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Childhood obesity – when to suspect an endocrine cause?

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ABSTRACT

Obesity in children represents a growing health problem of a global nature. It is associated with numerous metabolic and hormonal complications. The vast majority of childhood obesity cases are primary in nature and result from a long-term excessive energy balance. However, in a small percentage of cases, pathogenic factors cause secondary obesity. This work aims to present the principles and rules for differentiating between simple and secondary obesity and to indicate the so-called "red flags" that should prompt a physician to perform in-depth hormonal diagnostics. When excessive weight gain occurs alongside a slowing growth rate, it serves as an alarm signal indicating an endocrinological basis for obesity. Additional symptoms are also of significant importance: the onset of obesity in early childhood, disorders of sexual maturation, excessive hair growth (hirsutism), and skin changes. The following article discusses the most common endocrine causes of obesity in children, including hypothyroidism and Cushing's syndrome, along with their clinical presentation and diagnostic basics. A diagnostic workflow is outlined. It encompasses patient history, physical examination, and laboratory tests. This article focuses on the diagnosis of childhood obesity. This work allows physicians to avoid unnecessary, excessive diagnostic testing in children with primary obesity. In children whose obesity is caused by comorbidities, it also allows these conditions to be overlooked. Early diagnosis of the endocrine basis of obesity allows for early treatment, significantly improving prognosis.

Keywords: obesity, endocrine diseases, hypothyroidism, Cushing's syndrome

1. INTRODUCTION

Childhood obesity is one of the most important public health problems challenges of the 21st century. This global and national problem is of significant importance. According to World Health Organization (WHO, 2017) data, the number of children and adolescents with overweight or obesity worldwide increased from approximately 11 million in 1975 to over 124 million in 2017. Today, approximately 340 million children aged 5 to 19 are overweight. These data demonstrate the scale and dynamics of the growing problem of childhood obesity (Chylińska-Frątczak et al., 2022). Europe as a continent is grappling with disturbing trends in childhood obesity. Available epidemiological data indicate a systematic increase in the

prevalence of overweight and obesity in the pediatric population. According to the large nationwide OLAF study (2007–2009), overweight affected over 18% of boys and over 14% of girls, and the total prevalence of overweight and obesity, depending on age, varied from 9.1% in 16-year-old girls up to as much as 22.4% in 12-year-old boys (OLAF, Poland). According to WHO reports, overweight in Poland occurs in approximately 20% of boys and 14% of girls (WHO, 2017). Most cases of childhood obesity are primary in nature and result from an excessive energy balance. However, in a small number of cases, childhood obesity results from various disorders, including those of an endocrine nature. Clinicians estimate that disease-based obesity accounts for less than 10% of obesity cases in developmental age (Mazur et al., 2022). Recognizing the pathological basis of obesity early is of key importance, as it requires a different diagnostic and therapeutic approach.

2. REVIEW METHODS

Study design

This study is a narrative review conducted in accordance with the PRISMA 2020 guidelines.

