# Eating Problems In Children With Cerebral Palsy

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## Abstract

**Background:** Eating problems have a negative impact on children's health, such as impaired growth, susceptibility to infection, and even death. In addition, eating problems have the potential to cause cognitive and behavioral disorders, and are associated with anxiety disorders and eating disorders in children, adolescents and young adults. Eating problems can be classified into inappropriate feeding practices, small eaters, parenteral misperception and food preferences. Inappropriate feeding practices can occur primarily due to parents' lack of knowledge regarding proper feeding or secondary as a response to small eaters, food preferences, parenteral misperception. Cerebral palsy (CP) is a neuromotor development disorder that often occurs in children. This disorder occurs due to damage to the brain that is non-progressive during the growth and development process which can cause disturbances in attitude (posture), movement control, impaired muscle strength and is usually accompanied by impaired neurological in the form of paralysis, spasticity, disorders of the basal ganglia and cerebellum and mental disorders.

*Keywords: Eating problems, inappropriate feeding practices, parenteral misperception, food preferences, Cerebral palsy*

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Eating problems occur when a child does not want or refuses to eat, or has difficulty consuming food or drink of the type and amount according to age physiologically (naturally and naturally), namely starting from opening the mouth without force, chewing, swallowing until it is absorbed properly by digestion. without coercion and without administering certain drugs. Eating problems have a negative impact on children's health, such as impaired growth, susceptibility to infection, and even death. In addition, eating problems have the potential to cause cognitive and behavioral disorders, and are associated with anxiety disorders and eating disorders in children, adolescents and young adults.(1,2)

**Epidemiology of eating problems**

Based on the results of research conducted in London, the prevalence of eating problems in children with neurological disorders was found to be around 80%. Based on the results of a multicenter national study on children aged 1-3 years who experienced eating or weight problems, there were three main findings that became a reference for making a diagnosis, namely parental complaints, nutritional status, and implementation of feeding rules.(1)

**Clinical manifestations of eating problems**

Danger signs that must be evaluated and treated for every complaint of eating problems, namely: (2)

1. Structural abnormalities
    A. Naso-oropharyngeal abnormalities: choana atresia, cleft lip, Pierre Robin sequence, macroglossia, ankyloglossia
    B. Laryngeal and tracheal disorders: laryngeal cleft, laryngeal cyst, sublottic stenosis, laryngo-tracheomalacia
    C. Esophageal disorders: tracheoesophageal fistula, esophageal atresia/stenosis, esophageal stricture, vascular ring
2. Neurodevelopmental disorders, for example:
    A. Cerebral Palsy
    B. Arnold-Chiari malformation

C. Meningomyelocele
D. Familial dysautonomia
E. Muscular dystrophy
F. Myasthenia gravis
G. Oculopharyngeal dystrophy

3. Signs and symptoms that indicate a medical problem underlying eating problems include:
A. Repeated vomiting/regurgitation
B. Sandifer position (arching the back)
C. Recurrent diarrhea / chronic diarrhea / bloody diarrhea
D. Cough for more than 2 weeks or cough for more than 3 episodes within 3 months
E. Appears in pain/crying/screaming when being fed
F. Pale
G. Fever of unknown cause for 2 weeks
H. Enlarged cervical/inguinal/axillary lymph nodes (KGB).
I. Shortness of breath when drinking

Feeding problems can be classified into inappropriate feeding practices, small eaters, and parenteral misperception.
Inappropriate feeding practice is an eating problem caused by wrong eating behavior or giving food that is not appropriate for age. The causes of inappropriate feeding practices need to be explored further, primary or secondary. Inappropriate primary feeding practice is caused by parents' lack of knowledge regarding four aspects, namely (1) timely, (2) quantity and quality of food, (3) hygienic preparation and presentation, and (4) providing food that is appropriate to the child's developmental stages with implement feeding rules. Meanwhile, secondary Inappropriate feeding practice is a response to small eaters. Parents need to be educated on correct feeding rules and providing age-appropriate food including aspects of texture and ratio of solid to liquid food.(3)

