

## Obesity

### Definition / Supporting Information

Definitions of overweight and obesity in adults are based on body mass index (BMI).

- BMI = weight in kilograms divided by height in meters squared ( $\text{kg} / \text{m}^2$ )
- In children, body fat changes throughout growth and development, so BMI percentile must be used [[BMI chart, RCPCH](#)]
  - A BMI above the 91st centile for age and sex suggests overweight
  - A BMI above the 98th centile for age and sex suggests obesity

**Keywords / also known as:** excess body fat, overweight

### Essential History

**Ask about:**

- Conditions and factors associated with obesity
  - Age at weight gain (infantile obesity may be more likely to be due to genetic causes)
  - Assess lifestyle factors
    - Diet (eg, eating patterns, portion sizes, types of food, snacks, and drinks)
    - Exercise (eg, frequency, type, opportunities, and barriers)
    - Lifestyle (eg, sleep, screen time)
  - Family history of obesity, diabetes, cardiovascular disease
- Complications of obesity (Table 1)
  - Type 2 diabetes
  - Sleep apnoea
  - Menstrual problems
  - Bullying
  - Depression
  - Hypertension
  - Mobility and orthopaedic problems

**Table 1 Medical Conditions Associated with Obesity**

Cardiovascular	Hypertension (systolic or diastolic BP $\geq$ 98th centile for age using an appropriate sized cuff) Dyslipidaemia
Endocrine	Type 2 diabetes <b>Insulin</b> Resistance Polycystic ovary disease (menstrual irregularities, hyperandrogenism) (The incidence of these are higher in children of Asian origin at a 'lower' BMI)
Gastrointestinal / liver	Non-alcoholic fatty liver disease (NAFLD) Steatohepatitis
Respiratory	Snoring Apnoea Behavioural problems
Orthopaedic	Slipped femoral epiphysis Blount disease (bowing of the tibia) Osteoarthritis
Neurologic	Benign intracranial hypertension (headaches, vision changes, papilledema)
Mental Health	Low self-esteem, depression
Oncologic	Increased prevalence with adult obesity (endometrial, breast, colon cancer)

## 'Red Flag' Symptoms and Signs

### Ask about:

- Snoring and respiratory pauses (ie, signs of obstructive sleep apnoea)
- Symptoms of type 2 diabetes
- Headaches and / or visual symptoms (eg, benign intracranial hypertension)

### Look for:

- Obesity associated with short stature and / or poor height growth
  - Most individuals with simple obesity are of normal height expected for their genetic potential
- Acanthosis nigricans (black velvety pigmentation most commonly on neck, axilla or elbows)
- Dental caries
- Dysmorphic features
- Developmental problems

## Differential Diagnosis / Conditions

- Primary medical causes of obesity are extremely rare
- Secondary medical causes (eg, prolonged steroid use)
- Endocrine causes of obesity often cause short stature
  - Hypothyroidism
    - Associated with short stature
    - Weight gain, fatigue, constipation, cold intolerance
    - Testing
      - Thyroid-stimulating hormone (TSH) and free thyroxine, tetraiodothyronine (T4)
  - Cushing syndrome
    - Short stature
    - Central obesity, hirsutism, moon face, plethora, hypertension
    - Testing: 24-hour urine free cortisol, referral to endocrinologist if suspected
  - Pseudohypoparathyroidism
    - Short stature
    - Short 4th metacarpals, subcutaneous calcifications, dysmorphic facies, intellectual disability, hypocalcaemia, hyperphosphataemia
    - Testing: calcium, phosphate, parathyroid hormone (PTH)
  - Growth hormone deficiency
    - Short stature
    - Fatigue
    - Growth hormone stimulation test, insulin-like growth factor-1 (IGF-1)