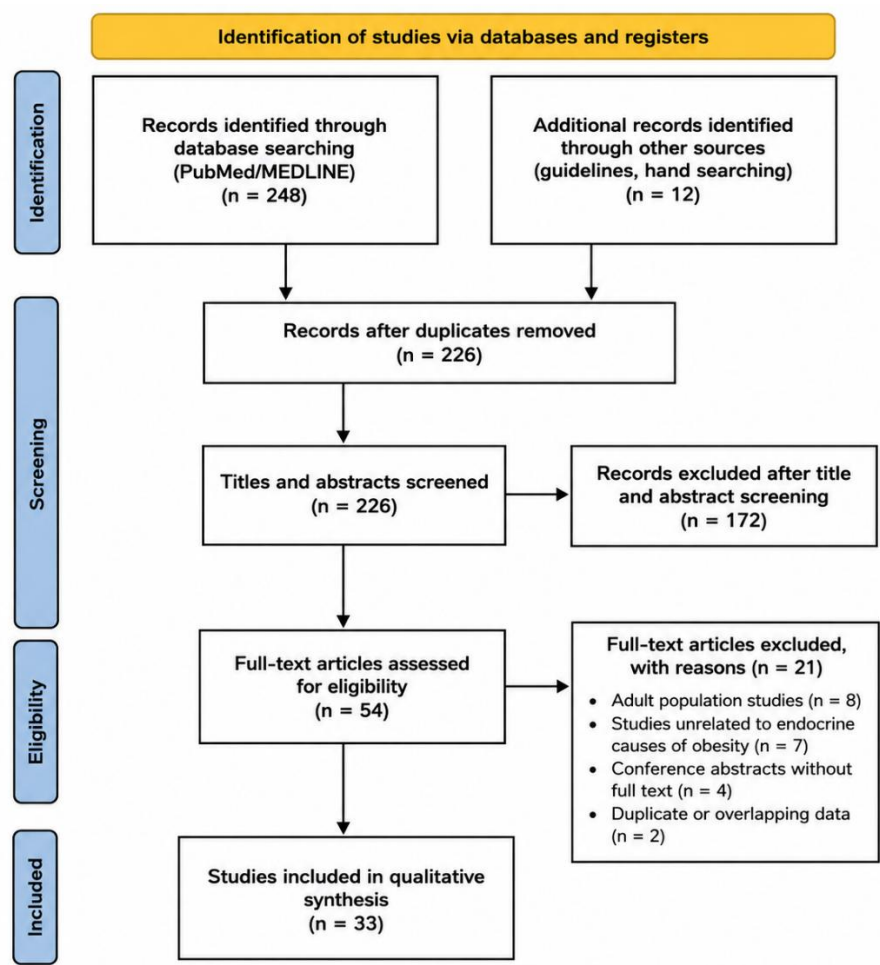


Figure 1. The PRISMA 2020 flow diagram illustrates the process of identification, initial screening, eligibility assessment, and study inclusion.

Data sources and search strategy

The sources consulted include publications indexed in PubMed, guidelines from professional societies, and articles from scientific journals. A significant portion of the paper focuses on recommendations from the Polish Pediatric Society, the Polish Society for Pediatric Endocrinology and Diabetology, the Endocrine Society, and the World Health Organization (WHO). The studies included in the literature review cover the period from January 2005 to December 2025.

Eligibility criteria*Inclusion criteria:*

- Studies published between 2005 and 2025;
- Articles written in Polish or English;
- Original studies;
- Review articles;
- Clinical practice guidelines;
- Studies concerning endocrine causes of obesity in children.

Exclusion criteria:

- Studies concerning adults only;
- Duplicate publications;
- Articles unrelated to endocrine causes of obesity.
- Study selection

An initial assessment of titles and abstracts was conducted. Full texts of articles meeting the eligibility criteria were analyzed. Duplicates were removed. Publications deemed relevant to the subject matter were included in the review. The study selection procedure according to the PRISMA 2020 guidelines is presented in the Figure 1.

3. RESULTS AND DISCUSSION

Primary obesity is the most common type of obesity in children. If a child presents with warning signs, endocrine disorders should be considered as a cause of obesity. A key symptom indicating secondary obesity is stunted growth accompanied by weight gain. Other warning signs include delayed puberty, early-onset obesity, skin changes, and excessive body hair. Hypothyroidism and Cushing's syndrome are the most common endocrine disorders associated with obesity. Interpreting growth rate indicators and analyzing the clinical presentation helps avoid unnecessary further testing.

Basic diagnostics and the definition of obesity*Definition of obesity*

Obesity is a recurring, chronic disease caused by excessive accumulation of body fat. This negatively impacts a person's health. Diagnosis is based on measuring body weight and height. Various indicators, such as BMI, are then calculated. BMI is interpreted based on the child's gender and age. BMI and body measurements sometimes fail to accurately reflect the distribution of body fat. In some cases, a precise assessment is required (Mazur et al., 2023).

