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Obesity


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**C21.S1 Overview**

Obesity is a major cause of morbidity and mortality worldwide and is common in adults and children. It arises as a result of a prolonged energy imbalance within an obesogenic environment, especially in genetically susceptible individuals. Lifestyle weight management is the cornerstone of treatment, including diet, physical activity, and behaviour change. Multicomponent interventions have been demonstrated to result in modest weight loss, which can be increased further by the addition of adjunct pharmacotherapy. Bariatric surgery has the greatest impact on weight loss and co-morbidities but is associated with the greatest risk of complications. Whatever treatment is used, lifelong vigilance to prevent weight regain is required. Prevention of excess weight gain is key, using multi-sectoral public health approaches.

C21.S1.1 Definition

Obesity is a disease characterized by excessive body fat accumulation with multiple organ-specific consequences and is most commonly diagnosed in adults using body mass index (BMI). Individuals are classified according to their risk of metabolic complications associated with excess weight (Table 21.1).

Although BMI is commonly used and useful at a population level, it is an indirect measure of body fatness that cannot distinguish between different tissue types, nor does it describe the health risks associated with fat distribution (see  Chapter 4, 'Body mass index'). BMI alone should be used with caution; ideally measures of fat distribution such as waist circumference (WC) should also be used, although at BMI >35 kg/m², WC does not improve prediction of co-morbidities.

WC is a single simple measurement and is a good indicator of intra-abdominal fat deposition, which is associated with adverse health consequences. Using WC (measured at the midpoint between the lower border of the ribcage and the iliac crest), the following cut-off points have been described (Table 21.2).

C21.S1.1.1 BMI and WC cut-offs for different populations

Different populations vary in their risk of metabolic abnormalities and population-specific WC cut-off points have been defined (Table 21.3).

Individuals of south Asian origin (Bangladeshi, Indian, and Pakistani origin) have greater prevalence of metabolic abnormalities at lower BMI than would be expected and it has been proposed that for these populations, lower cut-off points for public health action should be used.

Although there is a lack of UK-based evidence for ethnicity-specific cut-off points, because of increased risks at lower BMI (<25 kg/m²) experienced by members of black, Asian, and other ethnic groups, it is recommended that the lower cut-off points of 23.0 kg/m² for increased risk and 27.5 kg/m² for high risk are used to indicate need for action to prevent type 2 diabetes.

Other measures, such as waist-to-height ratio, are useful predictors of metabolic risk¹ but less well understood by most healthcare professionals. More complex measures of body composition, such as bioimpedance, are not recommended as alternatives to BMI in clinical practice.

1 Ashwell, M., Gibson, S. (2016). Waist to height ratio as an indicator of 'early health risk': simpler and more predictive than using a 'matrix' based on BMI and waist and circumference *BMJ Open* 6(3), e010159. doi: 10.1136/bmjopen-2015-010159.

Table 21.1 Classification of weight using body mass index*

BMI range, kg/m ²	Classification	Risk of co-morbidities
<18.5	Underweight	Low (but may be other health problems)
18.5-24.9	Healthy weight	Average
25.0-29.9	Overweight	Increased
30.0-34.9	Obesity I	Moderate
35.0-39.9	Obesity II	Severe
≥40.0	Obesity III	Very severe

*Reproduced with permission from World Health Organization (WHO). *Obesity: preventing and managing the global epidemic. WHO Technical Report Series 894*. Geneva, Switzerland: World Health Organization. Copyright © 2000 WHO. http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/.

Table 21.2 Cut-off points for risk of metabolic complications in Caucasian adults with obesity according to waist circumference*

Risk of metabolic complications	Waist circumference, cm	
	Men	Women
Increased	≥94	≥80
Substantially increased	≥102	≥88

*Source: data from Ashwell, M., Gibson, S. (2016). Waist to height ratio as an indicator of 'early health risk': simpler and more predictive than using a 'matrix' based on BMI and waist and circumference *BMJ Open* 14, 6(3):e010159. doi: 10.1136/bmjopen-2015-010159.

Table 21.3 Waist circumference cut-off points according to ethnicity*

Population	Gender	WC in cm (inches)
European	Men	≥94 (37)
	Women	≥80 (31.5)
South Asian, Chinese and Japanese	Men	≥90 (35)
	Women	≥80 (31.5)
Ethnic south and central Americans	Use South Asian recommendations in lieu of more specific data	
Sub-Saharan Africans	Use European recommendations in lieu of more specific data	

*Reproduced with permission from Alberti, K.G.M.M., et al. International Diabetes Federation: a consensus on type 2 diabetes prevention. *Diabetic Med.* 24, 451-63.