- Syndromic causes of obesity are often associated with cognitive impairment. The list is not exhaustive
  - Prader-Willi syndrome
    - Cognitive impairment
    - Hypogonadism, small hands and feet
    - Testing: FISH15q11 microdeletion (70% of cases)
  - Bardet-Biedl syndrome
    - Cognitive impairment
    - Retinitis pigmentosa, renal abnormalities, polydactyly, hypogonadism
    - Testing: BBS1 gene
  - Biemond syndrome
    - Cognitive impairment
    - Iris coloboma, hypogonadism, polydactyly
    - Testing: clinical
  - Alström syndrome
    - Cognitive impairment
    - Retinitis pigmentosa, diabetes mellitus, and hearing loss
    - Testing: ALMS1 gene
- Monogenic causes of obesity associated with rapid early-onset weight gain
  - Melanocortin 4 receptor mutation (MC4R)
    - Tall stature
  - Pro-opiomelanocortin (POMC)
    - Red hair
    - Pale skin
    - Adrenal insufficiency due to adrenocorticotrophic hormone (ACTH) deficiency
    - Mild hypothyroidism
  - Leptin deficiency
    - Frequent infections
    - Hypogonadism
    - Hypothyroidism
    - Hyperphagia (eg, constant food-seeking behaviour, clearing other peoples' plates, getting up at night to eat)

## Complications

- Obesity is associated with medical comorbidities affecting many organ systems
  - Some problems can be apparent after a relatively short duration of developing excess body fat
  - Other complications such as malignancy do not arise for decades

## Investigations

To be undertaken in primary care:

- Establish whether the obese child is tall or short
- Calculate BMI and BMI centile for age and sex of child. Plot on RCPCH WHO Growth Chart [[BMI chart, RCPCH](#)]
- Blood pressure
- Thyroid function tests, liver function tests and glycated haemoglobin (HbA1c) if possible

See Obesity: identification, assessment and management [[NICE clinical guideline CG189, section 1.3.11](#)]

In tier 2/3 services, assess associated comorbidities and possible causes of obesity. Investigations in these services may include:

- Lipid profile, preferably while fasting
- Fasting glucose or oral glucose tolerance test
- Fasting insulin
- HbA1c
- Liver function
- Endocrine function if short stature (eg, thyroid function, IGF-1)
- Blood pressure measurement
- Polycystic ovary disease tests (luteinizing hormone (LH), follicle-stimulating hormone (FSH), oestradiol, testosterone, sex hormone-binding globulin (SHBG), ultrasound scan pelvis)
- Sleep study if indicated
- Genetic tests if indicated

Interpret the results of any tests used in the context of how overweight or obese the child is, the child's age, racial background, history of comorbidities, possible genetic causes and any family history of metabolic disease related to being overweight or obese. Also consider the following:

- Monogenic causes of obesity (eg, MC4R, leptin deficiency)
- Referral for genetic consultation
- Plain film radiographs (eg, to look for slipped femoral epiphysis or Blount disease) if indicated

## Treatment Approach

The aim of weight management programmes for children and young people can vary. The focus may be on either weight maintenance in younger children or weight loss in older children who have completed growth.

See Obesity: identification, assessment and management [NICE guideline CG189, sections 1.4.12 and 1.2.13]

- Lifestyle modifications
  - Total energy intake should not exceed energy expenditure
  - Increase physical exercise
    - At least 60 minutes of moderate physical activity every day
  - Encourage overweight or obese parents to lose weight also
- Preventing secondary comorbidity and disability is the principal goal in treating overweight children and adolescents
- Obesity should be approached as a chronic condition that requires permanent lifestyle changes
- Prescribing a treatment plan without engaging the child and family can lead to frustration, impairing future attempts at weight control
- Enhancing the therapeutic relationship can begin with a question to the parent
  - “Have you ever struggled with your weight?”
    - The answer reveals the family’s perception of body weight as an indicator of health and well-being and the parent’s empathy for their child / children’s weight problems
- Readiness to change lifestyle behaviours can be assessed by asking the child and parent three questions:
  - “How concerned are you about your weight (your child’s weight)?”
  - “Do you think that you can improve your body fitness (your child’s body fitness)?”
  - “Do you think that your family can change eating and physical activity patterns?”
- Once the patient and family are ready to begin a treatment plan, the clinician should assist in setting realistic goals
- Weight maintenance rather than weight loss is usually the first step
  - The objective is to decrease the rate of weight gain and allow the child to achieve healthier body mass
  - Learning healthy eating and activity habits improves health over time
  - Focusing on health and healthy lifestyle changes allows gradual and long-term sustainable change
  - Fad diets and very-low-calorie regimens are not recommended without specialist supervision
- Role of health workers (health visitor, nurse, general practitioner (GP), paediatrician)
  - Intervene early
  - Assess the family’s readiness to change their current behaviours to a healthier lifestyle
  - Educate the family about medical complications of obesity