Diagnostic criteria

The criteria used to diagnose overweight and obesity in children rely on the BMI index interpreted using percentile charts for age and sex. Normal body weight occurs when the BMI falls between the 5th and 85th percentile. Overweight is diagnosed when the BMI is $\geq$ 85th percentile but $\leq$ 95th percentile. Obesity is diagnosed when the BMI is $\geq$ 95th percentile (Palczewska et al., 2010; Zarzycka et al., 2015).

Importance of growth assessment

The assessment of the growth process in children plays a very important role in the diagnosis of obesity because it helps to distinguish simple obesity from diseases with a hormonal or genetic basis. Taking into account the rate of height gain and referring the results to percentile charts allows clinicians to assess whether the excessive body weight results solely from a positive energy balance or if developmental disorders accompany it.

In the case of simple obesity, children most often grow normally, and sometimes even faster than their peers. On the contrary, a slowing of growth with a simultaneous gain in body mass may indicate endocrine diseases, such as hypothyroidism or Cushing's syndrome. The course of sexual maturation is also an essential element of the assessment. Obesity can influence its pace – in some children, its acceleration is observed, especially in girls, while hormonal disorders are often associated with its delay. Therefore, the

analysis of the stage of sexual maturation, alongside the assessment of growth, constitutes an important element allowing for early detection of abnormalities and proper direction of further diagnostics.

Primary vs. secondary obesity

Primary obesity is caused by a positive energy balance. The causes of primary obesity include an improper diet, excessive calorie intake, and insufficient physical activity (Zarzycka et al., 2015). Primary obesity is more common in children than other types (Pomahacova et al., 2023).

Secondary obesity, known as complex obesity, is characterized by excessive body weight caused by a disease or hormonal disorders. It can occur even while maintaining a healthy and balanced diet (Zarzycka et al., 2015). Several factors and diseases can contribute of secondary obesity. Researchers believe that obesity in children accompanying endocrine disorders affects only a small number of pediatric patients (Pomahacova et al., 2023). The main findings of the literature review are summarized in Table 1. The differences between primary and secondary obesity are summarized in Table 2.

Table 1. Summary of the main findings of the literature review.

Topic	Primary (Simple) Obesity in Children
Childhood obesity prevalence	The most common type of obesity is primary obesity.
Main red flags	Onset of obesity at an early age, growth rate inhibition, short stature, delayed puberty, characteristic skin lesions, hirsutism.
Most common endocrine disorders	Hypothyroidism and Cushing’s syndrome.
Key clinical indicator	Inhibition of growth rate with a simultaneous increase in body weight.
Laboratory tests	TSH, ft4, glucose, lipid profile, cortisol, IGF-1, ACTh.
Importance of growth assessment	Primary obesity is characterized by a normal growth rate. Secondary obesity is characterized by an inhibition of the growth rate.
Importance of early diagnosis	Thanks to early detection of the disease, we can start treatment and prevent unnecessary diagnostics.

Table 2. Differentiation between primary and secondary obesity.

Feature	Primary (Simple) Obesity in Children	Secondary Obesity in Children
Definition	Most common form of obesity resulting from calorie excess relative to energy expenditure	Obesity resulting from disease or medication
Frequency	Approximately 90–95% of cases	Approximately 5–10% of cases
Main causes	improper diet, lack of exercise, excessive screen time	hormonal, genetic, or neurological diseases
Lifestyle	sweets, fast food, lack of physical activity	Not the main cause
Growth rate	Normal or accelerated	They are often slowed down (!)
Height	Children are often taller than peers	They are often short in stature or have growth inhibition.
Additional symptoms	No specific symptoms other than excessive body weight	Symptoms of the underlying disease (e.g., fatigue, hormonal disorders)
Example causes	Overeating, low activity	Hypothyroidism, Cushing’s Syndrome, Prader-Willi Syndrome.
Psychomotor development	is usually normal	It may be delayed (especially in genetic diseases)
Treatment	Lifestyle change (diet, exercise, family education)	Treatment of the underlying disease + dietary support
Prognosis	Good with early intervention	Depends on the underlying disease

When to suspect an endocrine cause?