C21.S2 **Prevalence**C21.S2.1 **International**

Obesity is a global public health problem affecting both adults and children in low and middle income as well as high income countries. In 2014, 39% of adults globally were overweight and of those 13% were classed as obese.² This represents more than 1.9 billion adults being at least overweight, of whom more than 600 million were obese (266 million men and 375 million women).³ A recent study reported that overweight and obesity has doubled in more than 70 countries since 1980 and increased steadily in almost all other countries.⁴

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C21.S2.2 **UK**

Prevalence of excess weight in England increased by 72% between 1989 and 2013, and prevalence of obesity among adults rose from 15% to 27% between 1993 and 2015.⁵ Within the UK, 63% of adults were classed as overweight or obese in 2015 (68% men and 58% women).

By 2050 obesity is predicted to affect 60% of adult men, 50% of adult women, and 25% of children. Prevalence in the UK is comparatively high and ranked 8th for obesity prevalence in men (25.7%) and 11th for women (26.6%) out of 23 Organisation for Economic Co-operation and Development (OECD) countries in 2016.⁶

C21.S2.3 **Who is at risk?**

Major demographic risk factors for obesity include age, gender, ethnicity, and socioeconomic status. Prevalence of obesity is generally higher in older than younger adults, except for oldest adults. The relationship between ethnicity and obesity prevalence is complex and varies with gender and method of assessing obesity. Prevalence of overweight and obesity is higher in men than women (68% and 58%, respectively, in the UK in 2015);⁷ however, the prevalence of obesity was similar in both genders. An inverse relationship between socio-economic status and excess weight is seen in women but not men.

2 WHO. (2016). Obesity and overweight. Fact sheet 311. Available at: <http://www.who.int/mediacentre/factsheets/fs311/en/>.

3 NCD Risk Factor Collaboration (NCDRiskC) (2016). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet* **387**, 1377–96.

4 GBD 2015 Obesity Collaborators (2017). Health effects of overweight and obesity in 195 countries over 25 years. *N. Engl. J. Med.* **377**, 13–27. Available at: <http://www.nejm.org/doi/full/10.1056/NEJMoa1614362>.

5 Ng, M., et al. (2014). Global, regional and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* **384**, 766–81.


6 OECD (2018). Health statistics 2018, frequently requested data. Available at: <http://www.oecd.org/health/health-data.htm>.

7 HSCIC (2015). *Statistics on Obesity, Diet and Physical Activity*. Health and Social Care Information Centre, London. Available at: <http://www.content.digital.nhs.uk/catalogue/PUB16988/obes-phys-acti-diet-eng-2015.pdf>.



C21.S3 **Causes and consequences**

Obesity arises in genetically susceptible individuals exposed to obesogenic environments. As such it can be viewed as a normal response to an abnormal environment. The genetic heritability of BMI is estimated to range from 40% to 70%,⁸ and there are numerous potential mechanisms through which genes may mediate effects on body weight, e.g. on appetite, food and activity preferences.

However, the rapid increase in prevalence globally indicates that social and environmental factors are also important. Factors favouring weight gain include increased consumption of energy dense, nutrient-poor foods often in large portion sizes, reduced physical activity and increased time spent in sedentary activities, inadequate and/or disturbed sleep, and stress. The roles of prenatal influences, epigenetics and the gut microbiome have also received attention. Food prices and time cost of fast foods, marketing and advertising, fast food consumption, and related behaviours may also contribute. That obesity is caused by numerous physical, biological/physiological, environmental, societal (cultural and economic), and psychological factors which interact in a complex matrix appears to be beyond doubt,⁹ and action across all sectors is required to address this. See  Chapter 18, 'Obesity prevention'.

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C21.S3.1

Co-morbidities and costs of obesity

High BMI is the third highest contributor to disease burden expressed as a percentage of UK disability-adjusted life-years, after smoking and high blood pressure. BMI has been shown to strongly predict overall mortality; life expectancy both above and below the optimal 22.5kg/m² is comparatively reduced. Reductions of 2-4 years for BMI category 30-35 kg/m², and 8-10 years for BMI category 40-50kg/m² are estimated.