- Involve the family and caregivers in the treatment programme
- Aim for permanent dietary and activity change
  - Set and reward goals
- Avoid short-term diets or exercise programmes aimed at rapid weight loss
- Teach the family to monitor eating habits and activity levels
- Assist the family in making small, gradual changes to lifestyle
- Encourage positive steps in the right direction
- Praise success and avoid criticism

## Specific Treatment

### Prevention

- Clinicians should educate families about the importance of healthy nutrition and physical activity from earliest years
  - Healthy nutrition begins with breastfeeding
    - Associated with lower childhood obesity risk
    - Exclusively breastfeeding is recommended for first 4–6 months of life
    - Introduce infant foods no earlier than 4–6 months
      - Provide a range of flavours, including vegetables
  - Consideration of nutrient quality and caloric content
    - Plan meals based on a variety of vegetables, lean protein and low GI starchy carbohydrates
      - Refer to the Eatwell plate [[the NHS website](#)]
    - Plan snacks based on fruits or vegetables
    - Reserve calorie-laden foods with little nutritional value for occasional treats
    - Semi-skimmed milk (2% fat) can be introduced from 2 years and skimmed milk (1% fat) from 5 years of age (see Milk and dairy in your foods [[the NHS website](#)])
    - Children should be encouraged to drink water to quench thirst
      - Fruit juice (1 per day, < 4 ounces)
    - Healthy desserts
      - Fruit, yogurt, occasional puddings made with milk and eggs
    - Using less saturated fat is recommended for cardiovascular health
    - Attention to portion size is important
      - Refer to the Eatwell plate [[the NHS website](#)]
    - Home cooked food is healthier and cheaper than processed foods and takeaways
- Encourage physical activity (see UK physical activity guidelines [[Department of Health](#)])

- Children whose parents are physically active are more likely to be physically active
- Clinicians can encourage opportunities for family activities
- Children should engage in more than 60 minutes of physical activity on most, or preferably all days of the week
  - Paediatricians can reinforce the importance of daily physical activity and advise against reliance on organized sports for all of a child's physical activity
- Increased physical activity should be accompanied by decrease in sedentary activities
  - Limiting television or other recreational screen time to < 2 hours per day is recommended
  - The American Academy of Paediatrics recommends no television for children < 2 years old
- Parents should strive to be role models in their dietary and physical activity habits
  - Child health professionals can begin to talk to parents about healthy nutrition and activity during the first year of life
  - Themes can be revisited at annual health care maintenance visits
- Monitoring
  - Tracking growth trajectories and explaining patterns to parents is an essential component of primary prevention
  - Children with increasing BMI percentiles may be at risk for obesity
    - Healthcare professionals can help families evaluate nutritional and activity patterns and make adjustments

### **Dietary modifications**

- Drink water, sugar-free beverages, or milk.
- Use cooking spray instead of deep or shallow frying in oil
- Restrict snacks to fruits, vegetables or grains.
- Serve appropriate portions
  - Meat: size of palm
  - Starch: 1/2 cup
- Review school lunch menu with the child to pick healthy options
- Pack a lunch with lean meat, whole-grain bread, fruit or vegetable, and milk
- Limit fast food to very occasionally
- Schedule at least 20 minutes to eat meals together. Eating slowly helps to avoid overeating
- Turn off the television while eating
- Eat regular meals; skipping meals can lead to overeating