Small eaters is the terminology used for children who complain of eating little, poor nutritional status and proper feeding rules. Other literature uses the terminology infantile anorexia, vigorous child with little interest in feeding. According to Chatoor, children belonging to this group have different autonomic responses. Children who are classified as small eaters are active, have normal development, are often interested in the environment rather than food, and have no underlying medical problems. If small eaters are not handled properly, children can experience failure to thrive. Koletzko and Doukopil suggest the following approaches to increase energy density (1) analysis of diet, calorie requirements and eating problems; (2) individual counseling regarding dietary intake and feeding practices; (3) offer main meals and snacks more frequently; (4) increased calories in home foods or formulas with glucose polymers and/or fats in the form of oil, butter, coconut milk, or milk; (5) use of oral nutritional supplements; (6) providing enteral nutrition; (7) providing parenteral nutrition.(3)

Parental misperception is defined as a child who, in the parents' opinion, has eating problems, but after further history taking, it turns out that the parents/caregivers have implemented feeding rules correctly and the child has good nutritional status. In this case, support and appreciation are given to the parents that the child's nutritional status is good and the parents have implemented the feeding rules correctly. (4)

**Management**

Rules for feeding children.(2,5)

Schedule:
There is a regular schedule of main meals and snacks, namely three main meals and two snacks in between. Milk can be given two – three times a day. Meal time should not exceed 30 minutes
You can only consume water between meals

Environment:
A pleasant environment (no pressure to eat)
No distractions (toys, television, electronic gaming devices) while eating
Don't give food as a gift

Procedure:
Encourage the child to eat alone
If the child shows signs of not wanting to eat (closing his mouth, turning his head away, crying), offer him food again neutrally, that is, without persuading or forcing him. If after 10-15 minutes the child still doesn't want to eat, end it eating process.

**Cerebral Palsy**

Cerebral palsy is the terminology used to describe a group of chronic diseases that affect the center of movement control with clinical manifestations that appear in the first few years of life and generally get worse as growth progresses.(2)The term cerebral refers to both hemispheres of the brain, or hemispheres, and palsy. describes various diseases that affect the body's movement control center.(6) So, PS is a condition of persistent and non-progressive damage to brain tissue that occurs at an early age, disrupting brain development which is characterized by changes in muscle tone, posture abnormalities and movement disorders.(7)

Manifestations of motor or postural disorders can include spasticity, rigidity, ataxia, tremor, atonia or hypotonia, absence of primitive reflexes (in the early phase) or persistent primitive reflexes (in the later phase), and dyskinesia. Each of these symptoms can occur separately or in a combination of several symptoms. The spastic form of paralysis is the most common form, occurring in 70% to 75% of cases. Spasticity will increase muscle tone and cause muscle stiffness as well as functional disorders and muscle atrophy. Other forms are dyskinetic (10% to 15%) and ataxic (<5%).(8,9)

Cerebral palsy can be accompanied by several disorders or abnormalities, including intellectual disabilities, vision and hearing disorders, speech disorders, nutritional and swallowing disorders, upper respiratory tract infections, and epilepsy. (10)

Assessment of nutritional status in children with cerebral palsy

Suboptimal growth and nutritional status of children with CP have been reported in several studies. In a study that measured body weight, height, and body mass index in 24,920 children and adolescents with CP aged 2 to 20 years, the majority of CP children with moderate to severe motor impairments were reported to have impaired growth. Factors other than nutrition also play an important role in the growth of children with CP, namely children with hemiplegic type of CP whose growth is more impaired than CP children without hemiplegia.(11,12)