Co-morbidities include:


Metabolic: type 2 diabetes, cardiovascular disease, hypertension, hyperlipidaemia, some types of cancer, increased risk of liver and kidney disease, dementia, and reduced fertility as well as adverse outcomes of pregnancy, gallstones, stroke, and polycystic ovary syndrome.

Physical: osteoarthritis, sleep apnoea, back pain, poor mobility, and increased risk of accidents.

Psychosocial: low self-esteem, poor body image, and depression. Obesity is a highly stigmatized condition, perhaps the only remaining socially acceptable stigma. Stigma and bias can result in worse treatment outcomes, poor adherence to treatment plans, and reluctance to seek help.

Financial impact of obesity includes direct and indirect costs such as lost productivity, welfare payments, and increased morbidity and mortality. Additional hidden costs of obesity include increased fuel required for greater food production and transport of heavier people, increasing greenhouse emissions and carbon footprint.

8 Herrera, B.M., et al.(2011). Genetics and epigenetics of obesity *Maturitas* 69, 41–9.

9 Foresight (2007). Obesity Systems Map. Available at:  https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296290/obesity-map-full-hi-res.pdf.



**C21.S4 Weight management: assessment**

A thorough assessment to develop a tailored individualized care plan is fundamental to good practice. Suggested areas for assessment are shown in Table 21.4. Weight should not be the sole focus of either assessment or treatment; feasible healthy changes to behaviours, improving diet and activity levels, will increase the likelihood that changes will be sustained.

C21.T4 Table 21.4 Assessment topics in weight management***A. Anthropometrics**

- Height;
- Weight;
- Body mass index;
- Waist circumference.

B. Medical

- *Potential causes*, e.g. endocrine, neurological, medications, genetic influences (age of onset, family history);
- *Co-morbidities*: current and future risk;
- *Severity of obesity and extent of physical disability*.

C. Psychological

- *Identify psychological factors*, e.g. depression, addictive behaviours;
- *Eating disorders*: binge eating, bulimia nervosa, disordered eating;
- *Risk of potential barriers to treatment*, e.g. psychiatric history.


D. Nutritional

- *Weight history*: extremes of adult weight, patterns of weight gain and loss, age of onset, triggers to weight gain, triggers to disordered or excessive eating;
- *Dieting history*: number and types of diet, weight loss medications, success of previous attempts to manage weight, alternative or complementary approaches to weight management;
- *Current eating patterns*: meal patterns (meals skipped, snack consumption, largest meal eaten);
- *Nutritional intake*: nutrient density, nutritional supplements;
- *Environmental factors*: meals eaten away from home, fast food consumption, restaurant meals, ethnic foods, lifestyle factors (time, financial);
- *Exercise history*: current exercise, activities of daily living, exercise history, barriers to exercise;
- *Readiness to change*: reasons to lose weight, weight loss goals, support systems, likely difficulties, readiness for making changes.

*Source: data from American Dietetic Association (2009). Position of the American Dietetic Association: Weight Management. *J. Am. Diet. Assoc.* 109:330-46.



C21.55 **Weight management: overview**

First line treatment is lifestyle intervention to change eating and activity behaviours and achieve negative energy balance and weight loss. Modification of the Eatwell Guide may be used¹⁰ (see  Chapter 2), although this may be too unstructured an approach for those who struggle with portion size.

The aim of treatment is usually loss of 5-10% of initial body weight although this should relate to initial body weight, so those with a BMI <40 kg/m² may aim for 5% and those with BMI of >40 kg/m² aim for >10%. Weight loss at this level is achievable, sustainable, and incurs significant clinical benefit. The majority of weight loss occurs in the first 6 months, with weight regain thereafter in most individuals. Multicomponent interventions (i.e. those tackling diet, physical activity, and behaviour change) are recommended.

10 Public Health England. (2016). Eatwell Guide. Available at:  <https://www.gov.uk/government/publications/the-eatwell-guide>.

**C21.S6 Weight management: dietary approaches**

The ideal macronutrient composition of a weight loss diet is hotly contested, and a variety of approaches have been shown to result in modest weight losses in the short term. Studies lasting longer than a year typically do not show significant weight differences between different dietary groups, either in terms of weight lost or weight loss that is maintained. Adherence to weight management interventions in the long term is critical to success. Modest weight losses at the individual level have the potential for a large impact on public health. This suggests that so long as a hypocaloric weight loss diet is otherwise nutritionally complete, individual preferences can dictate the type of diet followed, and may help improve adherence to the programme.