- Remove snack foods, crisps, biscuits, and desserts from the house and only allow occasional treats (see The Eatwell Guide [[Department of Health](#)])
- Maximum daily amounts of added sugar are 5 cubes in 4-6 year olds and 7 cubes in 11+ years [[Change4Life](#)].
- Apps can quickly provide information on amount of sugar in foods
  - Eg, Sugar Smart [[Change4Life](#)]

### **Physical activity**

- Limit television and video games to less than 2 hours per day
- Engage in active family activities (eg, biking, walking after dinner, and swimming)
- Dance to your favourite music
- Walk with a friend rather than talking on the telephone
- Engage in team sports
- Take classes (eg, dance, martial arts, or swimming)
- Strategies for toddlers and preschool-aged children
  - Engage in outdoor play every day
  - Engage in active indoor play (eg, soft balls, jumping, or bouncing balls)
  - Buy toys that require activity rather than computer games or videos
- Use fitness apps for mobile phones or utilise wearable technology to aid lifestyle changes

### **Parenting skills**

- Find reasons to praise the child's behaviour with intervention
- Be consistent and set clear guidelines about food and avoid using food as a reward
- Establish daily family meal, family snack times, and physically active family time
- Determine what food is offered and when
- Allow child to decide whether to eat or not
- Offer only healthy options
- Remove temptations (eg, snack food in the home)
- Walk instead of drive, take the stairs
- Decrease television-viewing time
- Be a role model in diet and physical activity

### **Pharmacological interventions**

See Obesity: identification, assessment and management [[NICE clinical guideline CG189, sections 1.8 and 1.9](#)]

- Drug treatment is not generally recommended for children younger than 12 years
- In children younger than 12 years, drug treatment may be used only in exceptional circumstances. Prescribing should be started and monitored only in specialist paediatric settings

- In children aged 12 years and older, treatment with orlistat is recommended only if physical comorbidities (such as orthopaedic problems or sleep apnoea) or severe psychological comorbidities are present
- Treatment should be started in a specialist paediatric setting, by multidisciplinary teams with experience of prescribing in this age group
- Do not give orlistat to children for obesity unless prescribed by a multidisciplinary team with expertise in:
  - Drug monitoring
  - Psychological support
  - Behavioural interventions
  - Interventions to increase physical activity
  - Interventions to improve diet
- Drug treatment may be continued in primary care (eg, with a shared care protocol) if local circumstances and / or licensing allow
- If orlistat is prescribed for children, a 6–12 month trial is recommended, with regular review to assess effectiveness, adverse effects and adherence to treatment
- Hyperlipidaemia
  - Lipid-lowering medication is considered if behavioural modifications are unsuccessful
- Metabolic syndrome
  - There is some evidence for short-term effects on the efficacy of pharmacological treatment of metabolic syndrome. However, long-term outcome data in youth remains sparse
    - Studies of oral hypoglycaemic agents (specifically metformin) in adolescents have demonstrated reductions in blood glucose and BMI with short-term improvements in insulin sensitivity

### **Surgical intervention**

See Obesity: identification, assessment and management [[NICE clinical guidance CG189, section 1.10](#)]

- Surgical intervention is not generally recommended in children or young people
- Bariatric surgery may be necessary for a child who is seriously obese (> 99th percentile) or has medical complications
- Bariatric surgery may be considered for young people only in exceptional circumstances if they have achieved or nearly achieved physiological maturity
- Surgery for obesity should be undertaken only by a multidisciplinary team in a nationally recognised paediatric centre with expertise in childhood bariatric surgery
- Ensure all young people have had a comprehensive psychological, educational, family and social assessment before undergoing bariatric surgery
- Perform a full medical evaluation, including genetic screening or assessment before surgery to exclude rare, treatable causes of obesity