Diet history and physical examination are important in monitoring growth in children with CP. Assessment of nutritional status is one of the most important factors for monitoring normal growth and well-being in children with CP. The nutritional status of children with CP depends on the severity of the disease, the natural history of the disease, treatment and nutritional supervision by a team of nutritionists at the hospital. A physical examination is carried out to determine whether the child is growing normally or not. 27 A nutritional history helps whether there is growth failure due to poor nutrition or other abnormalities. Generally, the nutritional history focuses on the patient's eating difficulties. A nutritional history is also helpful in finding out whether the patient needs a higher calorie intake.(13)

Stallings et al showed that in a quantitative assessment, oral intake in CP (quadriplegic) children showed that 44% - 54% required a higher calorie intake than their actual needs. Data about the causes of growth abnormalities can be assessed with a complete physical examination. Examination of the skin and nails can reveal some initial information about micronutrient deficiencies and further preventive measures can be implemented immediately.(13,14)

In some situations, a pediatric patient's weight can be measured by calculating the combined weight of the child and caregiver. The caregiver holds the child in her lap. The caregiver's weight is subtracted from the total weight (child's weight plus caregiver's weight). This gives weight to the child. Children with certain conditions must be lifted and carried from their wheelchairs during weighing. Nevertheless, method consistency is essential to obtain an accurate patient weight profile. For accurate weight measurements, nutritional guidelines have been recommended by the Canadian Dietitian that weight and height measurements should be plotted against standards (e.g. WHO or CDC growth charts).(13)

Anthropometrics is used to measure and estimate the general health of both individuals and populations. Anthropometric examinations are also used to make revisions to growth charts, generally carried out after data on body weight (BB), height (TB) and head circumference (LK) are available. For children with chronic illnesses, measuring upper arm circumference (LILA) and skin fold thickness (TLK) is part of the assessment to determine body fat and protein stores. 29 Determination of nutritional status is carried out based on body weight (BB) according to body length (PB ) or height (TB) (BB/PB or BB/TB). The growth charts used as references are the 2006 WHO charts for children less than 5 years and the CDC charts for children over 5 years.(2)

Children with physical limitations, for example contractures, do not allow measuring PB/TB, so they require alternative measurement methods. Arm span (upper arm length) and lower arm length (knee height) are reliable and valid indices in measuring children's PB/TB measurements. This measurement is carried out using a sliding caliper for babies and a large anthropometer for children. All the above measurements were carried out with an accuracy of up to 0.1 cm.(15)

Upper arm span is a length measurement technique carried out with a 2 meter long ruler. Subjects stood with their feet and shoulders against a wall along the measuring tape. Readings are taken on a scale of 0.1 cm starting from the tip of the middle finger of the right hand to the tip of the middle finger of the left hand. Lower leg length (knee height) and knee height were measured using a Knne Height Caliper in a sitting position. Knee height is measured with a caliper containing a measuring ruler with the blade held at a 90 degree angle. The device

is attached between the heel to the proximal part of the patella bone. The measurement results in cm are converted to height using the Chumelea formula:
Male TB = 64.19 - (0.04 x age in years) + (2.02 x knee height in cm)
Female TB = 84.88 - (0.24 x age in years) + (1.83 x knee height in cm) (16)

**Eating problems in children with cerebral palsy**

Cerebral palsy (CP) is included in a group of chronic and non-progressive disorders of movement, posture and tone, resulting from damage to the central nervous system. The prevalence of children with CP is estimated at around two per 1000 live births, and the most common disorder is the spastic type. The most common typical neuropathological disorders are periventricular leukomalacia and cortical/cerebral atrophy. Gastrointestinal motor dysfunction, including gastroesophageal reflux disease (GERD), dysphagia, vomiting and chronic constipation are the most frequently complained of clinical symptoms in various degrees of central nervous system damage.(16,17)