Growth disorders

An endocrine basis is a relatively rare cause of obesity in children and concerns about 10% of cases (Mazur et al., 2022). However, clinicians should consider endocrine diagnostics in every patient in whom rapid weight gain goes hand in hand with short stature or a slowing/inhibition of the growth rate. In the presence of an endocrine disease, these children, alongside obesity, will have other symptoms resulting from endocrine system disorders. Examples of diseases accompanied by obesity related to endocrine disorders include hypothyroidism, endogenous hypercortisolism, or growth hormone deficiency. One of the most important alarm signals that should direct thinking toward an endocrine cause of obesity is the slowing of the growth rate (Zachurzok et al., 2024).

Early onset of obesity

Early onset of obesity may suggest an endocrine cause as the main reason for obesity in children. This applies in particular to the first years of life, i.e., <5 years of age. Vigilance is required when the development of obesity at a young age occurs with other symptoms indicating a risk of endocrine disease (Zachurzok et al., 2024).

Accompanying symptoms that suggest hormonal disorders

There are many endocrine diseases associated with obesity. Examples include hypothyroidism and Cushing's syndrome. Less common diseases associated with obesity include growth hormone deficiency and polycystic ovary syndrome (Zachurzok et al., 2024).

Apart from the symptom's characteristic of a given disease entity, recurring general symptoms, including obesity, are also present (Maślińska, 2008). Other general symptoms that suggest the coexistence of hormonal disorders include chronic fatigue, somnolence, and cold intolerance, which may accompany thyroid function disorders. It is also worth noting skin changes. When a patient suffers from hypothyroidism, their skin is dry. In the case of Cushing's syndrome, purple stretch marks appear on the skin (Zachurzok et al., 2024; Pomahacova et al., 2023; Jonczyk, 2014). If excessive hair growth and acne develop during puberty in females, these symptoms may indicate polycystic ovary syndrome (Pomahacova et al., 2023). It is also important to manage body fat. Central obesity, where excess fat is present in the trunk and face, but there is little of it on the extremities, suggests Cushing's syndrome (Jonczyk, 2014). Another group of symptoms seen in endocrine disorders is puberty disorders. These disorders can be premature or delayed. Girls with polycystic ovary syndrome may have irregular menstrual cycles (Pomahacova et al., 2023).

Most common endocrine causes of obesity

Hypothyroidism

Hypothyroidism is a set of clinical symptoms caused by a deficiency of thyroxine (T4) and the resulting insufficient action of triiodothyronine (T3) in the body's cells. Clinicians divide hypothyroidism into primary and secondary forms based on the underlying cause (table 2). Primary hypothyroidism occurs when various disease states lead to organ damage (e.g., Hashimoto's disease, other thyroid inflammations, total or partial removal of the organ, or an overdose of thyreostatic drugs) (Kucharska, 2020). In primary hypothyroidism, the concentration of thyrotropin (TSH) increases proportionally as thyroid hormone concentration decreases (Markiewicz et al., 2017).

Secondary hypothyroidism occurs when there is a deficiency or complete cessation of TSH secretion. Pituitary insufficiency causes this type of hypothyroidism, which can result from reasons such as inflammations, injuries, or various types of tumors (Kucharska, 2020; Markiewicz et al., 2017). Symptoms in children include: weight gain, slowed or stunted growth, persistent fatigue, impaired cold tolerance, drowsiness, dry skin, brittle nails, and bradycardia. (table 3). In adolescent girls, it may manifest as irregular menstrual cycles (Kucharska, 2020; Markiewicz et al., 2017; Counts & Varma, 2010). Table 3 lists the most common and important clinical symptoms.

Table 3. Clinical manifestations of hypothyroidism in children.

