidities, and the costs and benefits of weight loss. It is also essential to consider the person's family, work, and social context.

Therapeutic engagement:

Weight loss and long-term weight management are challenging. Most people need continuing support to maintain their motivation to adhere to lifestyle changes and not “give up” if they lapse or relapse. While weight management is primarily each person’s responsibility, healthcare professionals have a crucial role in suggesting strategies and providing continuing support. This is facilitated by a sustained relationship between one or more healthcare professionals and each person, which extends beyond individual consultations. Establishing an honest, respectful therapeutic relationship is significant in managing chronic, relapsing conditions that require long-term support. Such a relationship involves healthcare professionals building mutual knowledge, understanding, and trust, to maximize the potential for healing, empowerment, and beneficial change. Also, they need to be non-judgmental, patient, and empathetic and acknowledge the challenges people face, taking a collaborative approach that facilitates people being open about their particular situation, whatever their background or circumstances. In addition, discussing strategies and developing goals that people would like to work on in partnership, rather than imposing “solutions” on them, ensures that people continue to feel safe and supported, regardless of lapses and any changes in their circumstances.

Agreeing on treatment goals:

As behavioral change is fundamental to weight management, it may be a more appropriate short-term goal than weight loss, particularly for people who find weight loss difficult. Examples of behavioral change goals include reduced intake of energy-dense foods, regular eating (including breakfast), reduction in “non-hungry” eating (e.g., snacks), increased daily steps when walking, and increased days a week of planned physical activity. Specific tools may be of use in assisting people in identifying goals (e.g., SMART [specific, measurable, achievable, realistic, and timely]). Specific goals for individuals will depend on their situation but should be realistic and sustainable. For example, a person who is obese and has done no planned physical activity for some time may have a goal of a 5-minute walk each day in the first week and build up slowly from there. Treatment goals should also include health improvements (e.g., lowered blood pressure, blood lipids, and blood sugars), likely with only small amounts of weight loss. The increased benefit will be gained from further weight loss, particularly in people who are obese. Longer-term weight loss goals should be practical. A realistic estimate is around 5% - 10% of the initial weight. However, even after education about realistic weight loss, people may have high expectations about the weight loss they can achieve. It is essential to explain that even modest amounts of weight loss improve health and that weight gain and loss rates vary widely between individuals [222] [223] [224].

Tailoring lifestyle approaches to the individual:

All weight management programs will include lifestyle changes. Planning for lifestyle change needs to consider factors that may influence an individual’s ability to change behaviors and his or her life stage. Availability and access also need to be considered when planning intensive interventions. Most individuals are

faced with challenges when attempting to change lifestyle behaviors (Tables 10-12).

Lifestyle interventions at specific life stages:

(A) **Pregnancy:** Managing weight during pregnancy involves preventing excessive weight gain while maintaining adequate fetal nutrition. Women should be advised to moderate weight gain depending on their pre-pregnancy BMI (Table 13). Developing weight management plans with pregnant women while weight loss diets are contraindicated during pregnancy, dietary and exercise interventions in pregnancy can reduce maternal weight gain and improve outcomes for both mother and baby [225]. The 2009 US Institute of Medicine recommendations on weight gain in pregnancy are as follows: 1) Nutrition during

Table 10. Social factors that affect individual ability to change health behaviors.

Factor	Example of approach to providing support
Cultural factors affecting lifestyle choices and behaviors	Acknowledge the cultural significance of certain food and activities Ensure health messages are culturally appropriate and provide culturally specific resources
Limited access to healthy foods	Provide examples of affordable healthy food choices available locally
Limited understanding of high-energy versus low-energy foods	Provide practical nutrition messages (e.g. cut fat off meat before cooking, reduce sugar intake, increase consumption of fruit and vegetables, grill or boil foods rather than fry)
Limited opportunities for physical activity	Provide advice on increasing incidental activity and moderate-intensity activity (e.g. choosing the stairs, walking to work)
Attitudes to physical activity	Provide advice on locally available resources to support physical activity (e.g. walking groups, culturally appropriate physical activity classes, women-only venues)
Limited access to psychological services (e.g. due to costs or distance)	Consider alternative approaches to psychological support (e.g. telephone or online resources)
Limited access to culturally appropriate health services for follow-up	Involve relevant healthcare professionals to assist in providing culturally appropriate care (e.g. Aboriginal health worker, multicultural health worker, interpreter)
Limited access to healthcare services for follow-up (e.g. due to distance)	Consider referral to community-based program (peer support groups, commercial providers)
Lack of support to change	Involve family or close others in decision-making and interventions

Table 11. Physical factors that affect individual ability to make lifestyle changes.