There is evidence to support a range of dietary approaches resulting in moderate weight loss of approximately 5–8.5 kg (5–9%) in the first 6 months. These include an energy-restricted diet (generally 500–600 kcal below requirements), a low fat diet (<30% energy from fat), and meal replacements. This modest effect may reduce adherence to diets and expectations both of patients and commissioners must be addressed to reduce this possibility.

C21.S6.1 Low carbohydrate

Low carbohydrate diets appear to result in modestly greater weight loss compared with low fat diets. Systematic reviews^{11,12} found that low carbohydrate diets (≤ 120 g/day and ≤ 60 g/day, respectively) resulted in significantly greater weight loss and improved lipid profiles compared with low fat diets ($\leq 30\%$ energy from fat) and low energy diets (600 kcal deficit diet).

However, the long-term safety of low carbohydrate diets is unclear. Studies using low carbohydrate diets are heterogeneous, using different inclusion criteria, different levels of carbohydrate restriction, different study durations and follow-up, all of which may affect assessment of their clinical value. Additionally, many studies do not include intention-to-treat analysis, thus possibly overestimating their benefits.

C21.S6.2 Low GI/GL

Studies of low glycaemic index (GI) and glycaemic load (GL) tend to be small and heterogeneous. A systematic review¹³ concluded that low GI diets resulted in significantly greater weight loss and improved risk factors when compared with other diets. Even *ad libitum* low GI diets were at least as good as conventional energy restricted diets. However, only six small studies were included, duration of studies was short, ranging from 5 weeks to 6 months, and only two studies included obese adults. They are generally not recommended as a sole dietary management approach because of

11 Sackner-Bernstein, J., et al. (2015). Dietary intervention for overweight and obese adults: comparison of low-carbohydrate and low-fat diets. A meta-analysis. *PLoS One* 10, e0139817.

12 Noto H., et al. (2012). Low-carbohydrate diets and all-cause mortality: a systematic review and meta-analysis of observational studies. *PLoS One* 8, e55030.

13 Thomas D., et al. (2007). Low glycaemic index or low glycaemic load diets for overweight and obesity (review). *Cochrane Database Syst. Rev.* 3, CD005105.



a lack of well-controlled long-term studies. However, in those with insulin sensitivity or resistance, hypocaloric low GI/GL diets may be preferred and if they suit personal preference and are of adequate nutritional quality they may be a useful strategy for some individuals.

C21.S6.3 Intermittent fasting

Intermittent fasting or intermittent energy restriction (IER)^{14,15} can take a number of forms, but is defined as periods of energy restriction interspersed with normal energy intake. Studies have shown that IER approaches result in similar weight loss to interventions using continuous energy restriction, but a variety of different approaches to IER are used and many studies are short term. Weight loss outcomes in IER compared with continuous restriction for a minimum of 6 months do not differ significantly. Longer-term effects of IER, particularly if non-restricted days are used to either fast or feast are unclear. Therapeutic fasting practised too often or for too long may have negative effects. The approach has potential value for overweight or obese individuals who find continuous restriction difficult, because an intermittent approach means that usual intake can be consumed on non-restricted days, and IER was not shown to result in adaptive responses to restricted energy intake. There is some evidence that IER improves some aspects of mental health in overweight or obese individuals, but more research is needed using sufficiently powered studies to identify optimal IER patterns, whether there are differences in body composition between continuous restriction and IER and whether there are differential effects in men compared to women using this approach. In addition, potential longer-term effects, both positive and negative, need to be identified.

C21.S6.4 Meal replacements

These portion-controlled products supplemented with vitamins and minerals are designed to replace one to two meals per day, with one remaining meal using conventional foods, and an overall aim of achieving intakes of 1200-1600 kcal/day. They have been shown to be beneficial in short- and long-term use, in primary care and unsupervised 'off-the-shelf' use. A role in weight maintenance has also been demonstrated. For example, in the Look AHEAD trial,¹⁶ weight loss of 4.7% at 8 years in the intervention arm was seen. Meal replacements were one of the dietary strategies used in both the weight loss and maintenance phases of this trial involving 5145 ethnically diverse adults with type 2 diabetes. For those who have difficulty with portion control or food selection, they may be a useful strategy for both weight loss and weight maintenance.¹² Because they are neither

14 Harvie, M., et al. (2017). Potential benefits and harms of intermittent energy restriction and intermittent fasting amongst obese, overweight and normal weight subjects – a narrative review of human and animal evidence. *Behav. Sci.* 7, pii.E4. DOI: 10.3390/bs7010004.