System / Area	Clinical Symptoms
Growth and development	are slowing, short stature, and delayed puberty
Nervous system and mental state	Feeling of fatigue, somnolence, worsening of academic performance
Cardiovascular system	Bradycardia
Digestive and metabolic system	Constipation, weight gain, increased body mass relative to height
Thermoregulation	Intolerance to cold temperatures

Skin and subcutaneous tissue	Dry skin, skin pallor, facial myxedema
Endocrine/reproductive system	Irregular periods, delayed puberty
Muscular system	Proximal muscle weakness
Neuromuscular system	Delayed relaxation phase in tendon reflexes (e.g., ankle reflex)
Skin and skin appendages	increased body hair (hirsutism)

Laboratory abnormalities include: increased TSH concentration in primary hypothyroidism; a lack of significant increase in secondary hypothyroidism; and decreased FT4 concentration; decreased or normal FT3 concentration. The thyroglobulin concentration in children with thyroid ectopia may be low. In patients with agenesis, thyroglobulin is undetectable (Kucharska, 2020). In Hashimoto's thyroiditis, an autoimmune disease, anti-TPO and anti-Tg antibodies are present. Electrolyte disturbances can occur, such as hyponatremia, which results from impaired free-water (Kucharska, 2020; Markiewicz et al., 2017).

Diagnostic criteria:

- a) decreased FT4 concentration with increased TSH concentration (primary);
- b) decreased FT4 concentration without an adequate increase in TSH concentration (secondary) (Kucharska, 2020).

Treatment consists of administering substitution drugs; the drug of choice in primary hypothyroidism is Levothyroxine. The main causes and mechanisms of hypothyroidism are presented in Table 4.

Table 4. Types, causes and mechanisms of hypothyroidism

Type of Hypothyroidism	Cause	Mechanism / Notes
Primary	Congenital aplasia or hypoplasia of the thyroid	Absence or underdevelopment of the gland → decreased thyroid hormone production
Primary	Thyroid ectopy	Abnormal location of the gland → impaired function
Primary	Congenital hormone synthesis disorders (dyshormonogenesis)	Enzymatic defects in the production of T3 and T4
Primary	Autoimmune thyroiditis	Inflammatory process (e.g., Hashimoto's type) leading to thyroid destruction
Primary	Iodine Deficiency	Deficiency: insufficient synthesis of thyroid hormones
Primary	Iatrogenic (drugs, radiotherapy, surgery)	Damage to or removal of the thyroid gland

Cushing's Syndrome

Cushing's syndrome is a clinical state resulting from chronic exposure to an excess of glucocorticosteroids, regardless of whether it is endogenous (resulting from overproduction of cortisol by the adrenal glands) or exogenous (resulting most often from long-term steroid therapy). In children, the iatrogenic form occurs most frequently, while among endogenous causes, ACTH-dependent forms dominate (including Cushing's disease caused by a pituitary adenoma).

Typical signs include weight gain, a slowing of the growth rate, rounding of the face, acne, seborrhea, excessive hair growth (hirsutism), and delayed sexual maturation. Central obesity, muscle wasting, purple stretch marks, "buffalo hump," or "moon face" occur much less frequently in children than in adults. In girls, clitoral enlargement may occur, and in boys, enlargement of the penis with small, prepubertal testicular volume.

Confirmation requires demonstrating hypercortisolemia, an excess of cortisol produced by the adrenal glands. One should also remember pseudo-Cushing's syndrome, which psychological/physical stress, anxiety, obesity, malnutrition, pregnancy, or chronic diseases can cause. Diagnostics include laboratory and hormonal tests. Biochemical deviations include hypokalemia with hyperkaliuria, hypocalcemia with hypercalciuria, and hypophosphatemia with hyperphosphaturia. Hyperglycemia, impaired glucose tolerance, and dyslipidemia (high concentration of total cholesterol, LDL fraction, and triglycerides; low HDL) often occur (Magiakou et al., 1994).

Diagnosis of this condition requires confirmation of hypercortisolemia and its etiology. The first important symptom is a disruption of the circadian rhythm (elevated cortisol levels in the evening). The second symptom is an increase in free urinary cortisol excretion. The third symptom is a lack of suppression in the dexamethasone test. By measuring ACTH levels, we can distinguish between ACTH-dependent and ACTH-independent cortisol. A CRH stimulation test is also performed. In some cases, adrenal reactivity to atypical stimuli can be assessed (Koch et al., 2019; Bednarczyk et al., 2025; Mazur et al., 2023).