Factor	Example of approach to providing support
Reduced fitness due to comorbidities	Promote the benefits of any improvements in fitness Provide advice on types of activity suitable to the individual's level of fitness Advise a gradual increase in activity as fitness improves Consider referral for management of comorbidities (e.g. to dietitian, sleep clinic), considering the individual situation
Reduced mobility (e.g. due to obesity or comorbidities)	Promote the benefits of any increase in activity Provide advice on types of activity suitable to the individual's level of mobility Consider referral to a physiotherapist or exercise physiologist
Physical disability	Consider severity of functional limitations, coexisting mental health characteristics and quality of social supports Consider involving relevant allied health professionals (e.g. exercise physiologist, physiotherapist, dietitian, social worker, occupational therapist)

Table 12. Psychological factors that affect individual ability to make lifestyle changes.

Factor	Example of approach to providing support
Past or current life stressors (e.g. abuse, trauma, grief)	Consider referral to a psychologist
Additional health behaviors that individual wishes to change (e.g. smoking, alcohol intake)	Provide resources to support other lifestyle changes (e.g. referral to quit services, drug and alcohol services) Consider referral to a psychologist
Mood disorders (e.g. depression)	Explore the ways in which mental health affects health behaviors (e.g. lack of motivation) and provide practical advice on enabling change (e.g. healthy foods that are simply prepared) Offer advice on community-based supports Consider referral to a psychologist
Eating disorders (e.g. bulimia nervosa)	Involve relevant healthcare professionals (e.g. psychologist, dietitian)
Serious mental illness (e.g. bipolar disorder, schizophrenia, psychosis)	Involve relevant healthcare professionals (e.g. psychiatrist, psychologist, dietitian)
Intellectual and developmental disability	Provide advice that is suitable to the individual's understanding Involve family and/or carers in discussions about lifestyle change Consider coexisting functional limitations Consider involving relevant healthcare professionals (e.g. dietitian, social worker)

Table 13. Weight gain depending on pre-pregnancy BMI.

BMI kg/m ²	25.0 - 29.9	30.0 - 34.9	35.0 - 39.9	≥40.0
Weight gain kg	6.8 - 11.3	5 - 9	5 - 9	5 - 9

pregnancy should be appropriate for good fetal development. 2) Low- to moderate-intensity physical activity during pregnancy is associated with various health benefits and is not associated with adverse outcomes. 3) Higher level activities may be possible for women involved in these before pregnancy who have the required fitness level. The intensity of activity should be reduced in the third trimester. 4) Lifestyle counseling may reduce maternal weight gain. 5) Very low-energy diets, weight loss medications, and bariatric surgery are contraindicated. 6) After pregnancy, extended breastfeeding is recommended. 7) Infants who are breastfed for at least six months are less likely to gain excessive weight and develop obesity later in life [225]-[240].

(B) Older people: The approach to lifestyle intervention in older adults is debated, partly because of concern that weight loss could worsen frailty by accelerating the usual age-related loss of muscle. However, there is some evidence that the combination of weight loss and regular physical activity provides a more remarkable improvement in physical function and reduced frailty than either intervention alone. A recent analysis suggests that women may gain more benefits than men for the same level of physical activity and that being sedentary is especially harmful to older women [98] [241].

Developing weight management plans with older adults: 1) Multicomponent lifestyle interventions are likely to be the most successful. 2) Dietary advice should reflect evidence-based approaches for weight loss while emphasizing good nutrition. 3) Moderate physical activity is essential because it can reduce the risk of bone density loss and lessen other adverse health effects of being overweight and obese. 4) Physical activity should be tailored to accommodate chronic disease, sensory deficits, or functional limitations. 5) Innovative approaches may be needed to reduce barriers to lifestyle interventions in older adults (e.g., stigma, lack of evidence-based programs, and high costs of existing programs) [242].