15 Horne, B.D., et al. (2015). Health effects of intermittent fasting: hormesis or harm? A systematic review. *Am. J. Clin. Nutr.* 102, 464–72.

16 LookAHEAD Research Group. (2014). Eight-year weight losses with an intensive lifestyle intervention: the Look AHEAD study. *Obesity* 22, 5–13.



extreme dietary approaches nor total diet replacements, they can be used indefinitely.

C21.S6.5 **Very low energy diets**

Very low energy diets (VLED) or very low calorie diets (VLCD) are complete dietary replacements, providing 450-800 kcal/day, and are nutritionally complete apart from energy. They can be used for a maximum of 12 weeks continuously or intermittently as part of a comprehensive strategy with ongoing clinical support and should not be routinely used to manage obesity. The use of VLED has been shown to result in rapid substantial weight loss followed by rapid weight regain. They may be useful in situations where rapid weight loss is needed under clinical supervision and with a planned reintroduction of conventional foods.

Over >6 months, there appears to be little difference in the weight loss achieved by following diets differing in macronutrient composition. Adherence to the diet is what counts and what predicts weight loss, and this seems to be more important than the exact macronutrient breakdown. Part of a tailored approach may be modifying diets in terms of their macronutrient composition depending on the preferences and health status of the individual; with the proviso that the nutritional quality of the diet is a critical consideration.

Potential concerns associated with VLED include malnutrition and keto-acidosis but these were not identified as adverse effects by a recent systematic review.¹⁷

17 Parretti, H.M., et al. (2016). Clinical effectiveness of very-low-energy diets in the management of weight loss: a systematic review and meta-analysis of randomised controlled trials *Obes. Rev.* 17, 225-34.



**C21.S7 Weight management: physical activity**

Physical activity alone is less effective in bringing about weight loss than diet and physical activity combined.¹⁸ Regardless of its impact on weight, physical activity should always be recommended because of its beneficial effects on health and wellbeing. It is also thought to be a critical factor in weight maintenance. Those who successfully lost 10% body weight and kept it off at 24 months follow-up spent more time being physically active than those who did not. Successful weight loss maintainers report daily physical activity, both planned and activities of daily living, and this may be the key to their success.



18 Johns, D.L., et al. (2014) Diet or exercise interventions vs combined behavioural weight management programs: a systematic review and meta-analysis of direct comparisons. *J. Acad. Nutr. Diet.* 114, 1557–68.

C21.S8 **Weight management: behavioural approaches**

Multicomponent interventions including diet, physical activity, and behaviour change are more effective than either diet or activity alone.

Current UK guidance¹⁹ suggests that the following strategies should be included in behavioural interventions for adults, as appropriate:

- self-monitoring of behaviour and progress;
- stimulus control;
- goal setting;
- slowing rate of eating;
- ensuring social support;
- problem solving;
- assertiveness;
- cognitive restructuring (modifying thoughts);
- reinforcement of changes;
- relapse prevention;
- strategies for dealing with weight regain.

19 National Institute for Health and Care Excellence (NICE). (2014). *Obesity: identification, assessment and management. Clinical guideline 189*. Available at: <https://www.nice.org.uk/guidance/cg189/chapter/1-Recommendations#identification-and-classification-of-overweight-and-obesity>.

c21.S9 Pharmacotherapy

Currently only one medication, orlistat (brand names include Xenical and Alli) is licensed for use in the UK. Orlistat is a pancreatic lipase inhibitor which reduces absorption of dietary fat by approximately 30% when given with a diet comprising approximately 30% fat. Used in combination with lifestyle change, weight loss of 2.9 kg greater than placebo was observed. Orlistat is not well absorbed so systemic side effects are minimal; the largest problems relate to unabsorbed dietary fat until patients learn to reduce their dietary fat intakes. There may be some reduced absorption of fat-soluble vitamins and reduced absorption of the drug acyclovir. Severe adverse effects are very rare but may include acute kidney injury so orlistat should be used with caution in renal impairment.