The prevalence of feeding difficulties in children with CP varies between 30% and 90%. Children with special needs, including children with CP, are at risk of experiencing oral intake deficiencies due to oromotor abnormalities, aspiration-related pharyngeal phase disorders, and communication difficulties that reduce the ability to ask for food and drink. Several other disorders such as intellectual disabilities, vision and hearing problems, and seizures also influence the degree of feeding difficulties in children with CP.(11,12)

The Canadian Pediatric Society has conducted a study which shows that calorie intake in children with CP is lower compared to children their age. This occurs due to a lack of eating skills in children with CP. Lack of coordination between hands and mouth causes a lot of food to be spilled and it takes a long time to finish food with sufficient calories, so that the desired amount and calorie target is not achieved. Children with severe CP are very dependent on parents or caregivers in the feeding process, they are also unable to communicate feelings of fullness and hunger, so there are often misinterpretations by parents or caregivers regarding the adequacy of intake. Dysmotility, hypotonia, and difficulty walking play a major role in the occurrence of constipation which also affects intake in children with CP.(18,19)

a. Dysphagia

Oromotor dysfunction is common and is one of the early signs of neuromuscular disorders. Swallowing problems are the most common problem (90%) in children with neurological disorders, and this is one of the factors that contributes to malnutrition in children with CP. The development of oromotor abilities is a reflection of general neurological maturation and requires coordination of skeletal muscle movements of the oral cavity, pharynx and esophagus with the involvement of cranial nerve VI and the brain stem and cerebral cortex.(20)

Clinical manifestations of dysphagia can include distress during eating (including coughing, choking, and refusal to eat), episodes of aspiration or chronic aspiration related respiratory abnormalities, and failure to thrive. Difficulty swallowing food is often found in children with CP. Swallowing problems can trigger GERD and esophagitis in children with CP. Most children with CP experience dysfunction in the oral phase of swallowing, with abnormal formation of a food bolus due to uncoordinated movements or contractions or a rigid tongue. Swallowing problems have significant implications for development, nutrition, airway health and gastrointestinal function in children with CP. Dysphagia conditions will cause reduced nutritional intake, which can lead to malnutrition. Apart from that, problems that can arise due to difficulty swallowing in children with CP are recurrent aspiration pneumonia.(13,21)

b. Esophageal dysfunction

Gastroesophageal reflux disease (GERD) is often found in children with neurological disorders. The incidence rate varies between 70% to 90%, depending on the diagnosis using esophageal pH testing or upper gastrointestinal endoscopy (esophagogastro-duodenoscopy, EGD). Prolonged supine position, increased intra-abdominal pressure due to spasticity and scoliosis, and the comorbidity of hiatal hernia are contributors to the increased frequency of gastroesophageal reflux (GERD). Dysfunction of the central nervous system (CNS) is the main cause of dysmotility throughout the upper gastrointestinal tract, even the entire small intestine. In this condition, the lower esophageal valve will experience a decrease in pressure during the resting phase and an increase in the frequency of transient relaxation. This situation, coupled with abnormal motility, will cause neuromuscular incoordination.(13)

Several studies show a high incidence of GERD in the form of reports of symptoms of vomiting, rumination and regurgitation of 20% to 30% in children with CP. The incidence of iron deficiency anemia and hematemesis associated with GERD is reported to be 10% to 20%. According to Savary-Miller pathological pH-metry testing was found in 48% of cases, with endoscopy results showing reflux esophagitis in 96% of cases; consisting of 14% grade 1 esophagitis, 33% grade 2, 39% grade 3, and 13% grade 4. Barrett's esophageal abnormalities were found in 14% of cases and peptic strictures were found in 4% of cases.(13)

c. Constipation

Complaints of infrequent bowel movements (less than normal frequency) and hard stools are common complaints encountered in children with CP, although they are often conditions that are not properly diagnosed. Chronic

constipation occurs due to prolonged transit time in the colon (especially the left colon and rectum), secondary to upper gastrointestinal dysmotility. Another thing that contributes to chronic constipation in children with CP is a diet lacking in fiber and fluids and delayed diagnosis.(13)