There is insufficient data to evaluate the safety or efficacy of weight loss medication or bariatric surgery in older adults. Rates of adverse surgical outcomes found in younger adults may not be generalizable to older people because chronic disease increases with age, and both age and comorbidity are linked with perioperative risk. Limited observational data suggest that bariatric surgery can be safe in the short term in older adults [242] [243].

Supporting self-management:

A self-management approach may support lifestyle change and weight loss. Self-management approaches generally include lifestyle education, individualized approaches to care planning, and emphasis on defining the person's goals and suitability for people at different stages of change. Self-management techniques are part of a multicomponent intervention rather than a stand-alone in-

tervention. Examples of self-management approaches associated with weight loss in recent studies include peer-led education on improving self-efficacy in making changes, intensive weight loss counseling based on self-management principles, short-term goal setting or action planning, and an adapted “symptom cycle” [244] [245] [246] [247].

Recommendation 16: *For adults, include a self-management approach in weight management programs. C*

Various healthcare professionals and organizations could deliver practical advice for self-management approaches. Resources such as Life scripts and other health promotion activities are readily available on the internet. Assistance with developing skills for self-advocacy and self-management requires support and consultation by healthcare or support programs for the individuals. This component may have time and cost implications. Group approaches are similarly practical to individual approaches and maybe a more cost-effective option for the healthcare system. Depending on local service providers and access to healthcare professionals, referral to community-based programs may be a cost-effective option for the individual and healthcare system to provide continuing self-management, lifestyle advice, and peer *support*. Self-monitoring of weight is a helpful self-management strategy—more frequent self-weighing is associated with more significant weight loss and weight gain prevention. Regular self-weighing (e.g., weekly) may be a valuable component of self-management [248] [249] [250].

Practical advice to support individual self-management:

Identify which changes to work on first. Start by making small changes and work up to your targets. Involve family and friends if appropriate. Identify activities and healthy foods that you enjoy. Monitor your progress (e.g. keep a food and/or exercise diary). Weigh yourself regularly (e.g. each week). Reward yourself for meeting each goal (e.g. spend time with a friend). Don’t expect to meet all of your lifestyle change targets straight away.

Planning for review and monitoring:

The duration over which an intervention is provided and the frequency of contact with a health professional appear to influence the success of weight loss interventions in adults. Therefore, the weight loss program should include arrangements for regular review throughout initial weight loss and continuous monitoring for at least 12 months [62] [246] [251] [252] [253].

Recommendation 17: *For active weight management in adults, arrange fortnightly review for the first 3 months and plan for continuing monitoring for at least 12 months, with additional intervention as required. B*

Increased frequency of contact may have resource implications for the health system and the individual. Depending on the level of obesity, comorbidities, and type of intervention, frequent monitoring can be undertaken by various healthcare professionals, organizations, or programs to reduce costs to the individual and healthcare system. Sustained weight loss is unlikely to result from episodic care but needs to be actively managed and monitored. Suppose the practice cannot provide a program in-house. In that case, referral to a group or estab-

lished weight loss program to provide ongoing monitoring, structured education, self-management, and peer support should be considered. Discussing cost and access considerations with the individual should include provider attendance and availability, transport, and suitability for specific activities based on age, life stage, and gender.

Referral:

Lifestyle interventions are well suited to delivery in primary health care. The role of primary health care in intensive weight loss interventions will depend on the severity of health risk (e.g., the degree of obesity and associated comorbidities), accessibility and cost, and the healthcare professional's availability and expertise in weight management. Referral may be appropriate in a range of situations (Table 14). However, while it might be ideal to refer in these situations, the primary healthcare professional may need to continue overall management if waiting times are extended, or specialist support is unavailable. Primary healthcare professionals should maintain a role in monitoring and reviewing progress, even when the person is referred for specialist care.