Current guidance in the UK:²²

- Prescribe for adults with a BMI of ≥ 28 kg/m² plus co-morbidity or BMI ≥ 30 kg/m² as part of a plan to manage obesity.
- Continued prescribing should only occur in those who have lost at least 5% of their initial body weight, although lower targets may be set for those with type 2 diabetes, in whom weight loss tends to be lower.
- Supplements are generally not considered necessary unless orlistat is used in vulnerable groups, e.g. young people.

Sibutramine, an appetite suppressant, was withdrawn from licence for treating obesity in the UK in 2010 and in several other countries including the European Union, India, and USA because of associated cardiovascular risks. Other appetite suppressants, including dexfenfluramine and rimonabant, have had approval withdrawn because of health risks exceeding possible benefits. However, unlicensed drugs are available to purchase online so health professionals need to be aware of the risks associated.

Drugs that aim to promote satiety via gastrointestinal effects, e.g. methyl cellulose and sterculia, are not recommended because of lack of evidence that they are effective.

Ongoing obesity pharmacology development indicates that new drugs may become available in the near future.²⁰

20 Coulter, A.A., et al. (2018). Centrally acting agents for obesity: Past, present and future. *Drugs* 78(11), 1113-32.



c21.s10 **Bariatric surgery**

Bariatric surgery is the most effective intervention for achieving weight loss in obese adults,²¹ but has more complications than non-surgical methods. All types of bariatric surgery are associated with significantly greater remission of diabetes compared with controls at 10 years and 15 years post-surgery, and significant improvements to weight-related complications.

Current UK guidance²² recommends bariatric surgery:

- as first line treatment in those with BMI ≥ 50 kg/m² in whom other interventions have failed;
- as a treatment option in those with BMI ≥ 40 kg/m² or between 35 and 40 kg/m² and significant disease that would benefit from weight loss;
- all appropriate non-surgical measures have been tried but adequate weight loss has not occurred or been maintained;
- patients receiving intensive management in a tier 3 service;
- patients generally fit for anaesthesia and surgery;
- committed to need for long-term follow-up;
- expedited referral to bariatric surgery should be offered to those with BMI ≥ 35 kg/m² diagnosed with type 2 diabetes in the last 10 years, so long as they will receive assessment in tier 3 or equivalent service.

A **gastric band** is an inflatable band placed around the upper portion of the stomach resulting in a reduced stomach capacity above the band. The degree of tightness of the band can be altered using sterile saline injected through a port under the skin, thus potentially inducing satiety (🔗 <https://asmbs.org/patients/bariatric-surgery-procedures#band>).

Roux-en-Y gastric bypass is the most common form of bypass; a small stomach pouch (approximately 30 mL) is made by dividing the top from the rest of the stomach. This is connected to the small bowel (this is the Roux limb). The Roux limb is connected by a Y join to the lower part of the small intestine so the stomach acid and enzymes from the bypassed stomach and first part of the small intestine can mix with the food and the remaining stomach is left undisturbed. Re-routing the stomach alters gut hormones promoting satiety and suppressing hunger, and the small stomach pouch results in satiety after small meals. In addition, there may be some malabsorption (🔗 <https://asmbs.org/patients/bariatric-surgery-procedures#bypass>).

Sleeve gastrectomy: approximately 80% of the stomach is removed, restricting the volume of food that can be consumed. Hormonal changes also impact on satiety, hunger, and control of blood sugar (🔗 <https://asmbs.org/patients/bariatric-surgery-procedures#sleeve>).

Long-term follow-up of morbidities, medication, and nutritional status are required (Table 21.5); the nature and frequency of monitoring and type of supplementation required will depend on the procedure the patient has undergone.

21 Picot, J., et al. (2009). The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: a systematic review and economic evaluation. *Health Technol. Assess.* 13(41), 1-190, 215-357, iii-iv.