**Comprehensive nutritional management**

Appropriate and comprehensive handling of nutritional problems in children with CP can be carried out by providing pediatric nutritional care, which includes 5 steps in the form of assessing nutritional status, calculating needs, determining routes and formulas as well as monitoring and evaluation.(22)

1. Assessment of nutritional status is carried out by taking anamnesis on various aspects, including:

a. Nutrition history in the form of eating patterns and feeding practices, texture, type and amount of food, level of eating skills, socio-psychological interactions when eating, duration and length of eating as well as identification of environmental influences on the feeding process. An assessment was also carried out regarding the history of motility disorders, constipation, dysphagia, gastroesophageal reflux, history of choking, recurrent respiratory tract infections, coughing when eating.(11,22)

b. History of illness and treatment, by asking about medications that have been given, a history of atopy or allergies to certain foods or medications, as well as a history of previous illnesses.(22)

c. History of growth and development, recording birth weight, body weight, body length and head circumference over time and plotting on a growth chart. Midparental height should be measured and can be used as an estimate of the potential height that can be achieved.(22)

d. A thorough physical examination must be carried out, starting with correct measurements of weight and height as well as other anthropometric indices. Conditions in CP often cause weight and height measurements to not be taken perfectly. In CP children with scoliosis or contractures, as an alternative, lower extremity length (knee height) or upper arm length (arm span) can be used. Measurements of triceps skinfold thickness and upper arm circumference are more reliable than weight for height in determining nutritional status in conditions like this.(22)
On physical examination, you should look for decubitus ulcers, edema, hypotonia, spasticity, contractures, scoliosis, and movement disorders. The mouth, jaw and teeth need to be checked, because they are closely related to the ability to eat. Chest examination, heart-lung auscultation needs to be done to look for aspiration or other abnormalities that aggravate the condition. Likewise, assessing the presence of clubbing fingers can indicate the presence of chronic hypoxia that may occur. Examination of bowel movements and dysmotility as well as the presence of constipation should also be carried out.(22)

e. Supporting examinations, including blood and urine laboratory tests, as well as various radiological modalities, are carried out according to indications. A complete peripheral blood examination can be an initial suspicion of iron deficiency, an albumin examination shows a lack of protein, an examination of calcium and vitamin D may need to be carried out if osteoporosis is suspected. Swallowing studies (examination of swallowing mechanisms) with various textures and types of food may be needed to assess the effectiveness and safety of choice of form and route of feeding in order to prevent aspiration.(22)

2. Calculation of needs

a. Energy:

Calorie needs are determined based on ideal body weight multiplied by RDA according to height (height age). Age-height is the age when the child's height is P50 on the chart. Certain nutrient requirements are specifically calculated for certain clinical conditions.(11)

Based on ideal BB target calculations:

BB-ideal x RDA according to age-height

Giving initial calories of 50-75% of the target to avoid refeeding syndrome.(23)

Broadly speaking, nutrition consists of macronutrients (carbohydrates, protein and fat), micronutrients (vitamins and fat) and water. Macronutrients are the main substances found in the diet and function as a source of energy for the body which is used for growth, maintenance and activity. Please remember that these calculations are only basic guidelines that should always be followed with monitoring and evaluation for individual use. Ideally, the gold standard is used in the form of measuring calorie needs based on indirect calorimetry.(24,25)

b. Protein: Estimated protein requirements are calculated using the recommended dietary allowance (RDA) according to chronological age or can also use height, especially if the growth parameters are far below chronological age.(25)