Primary healthcare professionals (e.g., practice nurse, social worker) may also need to assist people in addressing barriers to referral and attendance, including providing information about the cost of programs or attending visits to healthcare professionals, transport, attitudes towards treatment, and time of day that the program or provider is available.

Table 14. When to refer?

Referral to an allied health professional	Referral to specialist support
<ul style="list-style-type: none"> • When individuals ask for specific information related to weight management or indicate interest in undertaking a specific weight loss program • When community-based programs are available, especially for people with a BMI < 35 and without major comorbidities who are ready for change • When specific health indicators demonstrate increased health risks (e.g. increased blood pressure, lipid profiles, blood glucose) and the individual would benefit from interventions related to weight loss • When the individual's eating patterns are not meeting nutritional requirements (e.g. to a dietitian) • When the individual might benefit from attending a structured group support program When the individual is having difficulty achieving behavioral change and may benefit from a behavioral weight loss intervention (e.g. to a psychologist) 	<ul style="list-style-type: none"> • When the individual has a BMI > 35 kg/m² or BMI > 30 kg/m² with comorbidities • When comorbidities need specialist management (e.g. musculoskeletal problems, sleep apnea, fertility problems, type 2 diabetes, eating disorders, depression or other mental health comorbidities) • When a very low-energy diet or weight management medication is recommended (e.g. refer to a specialist weight management clinic) • When bariatric surgery is a consideration (e.g. refer to a specialized bariatric surgery center) • When an endocrine or syndromic cause is suspected (e.g. refer to an endocrinologist)

6. Monitoring: Short-Term and Long-Term

Key messages

- A periodic review of the weight loss program in the first three months allows for assessing its suitability for the individual and supporting program goals.
- Long-term weight management is challenging—people need to overcome potent physiological responses that increase hunger, encourage weight to regain, and resist returning to weight-promoting lifestyle habits.
- As with weight loss, lifestyle interventions underpin long-term weight management, whether or not more intensive interventions are also used to help prevent or to reverse weight regain.
- Weight regain is common after weight loss. However, the health benefits of weight loss persist even if some weight is regained.
- Long-term monitoring and support are essential—longer-term approaches to supporting weight management that includes frequent contact with health-care professionals achieve better results.
- Weight management may get easier over time. Once people have maintained a weight loss for 2 - 5 years, the chances of longer-term success significantly increase.

Review and monitoring: The early stages of the weight loss program provide an opportunity to establish a sustainable lifestyle change approach. Systematic review at this time may also support more rapid weight loss. Continuing review for 12 months and more aims to ensure that the weight loss program remains appropriate, comorbidities are monitored, and people are supported through the challenges associated with long-term weight management.

Early review of the suitability of the weight loss program: A weight loss program specific to the individual should achieve some weight loss in the first weeks of intervention. The early review includes assessing whether the person is facing challenges in keeping to the eating plan (e.g., whether the plan is suitable in terms of individual preferences and includes foods that are available and affordable), whether the type of physical activity being undertaken is suitable to the person's level of fitness and opportunities are available to increase physical activity (e.g., walking groups, community facilities), psychosocial support, including psychological therapy, is available and accessible, or any negative occurrences have resulted from the weight loss program (e.g., weight gain, worsening of comorbidities). This early review can be by a practice nurse, allied health professional, or community-based program leader and conducted individually or in a group.

The weight loss plan should be reviewed after 2 weeks to determine its suitability for that individual and to assess whether it needs to be modified.

Review in the first three months: Frequent (e.g., fortnightly) review should continue through the first three months of a weight loss program. A 3-month medical review may include calculating BMI and measuring waist circumference, and comparing these to baseline measurements and anticipated weight

loss and targets, tracking progress towards goals (e.g., whether health behaviors have changed), monitoring changes in risk factors and comorbidities, reviewing the care plan, providing support and encouragement. For adults who are overweight and have comorbidities or who are obese and do not lose weight in the initial stages of the weight loss program, additional intensive weight loss measures may be indicated, both for weight loss and to support motivation. Referral to healthcare professionals or services with expertise in obesity management should also be considered [152] [246] [251] [252] [253].