C21.T5 **Table 21.5** Recommendations for annual blood test monitoring and supplements according to bariatric procedure**

Procedure	Supplement recommendation	Annual blood test monitoring recommendations
Gastric band	Comprehensive multivitamin and mineral supplement recommended	
Gastric bypass	Over the counter (OTC) daily multivitamin and mineral supplement Vitamin B ₁₂ injections every 3 months Calcium and vitamin D (additional vitamin D may be required) Iron (start with 200 mg daily and monitor dosage especially in premenopausal women)	Liver function tests Full blood count Ferritin Folate Vitamin B ₁₂ * Calcium and vitamin D Parathyroid hormone Zinc and copper Vitamin A (if long-limb bypass, night blindness, or symptoms of steatorrhoea present) Selenium (only measure if concern about possible deficiency)
Sleeve gastrectomy	OTC daily multivitamin and mineral supplement. Vitamin B ₁₂ injections every 3 months Calcium and vitamin D (additional vitamin D may be required). Iron (start with 200 mg daily and monitor dosage especially in premenopausal women)	Liver function tests Full blood count Ferritin Folate Vitamin B ₁₂ * Calcium and vitamin D Parathyroid hormone Zinc, copper, and selenium (measure if concerns about possible deficiency)

*Annual checks may be unnecessary if patient is receiving 3-monthly injections of vitamin B₁₂.

**Source: data from O'Kane, M., et al. (2014). *BOMSS Guidelines on perioperative and postoperative biochemical monitoring and micronutrient replacement for patients undergoing bariatric surgery*. <http://www.bomss.org.uk/wp-content/uploads/2014/09/BOMSS-guidelines-Final-version1Oct14.pdf>.

**C21.S11 Structure of treatment**


Many weight loss interventions are delivered within group settings and group treatment may be more effective than individual treatment, providing social support and cost-effective delivery. Commercial weight-management services are delivered within groups and have been shown to be cost-effective.²² However, if these services are offered to patients it is important that only programmes which follow best practice guidance are offered and that healthcare professionals continue to monitor patients.

C21.S11.1 Weight loss maintenance

A variety of lifestyle approaches induce weight loss, but typically when interventions stop, weight regain occurs. Keeping lost weight off is a life-long challenge and different behaviours are needed to keep weight off from those to lose weight. Those who successfully keep weight off use a variety of strategies including diet, physical activity (activities of daily living and structured), and a high degree of self-monitoring. Physical activity has been identified as a critical influence protecting against weight regain.

C21.S11.2 Prevention and public health approaches

The first aim of public health should be preventing gradual weight gain in adults. Simplistic messages about making small changes (such as eating less and moving more) ignore the complex nature of energy balance. Public health approaches should target the food, physical activity, and socio-economic environments, have a direct influence on behaviours, and support clinical interventions and health services. A healthy environment in which healthy choices are the easy choices is advocated with action taken across the lifecourse.

See  Chapter 18, 'Obesity prevention'.

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22 Jolly, K., et al. (2011). Comparison of range of commercial or primary care led weight reduction programmes with minimal intervention control for weight loss in obesity: Lighten Up randomised controlled trial. *BMJ* 343, d6500.



**C21.S12 Conditions associated with obesity**

A number of conditions are associated with obesity.

C21.S12.1 Down syndrome

Obesity is not inevitable for those with Down syndrome but it may be more common. As with other individuals, preventing excess weight gain using diet and physical activity is better than managing excess weight gain. Those with Down syndrome do not need different lifestyle approaches compared with others, and similarly to others information needs to be tailored and accessible. Sustainable changes to diet and activity to encourage healthier lifestyles should be encouraged, within a supportive family environment.

C21.S12.2 Polycystic ovary syndrome (PCOS)

This condition affects about 5-10% of women and is characterized by weight gain, hirsutism (on the face or body), irregular menstrual cycles, anovulation, reduced fertility, hormonal abnormalities, and skin changes. Women with PCOS have an increased risk of developing type 2 diabetes and heart disease. Losing weight can significantly improve PCOS and reduce risks of co-morbidities. Aiming for 5-10% weight loss is achievable, sustainable, and associated with clinical benefits. Modification of diet and lifestyle is first-line treatment.

C21.S12.3 Prader-Willi syndrome

This rare genetic condition is characterized by reduced growth and muscle tone, a constant feeling of hunger and drive to eat, learning difficulties and immature sexual development. Because there is no cure, management of symptoms is key. Maintaining a healthy weight is key but is difficult to achieve, as eating behaviours can be obsessive. A care plan will be developed with healthcare professionals, ideally a paediatric dietitian, and this will be monitored and assessed over time. The family should be involved in the development of the care plan.

C21.S12.4 Further information

- 🔗 <https://www.downs-syndrome.org.uk/>
- 🔗 <http://www.pcos-uk.org.uk/about-pcos.html>
- 🔗 <https://www.pwsa.co.uk/>

C21.R1 Obesity: further information

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