Calorie needs = RDA for TB age (according to height-age)*

*age where TB is currently at the 50th percentile

** 50th percentile BB according to current height-age.(25)

c. Vitamins/minerals: Micronutrient deficiencies that often occur are vitamins A, C, D, and folic acid as well as iron and calcium deficiencies. Supplementation and therapy are given according to recommendations in normal populations.(43)
d. Fluids: Fluid requirements may be slightly higher than the normal population, because children with CP often have constipation and need to take into account fluids that come out through drooling, vomiting or other things. But basically fluid calculations can be done based on the Holliday-Segar formula, namely fluid requirements of 100 mL/kg up to a body weight of 10 kg, 1000 mL + 50 mL/kg above 10 kg for a body weight of 10 kg to 20 kg, and 1500 mL + 20 mL/kg over 20 kg for body weight 20 kg or more.(25)

3. Route determination
The easiest and least invasive method to increase calories is to increase oral intake. It is very important to regulate and correct body posture during the eating process. Oromotor skills can be trained and treated, although progress depends on many factors. Oral intake should always be maintained as long as it is known that there is no risk of aspiration, the child is growing well and the feeding time is not long (±30 minutes). If these three things cannot be met, enteral nutrition must be given immediately. Administration via a nasogastric tube is the most frequently used option because it is less invasive and easy. Choosing a nasogastric tube primarily aims to increase tolerance and efficacy, because its use is only for the short term (no more than 3 months). Enteral nutrition is indicated if oral feeding and the condition of the stomach is not possible or cannot meet nutritional needs provided that intestinal function is still good. The enteral nutrition route can be oral or via a feeding tube. Enteral nutrition is safer, cheaper and more practical compared to parenteral nutrition. Another advantage of enteral nutrition is that it is physiological and has a complete nutritional composition. Even though it is only given 10-15% of total calorie requirements, enteral nutrition can improve intestinal structure and function (trophic effects). Parenteral nutrition is only considered if enteral nutrition is not possible. The route of parenteral nutrition is via peripheral veins or central veins.(22,25)

4.Selection of formula
The choice of formula is based on the route that can be used by the child, the intended calorie target, the child's activity and condition (other comorbidities, allergies), and the child's tolerance. Providing formula with a high calorie density is an option for children with limited volume tolerance. There is a high calorie density (1-1.5 calories/ml) for children over 1 year and a calorie density of up to 1 calorie/ml for children under 1 year. 44 The recommended method of administering formula is intermittent, which is more physiological. and resembles daily eating patterns. Continuous administration of formula is recommended in children with poor tolerance and when used via a gastrojejunal tube. Nutritional management often requires food modifications in an effort to achieve targets for macro and micronutrient needs.(26)

5. Monitoring and evaluation
Monitoring of the tolerance, safety, and effectiveness of route and formula options should be performed periodically. Likewise, needs calculations must always be evaluated and adjusted.47
Children with CP who use assistive devices/wheelchairs but are still able to carry out activities are said to have good growth if they are at the 25th percentile of the normal growth chart. In children with CP who just lie down, the growth target is to be at the 10th percentile of the weight-for-height curve of the normal population.(27)
Management of CP is multidisciplinary, including general approaches, motor therapy techniques and approaches, assistive devices and technology, interventions for oromotor skills for eating and swallowing, approaches for treating spasticity, orthopedic treatment and surgery, as well as interventions for related health conditions. Physiotherapy, occupational therapy, and speech therapy may be considered standard therapy.(28)

**Summary**
Children with CP can experience significant gastrointestinal dysfunction, manifested by impaired oromotor function, rumination, GERD with or without aspiration, impaired gastric emptying, and constipation. A careful history, thorough physical examination and early diagnosis will prevent further consequences of severe malnutrition which will affect quality of life. Providing adequate nutrition is an inseparable part of the comprehensive management of children with CP. All children with CP are at risk of experiencing nutritional problems, therefore it is necessary to carry out early detection from the start by paying more attention to the presence of oromotor dysfunction which is closely related to the incidence of malnutrition. Giving oral intake is preferred for children with CP who are not at risk of aspiration. Enteral nutrition must be given immediately in cases of oromotor dysfunction that are prone to aspiration or children with CP who cannot meet their needs through oral intake.

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