Diagnostic procedures

Medical history in the diagnostics of endocrine obesity in children

The medical history is the foundation of evaluating a child with excessive body weight. The conducted interview allows for a preliminary estimation of whether obesity may have an endocrine basis. A detailed history includes information regarding the development of body mass and the child's lifestyle. Family history and related disease burdens are important.

Onset and dynamics of weight gain

It is important to determine when weight gain began. A rapid increase in weight over a short period may suggest an endocrine basis. It also suggests weight gain associated with hormonal maturation. Percentile charts are used to compare weight gain with age- and gender-specific norms.

Diet and physical activity

Assessment of the child's nutrition helps to determine whether the excess energy supplied by food is the main cause of obesity. Data should include consumed meals, food quality, consumption of sweets, and dietary habits at home and at school. The interview regarding physical activity includes the type, intensity, frequency of exercises, and time spent in front of a screen (Mazur et al., 2023; Zachurzok et al., 2024; Zarzycka et al., 2015).

Family history

Excess body weight has both environmental and genetic causes. It is important to determine whether obesity or endocrine disorders run in the patient's family. It is also important to assess the family history of conditions such as hypothyroidism, type 2 diabetes, and Cushing's syndrome.

Other aspects

The history should take into account accompanying symptoms: slowing of the growth rate, skin changes, excessive hair growth, irregularity of menstrual cycles, or symptoms related to glycemia and arterial blood pressure. Every such signal may indicate the need for further laboratory and imaging diagnostics.

Physical examination

The physical examination is a crucial step. It allows us to detect features that suggest an endocrine basis for obesity. This examination must be systematic, including body measurements, body morphology, and the development of sexual characteristics.

Height, body mass, and BMI

These are the basic elements of the examination. It is necessary to calculate the BMI and determine the child's percentile position. In endocrine obesity, weight gain is often disproportionate to growth (e.g., in Cushing's syndrome or hypothyroidism) (Kucharska et al., 2020; Markiewicz et al., 2017; Counts & Varma, 2010).

Body proportions and dysmorphic features

Assessing body proportions can facilitate the diagnosis of endocrine diseases and genetic syndromes.

Puberty

Clinicians should assess pubertal development in each child using the Tanner scale. This scale should be an integral part of every examination. Abnormalities in sexual development may be associated with endocrine obesity. Accelerated puberty in a child with excess body weight may indicate early puberty or excess steroid hormones. Delayed puberty in the presence of obesity may suggest hypothyroidism or Cushing's syndrome (Counts & Varma, 2010).

A systematic physical examination allows physicians to assess the degree of obesity. It allows us to diagnose clinical symptoms that suggest an endocrine basis. Assessment of height, weight, body proportions, the presence of dysmorphic features, and assessment of sexual maturation are crucial for further diagnostic guidance.

Laboratory tests in the diagnostics of endocrine obesity in children

Laboratory tests are key elements of diagnostics. They are performed particularly when the history and physical examination suggest an endocrine basis. The goal is to detect hormonal and metabolic disorders contributing to sudden weight gain or weight gain resistant to treatment.

Thyroid hormones - TSH and fT4

This evaluation allows for the diagnosis of hypothyroidism. High TSH concentration with low fT4 suggests primary hypothyroidism (Kucharska et al., 2020; Markiewicz et al., 2017). Subclinical hypothyroidism (slightly elevated TSH, fT4 within the norm) requires observation and assessment of the growth rate (Kucharska et al., 2020).

Cortisol

Diagnosing elevated cortisol levels requires measuring cortisol concentrations. Hypercortisolemia occurs, for example, in Cushing's syndrome. Hypercortisolemia observed in 24-hour blood tests or after a dexamethasone suppression test may suggest adrenal hyperfunction. Young patients with elevated cortisol levels often exhibit symptoms such as central obesity, a "full moon" face, buffalo hump, and growth retardation (Jonczyk, 2014; Bednarczuk et al., 2025; Mazur et al., 2023).