If there is no weight loss (less than 1% body weight or no change in waist circumference) after three months of active management, lifestyle behaviors and causes of weight gain should be reviewed. Intensive weight loss interventions may also be considered depending on the degree of overweight or obesity and whether comorbidities are present.

Continuing support: While contact with and support for the person may decrease after the first intensive 2 - 3 months, long-term monitoring and support are essential to weight management programs. The rate of weight loss can be expected to decrease or plateau after the initial stages due to physiological adaptation. The individual trying to lose weight may regard this as a failure of intervention because it can occur while they are still restricting energy intake and exercising regularly. Continuing support and encouragement are needed, including reiterating that even modest amounts of weight loss improve health and that weight gain and loss rates vary widely between individuals. Where people continue to have difficulty losing weight or maintaining a new lower weight, healthcare professionals should be aware of the possibility of psychological issues, including eating disorders. Continuing monitoring and support of weight management will also involve reviewing various health indicators (e.g., blood pressure, lipid profile) and managing the consequences and complications of overweight and obesity. Referral to allied health professionals or specialists may be appropriate in various situations [254].

Long-term weight management: When realistic treatment goals have been reached—for example, 5% of body weight lost or blood pressure lowered by a clinically significant amount—it is important to discuss strategies for managing weight in the longer term, including preventing weight regain. Weight regain is common after weight loss achieved by lifestyle interventions, with studies finding that 1) Weight loss is usually regained by five years of follow-up, 2) Weight regain to pre-intervention weight occurs regardless of whether the participant has overweight or class I, II or III obesity, and in participants with regular blood sugar, prediabetes and type 2 diabetes [100] [255] [256].

Recommendation 18: *For adults who achieve initial weight loss, strongly recommend the adoption of specific strategies, appropriate to their individual situation, to minimize weight regain. A*

Weight regain is not caused simply by people resuming former lifestyle habits—instead, it has a solid physiological basis. The adaptation that causes slowing of weight reduction in the weight loss phase also causes weight to regain in

the longer term. The changes in energy balance regulation in the body that lead to reduced energy expenditure persist for at least one year [257]. Increasing evidence indicates that changes in appetite-regulating hormones also occur after diet-induced weight loss, including decreased levels of leptin, insulin, cholecystokinin, triiodothyronine (T3), and an increased level of ghrelin. Many of these changes would be expected to reduce feelings of fullness after eating (satiety) and increase hunger. Recent evidence suggests that hormone changes do not reverse for at least one year after initial weight loss [167] [258]. These findings indicate that, for successful long-term weight management, people must overcome strong physiological responses that encourage weight regain and resist a return to weight-promoting lifestyle habits.

Disordered eating patterns (including binge eating and strict dietary restriction), body dissatisfaction, inflexible thinking style, and eating to regulate mood or avoid negative affect are all associated with a greater likelihood of weight regain. People's social context, including their level of peer and family support, also influences their ability to manage their weight. Despite the evidence highlighting the challenges, there is evidence that long-term weight management is possible when specific strategies are identified and followed. There is also evidence that the health benefits of weight loss (e.g., preventing type 2 diabetes) are maintained in the longer term, even if there are some relapses [68] [146] [259] [260] [261] [262].

Factors influencing long-term weight management (Table 15): [263] [264] [265] [266]

Discussing long-term weight management

Preventing weight regain may be a more helpful focus than trying to lose more weight, as being satisfied with the amount of weight that has been lost supports long-term weight management. Also, even when weight management is successful, modest weight regains, and weight fluctuations are common. Acting rapidly is critical because of the difficulty of reversing even small weight regains. Clear messages are needed, so the individual understands that: 1) After weight loss, the body is “hardwired” to encourage weight to regain, so hunger may increase, 2) Preventing weight regain can be even more challenging than losing

Table 15. Barriers to and predictors of successful long-term weight management.