## Ongoing care

### Follow-up

- A key role for child health professionals is monitoring
  - BMI should be calculated and plotted at each healthcare maintenance visit
  - Assessment of met / unmet targets

### Prognosis

- Early childhood obesity often resolves with appropriate intervention, thus optimism is required in the early years
- By adolescence, nutritional and activity patterns are more difficult to change, and families have less influence
- Obesity remains an emotionally charged issue, creating more difficulties for the family and clinician than do more purely medical problems
- Blood pressure can decrease with as little as 5 kg of weight loss (see Management of Obesity [[SIGN guideline 115, section 7.6](#)])
- The age at which the child becomes obese is related to how likely the child is to be obese in adulthood
  - Children who are obese from 6–11 years old
    - 50% of girls and 30% of boys will be obese as adults, compared with 18% of age-matched peers
  - Obesity during adolescence
    - More than 60% will maintain obesity into adulthood
  - Obese adults who became obese during childhood
    - More likely than those who become obese during adulthood to have severe obesity (BMI > 40 kg/m<sup>2</sup>)
- Overweight and normal-weight children with one obese parent are at twice the risk of adult obesity compared with children without an overweight parent
  - Overweight 10–14 year olds with at least one obese parent
    - 80% of these adolescents will remain obese as adults

## When to Refer

Refer to a paediatric endocrinology / obesity specialist or appropriate tertiary team for acute complications or obesity associated with comorbidities such as:

- Early-onset rapid weight gain
- Clinically severe obesity with comorbidities (BMI > 99.6th centile)
- Obesity in the context of short stature
- Acanthosis nigricans, type 2 diabetes, and metabolic sequelae
- Benign intracranial hypertension (eg, headaches)
- Obstructive sleep apnoea (eg, snoring, respiratory pauses, and daytime tiredness)

- Orthopaedic problems

### When to Admit

- The morbidly obese patient with continued weight gain may need to be hospitalised for a low-calorie weight reduction programme.

### ‘Safety Netting’ Advice

- In early-onset rapid weight gain, assess for monogenic, genetic or endocrine causes of obesity
- Assess and review for complications of obesity (eg, hypertension, fatty liver, type 2 diabetes)
- The aim in growing children is to maintain the body weight, thus allowing a reduction in BMI with growth
- Consider safeguarding issues
  - Obesity may be considered to be a form of childhood neglect. This may be a contributory factor to or cause of obesity in children
    - Concerns should be raised as appropriate depending on the progress and engagement with weight management services.

### Patient / Carer Information

***\*Please note: whilst these resources have been developed to a high standard they may not be specific to children.***

- [What can I do if my child is very overweight?](#) (Web page), the NHS website
- [Change 4 life](#) (Website)
- [12-week fitness plan](#) (Web page), the NHS website
- [British Heart Forum](#) (Web Page), British Heart Foundation
- [What can I do if my child is very overweight?](#) (Web page), the NHS website
  - Includes: ‘Be a good role model’, ‘Keep to child-size portions’, ‘Eat healthy meals’ and ‘Less screen time and more sleep!’

### Resources

#### National Clinical Guidance

[Obesity: identification, assessment and management](#) (Web page), NICE clinical guideline CG189, National Institute for Health and Care Excellence.

[Management of Obesity](#) (Web page), SIGN guideline 115, Scottish Intercollegiate Guidelines Network

## Medical Decision Support

Wright N, Wales J. [Assessment and management of severely obese children and adolescents](#). Archives of Disease in Childhood 2016;101:1161–1167.

## Suggested Resources

***\*Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.***

[Metformin for diabetes](#) (Web page), Medicines for Children

[Sugar reduction: from evidence into action](#) (PDF), Public Health England

[British Dietetic Association](#) (Website)

[Toddler Feeding Forum](#) (Website)

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