IGF-1 (Insulin-like growth factor-1)

This acts as a marker of the growth axis (GH/IGF-1), which is helpful when growth hormone deficiency is suspected. GH deficiency can occur with obesity. Low IGF-1 with slowed growth and an increase in body mass suggests deficiency. Elevated IGF-1 may be associated with an excess of anabolic hormones or other endocrine disorders.

Glucose and Lipid Profile

The lipid profile and fasting glucose levels play an important role in assessing early metabolic complications associated with obesity. Impaired fasting glucose tolerance or elevated blood glucose levels may suggest insulin resistance or the development of type 2 diabetes. Type 2 diabetes, in turn, frequently coexists with obesity in children. Abnormal lipid profile results, such as increased total cholesterol, LDL, or triglycerides, or decreased HDL levels, may indicate secondary dyslipidemia and serve as markers of metabolic syndrome.

Blood tests should be individually tailored to each patient. These are performed based on the patient's history and physical examination. We assess TSH, fT4, cortisol, glucose, lipid profile, and IGF-1. Based on the test results, the doctor identifies hormonal causes and the early metabolic consequences of obesity. Based on the evaluation of laboratory tests, the doctor can implement appropriate treatment and plan further diagnostics.

Management algorithm

The management algorithm for suspected endocrine obesity in children should be multi-stage and orderly.

Obesity diagnosis (BMI)

The first step in diagnosing obesity in children is to assess the body mass index (BMI) relative to age- and gender-specific percentiles. Obesity is diagnosed when BMI is $\geq$ 95th percentile. It is also important to assess the rate of weight gain, as a rapid increase in BMI may suggest a secondary cause of obesity (Styne et al., 2017).

Growth assessment

A key element in differentiating between simple and secondary obesity is the analysis of growth velocity. Children with simple obesity typically grow normally. However, growth retardation or a decrease in growth velocity (a decrease of $\geq$ 1 percentile) is an alarm signal and suggests possible endocrine disorders (Han et al., 2010).

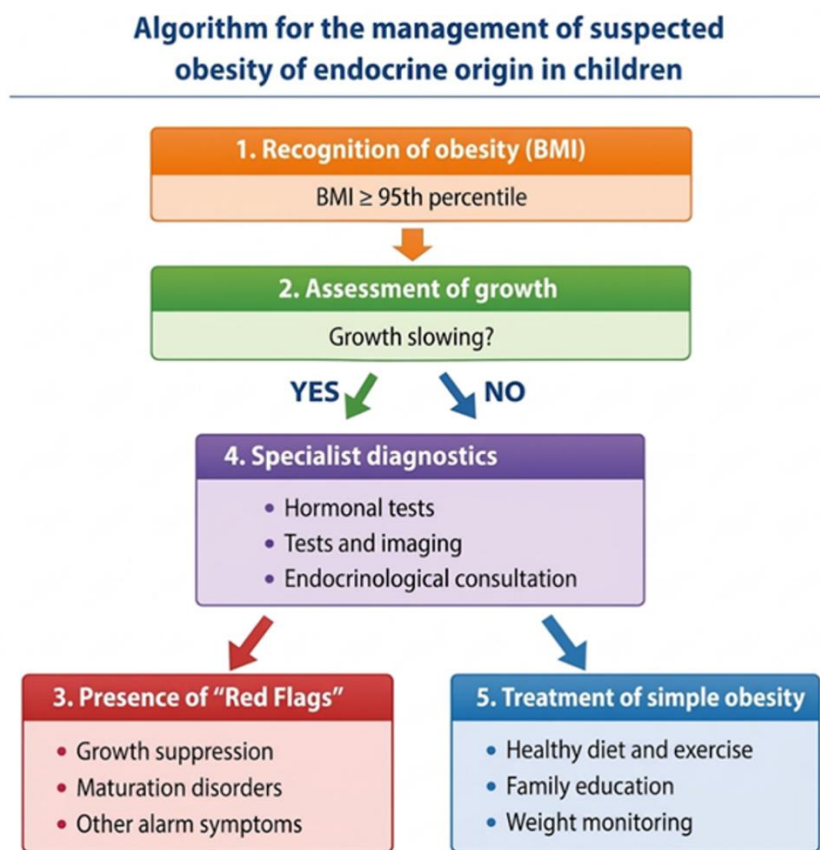


Figure 2. Algorithm for the management of suspected endocrine-related obesity in children