Barriers to successful long-term weight management	Predictors of successful long-term weight management
Physiological adaptation to energy deficit	Continued healthy eating plan
Waning motivation to sustain lifestyle change	High levels of regular physical activity
Resumption of old habits	Continued contact with health professional
Depressive symptoms	Self-monitoring of body weight
Negative peer and family influence	Peer and family support

weight, especially during the first year, 3) Weight regain is pervasive and is not a sign of failure, 4) Some benefits of weight loss persist even if a small amount of weight is subsequently regained, 5) It may be helpful to set a weight to regain limit at which advice from a healthcare professional is sought, and 6) If weight regain limit is attained, it is essential to continue to make sustainable lifestyle changes and possibly consider one or more intensive interventions [267] [268].

For long-term weight management, adults can be advised to act (e.g., seeing a healthcare professional) when small amounts of weight (approximately 3 kg) have been regained. If there is weight regain, consideration should be given to reassessing energy intake and physical activity and re-intervening with weight loss strategies.

Successful weight management strategies: An American national database of self-reported long-term weight management identified the following weight management strategies as being successful: 1) Maintaining high levels of physical activity and limiting sedentary activities (e.g., television viewing), 2) Eating a diet low in kilojoules, 3) Regularly eating breakfast, 4) Maintaining a consistent eating pattern throughout the week and year, 5) Identifying triggers of emotional eating and developing alternative strategies for regulating mood, 6) Frequently monitoring weight, and 7) Catching lapses before they become large-scale weight gains [146].

Some studies support the value of 200 - 300 minutes a week of physical activity to reduce weight gain after weight loss, and it appears that “more is better”. While there is an overlap between weight loss and long-term weight management strategies, practices that lead to weight loss might differ from those that help people manage weight in the longer term [145].

In a cross-sectional survey of American adults who were successful at maintaining weight loss for one year, the following practices were associated with maintaining weight loss but not with initial weight loss: following a consistent exercise routine, rewarding themselves for keeping to their eating or physical activity plan, and reminding themselves why they need to control their weight. While most of these strategies involve self-management, healthcare professionals have an essential role in continued monitoring (e.g., through regular visits) to review weight and behaviors, provide continuing support, reinforce lifestyle and behavioral advice, and discuss intensive interventions when needed. Phone counseling and internet-based interventions can be used to augment long-term weight management [269] [270] [271] [272] [273].

Long-term weight management may be more successful if it involves a self-management approach, continuing contact with healthcare professionals and behavioral strategies for maintaining motivation. Self-management strategies for long-term weight management may include maintaining a healthy lifestyle, identifying ways to manage hunger, setting, and reviewing goals, and regular self-weighing.

Developing a long-term weight management program:

As with weight loss, the type and intensity of the long-term management pro-

gram will depend on various individual characteristics. Given the complex interaction of factors causing the weight to regain, the program should be sensitive to individual needs and differences and allow people to adopt behavioral changes that suit their lifestyles. Although the ideal outcome is stabilizing at the new lower weight, there may be other options. If this is the case, the aim should be to delay weight regain for as long as possible [264] [274].

Lifestyle interventions underpin long-term weight management, and for many people who regain weight, re-intervention with more intensive lifestyle changes is sufficient. Interventions to manage psychological issues may be required if the person has a mental health comorbidity (e.g., eating disorder, depression) or is continuing to find behavioral change difficult. Weight management may get easier over time. Once people have maintained a weight loss for 2 - 5 years, the chances of longer-term success significantly increase [275].

Very low-energy diets, pharmacotherapy, and bariatric surgery may be options where people cannot manage the increased hunger that follows weight loss and/or if obesity and/or comorbidities are causing health risks. Lifestyle interventions combined with pharmacotherapy result in less weight regain than lifestyle interventions alone. However, by ten years of follow-up, the most lost weight has been regained, regardless of whether weight was lost by lifestyle intervention or pharmacotherapy [76] [107] [171] [276] [277].

In people with Class III obesity, bariatric surgery is associated with less weight regain than lifestyle interventions or pharmacotherapy. Weight loss appears to be most significant in the first year after surgery but continues for 2 - 3 years. After this, weight regain appears to occur. However, at least 16% of weight loss can be maintained at up to 10 years of follow-up [72] [101] [188].

Long-term review and monitoring:

Studies involving long-term support have successfully prevented regain of baseline weight. Planning for review and monitoring should include discussion about: 1) the intensity of the program and schedule of visits, 2) the scope of self-monitoring and what will be reviewed at regular visits, and 3) the availability and benefits of participation in a weight management program in the community or person's workplace [265].

7. Obesity and Overweight Management Plan in DM

Obesity management is beneficial in the treatment of type 2 DM. For overweight or obese, modest and sustained weight loss improves glycemic control [34] [278] [279] [280].

Assessment: Each visit, **calculate BMI and document** it in the patient's medical record. Educate DM overweight or obese that higher BMIs increase the risk of CVD and all-cause mortality. Providers and patients should jointly determine goals and interventions to achieve weight loss [34] [278] [279] [280].

Interventions: Overweight or obese patients with type 2 DM should achieve and maintain > 5% weight loss. Diet, physical activity, and behavioral therapy

are interventions to reach this goal (Table 16). Plan to **achieve the target weight in 6 months**. Diets should be individualized with other interventions to achieve an energy deficit of 500 - 750 kcal/day. For those who achieved **weight-loss goals**, use long-term (1 year) comprehensive weight maintenance programs. At least once per month, contact them and encourage ongoing monitoring of body weight. **Short-term (3-month)** interventions with very-low-calorie diets (<800 kcal/day) and total meal replacements may be used with close medical monitoring. Long-term comprehensive weight-maintenance counseling is needed to maintain weight [34] [278] [279] [280].

Pharmacotherapy: Always minimize medications that cause weight gain to wither antihyperglycemic agents or other agents for comorbid conditions. Pharmacotherapy (Table 17) may be used for weight loss for selected patients with BMI ≥ 27 kg/m². Consider re-assessing pharmacotherapy after three months according to the effect on body weight [34] [278] [279] [280] (Figure 2).

Metabolic Surgery: People presenting for metabolic surgery should receive a comprehensive mental health assessment and support [34] [278] [279] [280].

Table 16. Treatment options for overweight and obesity in type 2 DM.

Intervention	BMI category (kg/m ²)				
	25.0 - 26.9	27.0 - 29.9	30.0 - 34.9	35.0 - 39.9	≥40.0
Diet, physical activity & counseling	+	+	+	+	+
Pharmacotherapy		+	+	+	+
Metabolic surgery			+/-	+/-	+

Table 17. Medications for the treatment of obesity in type 2 DM [34] [278] [279] [280].

Class	Relative weight loss	Side Effects	Therapeutic Considerations
Gastrointestinal lipase inhibitor: (orlistat)	↓	Loose stools, GI upset, rare liver failure	Oral medication, decreases fat absorption, may require vitamin supplementation
GLP-1 receptor agonist: (liraglutide 3.0 mg)	↓↓	Nausea, GI upset, rare gallstones and pancreatitis	Subcutaneous injectable, increases satiety

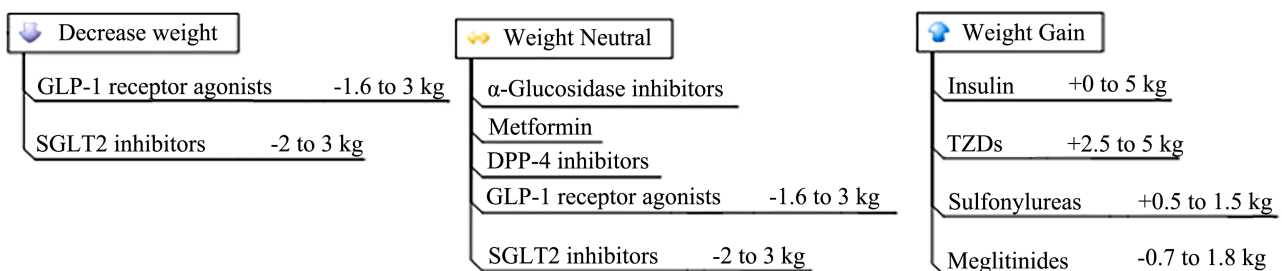


Figure 2. Weight effects of Antihyperglycemic drugs.

8. Conclusion

The early screening and management of obesity are beneficial against the significant burden, and always, prevention is better than treatment, so increase awareness of the public.

Conflicts of Interest

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

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