Presence of "red flags"

Alarm symptoms that you should actively look for include:

- slowing down the growth rate,
- delayed puberty,
- dysmorphic features,
- suspicion of a genetic syndrome,
- rapid weight gain,
- symptoms of endocrinopathy (dry skin, bradycardia, hypertension, purple stretch marks),
- neurological disorders (headaches, vision disorders),
- very early onset (< 5 years of age) (Han et al., 2010).

If any of the "red flags" are present, it is advisable to investigate the endocrine system further. It is worth performing tests such as:

- hormonal tests (TSH, fT4, cortisol, ACTH, IGF-1),
- dynamic tests (if indicated),
- imaging diagnostics (e.g., magnetic resonance imaging of the pituitary gland),
- genetic consultation (in justified cases) (Speiser et al., 2005).

In the absence of alarm symptoms and with a normal growth rate, simple obesity is most often diagnosed. To confirm the diagnosis, it is worth performing the following procedures:

- lifestyle modification,
- psychological support,
- family education,
- regular monitoring of growth and weight (Styne et al., 2017).

This approach helps avoid unnecessary diagnostics and allows for the detection of rare endocrine causes. A practical diagnostic pathway for children with suspected endocrine obesity is presented in Figure 2.

Most common errors in obesity diagnostics

In everyday clinical practice, the assessment of a child with excess body weight is subject to various diagnostic errors. These can lead to the overdiagnosis of endocrine disorders. At the same time, underdiagnosis can cause clinicians to miss cases requiring urgent specialist intervention. One of the most common problems in obesity diagnosis is excessively extensive hormonal testing without clear clinical indications. Most cases of childhood obesity are simple, and performing various laboratory tests can lead to false positive results. This unnecessary overdiagnosis also contributes to unnecessary stress for the young patient. Hormonal testing should always be targeted and based on the presence of symptoms suggesting a secondary cause of obesity.

Ignoring growth velocity is another mistake in diagnosing childhood obesity, as it is one of the most sensitive indicators of hormonal imbalances. Even if a child's current height is within the normal percentile range, a decrease in growth velocity should raise a diagnostic alert. At the same time, delayed referral of overweight children to a specialist is a significant error. Children who exhibit any alarming symptoms, such as growth retardation, pubertal disorders, or features of genetic syndromes, should be immediately referred to a pediatric endocrinologist. Delaying specialist consultation can lead to the progression of the underlying disease and a worse prognosis (Wójta-Kempa and Lewandowska, 2011).

4. CONCLUSION

Childhood obesity most commonly stems from primary obesity. Endocrine disorders should always be considered when "red flag" symptoms are present—particularly when a slowing of growth velocity coincides with weight gain. The most common endocrine conditions causing obesity in children are hypothyroidism and Cushing's syndrome. A thorough medical history and physical examination are key to diagnosing obesity, as is the assessment of growth velocity. Conducting these evaluations meticulously enables the early identification of underlying conditions. Early detection of endocrine-related obesity allows for the timely initiation of treatment, which significantly improves the prognosis.

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Authors' Contributions

JK conceived the study and drafted the manuscript. AD, AK, and KK contributed to data analysis and literature review. MK, SP, NK, DS, MM, and MJ participated in manuscript revision. All authors approved the final version of the manuscript.

Informed consent

Not applicable.

Ethical approval

Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

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Conflict of interest

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability

All data associated with this study will be available based on the reasonable request to corresponding author.

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