FEATURES OF METABOLISM IN CHILDREN

Academic discipline «Pediatric Propedeutics»
Self-study guide for the 3rd year
English medium students

ОСОБЛИВОСТІ ОБМІНУ РЕЧОВИН У ДІТЕЙ

З дісципліни «Пропедевтика педіатрії»
Методичні вказівки
до самостійної роботи студентів 3-го курсу
медичного факультету

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
Харківський національний медичний університет

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Contents

The metabolism is one of the essential sign of life. The term “Metabolism” means the ability of organism to accept, to digest, and to assimilate nourishment.

Metabolic processes include assimilation process (digestion of substances which are admitted from environment), synthesis process (building of composite chemical compound from more simple elements for creation of live matter) and dissimilation process (disintegration of substances forming alive organism).

Processes of synthesis of organic compounds (energy expending processes) are called anabolic processes (anabolism, constructive metabolism), processes of disintegration (energy forming processes) are called katabolic processes (catabolism, destructive metabolism). Life is possible if the constant tie between processes of disintegration and synthesis are present, due to this fact development and regeneration is possible.

Children have the predominance of anabolic processes at katabolic processes during all periods of childhood, degree of prevalence is parallel to growth intensively.

Specific goals:

- to explain the peculiarities of energy, protein, carbohydrate, lipid, water, mineral and acid-base metabolism in children.
- to carry out a clinical examination in children with metabolic disorders.
- to recognize these clinical symptoms of metabolism disorders and to identify major syndromes.
- to interpret the results of laboratory and instrumental methods of investigation.

To know:

- Patterns of age-related changes of energy metabolism in children.

Features of neuroendocrine regulation of metabolism in children. The general idea of metabolic diseases. Thermal balance the child's body. Features of thermogenesis and thermoregulation in childhood. Semeiology of hiper- and hypo- thermiaes children.

- Features of protein metabolism and semeiology of its disorders in children.
- Features of carbohydrate metabolism and its semeiology disorders in children.
-. Features of lipid metabolism and semeiology of its disorders in children
- Age characteristics of water and mineral metabolism and acid-base balance of the body in children. Violation of water and mineral metabolism and clinical manifestations.
- Value for vitamin metabolism child's body. Semeiology hypo- and hypervitaminosis in children.

Be able to:

- to collect anamnesis of a patient with diseases of the metabolism disorder.
- to conduct an objective examination of the child with metabolic diseases.
- to interpret the results of investigation.

Basic knowledge, practices and skills necessary for the topic (interdisciplinary integration).

Names of previous branches of learning	Acquired skills
1. General anatomy	Knowledge of organs and body systems. Meaning of some anatomical features of the children's body for organization of the children's care.
2. General physiology.	Knowledge of characteristics of organs and body systems functioning.
3. Introduction to psychology. Introduction to pedagogics	Analysis of patient's emotions, interpersonal relationships, children's behavior.

Control questions to the lesson:

1. Tell about the energetic metabolism in children, the peculiarities of neuroendocrine regulation of metabolic processes in children, overview of diseases of metabolism.
2. Tell about the peculiarities of the protein metabolism, semeiotics of its disorder in children.
3. Tell about the peculiarities of the carbohydrate metabolism, semeiotics of its disorder in children.
4. Tell about the peculiarities of the lipid metabolism, semeiotics of its disorder in children.
5. Tell about the peculiarities of the water-electrolyte and acid-base metabolism, semeiotics of their disorders in children.
6. Tell about the role of vitamins for metabolic processes of child organism, semiotics of hypo- and hyper vitaminosis in children.

Tests for self-control:

1. A 4-month –old boy admitted to a hospital with complaints of vomiting, often watery stool. The boy is sick during 3 days. At admission general condition is severe. Loose of weight is 12%. Results of biochemical investigation of blood: hematocrite 63%, protein 65g/l.

The prior diagnosis is:

a) Gastroenteritis, hypotrophy
b) Gastroenteritis, dehydrotation syndrome
c) Gastroenteritis, polycitemia
d) Galactozemia
e) Hypotrophy, hypoproteinemia.

2. A 7-year-old-girl admitted to a hospital with complaints of the thirst, vomiting, abdominal pain, restless. At admission the general condition is very severe. The girl is unconscious. Los of weight is 8 kg. The skin is pail. Decrease of turgor and elasticity is marked. The glucose of the blood is 12mmol/l, the glucose of urine is 2%. Acetone ++++.

The prior diagnose is:

a) acute gastritis, hyperglycemia
b) acute gastroenteritis, hyperglycemia
c) diabetus mellitus, hypaglycemic coma
d) gastritis, syndrome of acetonic vomiting
e) myocarditis, hyperglycemia

3. A 14-year-old boy is sick with diabetus mellitus during 3 years. After injection of 15 units of insulin the child did not take any food. At 10 min the child stats to be very pale, convulsions are noticed. At moment admission to the hospital the child was unconscious, paleness of skin, decrease muscle tone, convulsions are marked. Glucose of the blood is 1,2 mmol/ l.

The prior diagnose is:

a) Diabetes mellitus, hyperglycemic coma
b) Diabetes mellitus, hypoglycemic coma
c) Epilepsy, hyperglycemia
d) Vegetative dysfunction, hyperglycemia
e) Meningoencephalitis, hypoglycemia

4. A 3-month-infant has the natural feeding. The child can not keep up the head, does not smile. Periodical convulsions has appeared 2 weeks ago. At admission the child to the hospital high level of phenylalanine was found in the blood of the child.

The prior diagnose is:

a) Meningitis, hyperphenylalaninemia
b) Meningitis, hypophenylalaninemia
c) Phenylcetonuria
d) Retardation of psychomotor development, hypophenylalaninemia
e) Epilepsy, hypophenylalaninemia

5. A 7-day-old newborn has vomiting, distention of the abdomen, watery stool 12 times a day after taking breast milk. At admission to the hospital jaundice, enlargement of livery are founded (border of liver palpated on 5 cm below arcus of

ribs). It is known from anamnesis that the farther of the infant does not use milk due to disfunction of stool after taking milk.

The prior diagnose is:

a) Gastroenteritis, conjugation jaundice
b) Gastroenteritis, dehydratation syndrome
c) Galactosemia
d) Hepatatis
e) Hypotrophia, dehydratation syndrome

6. A 4-month-old infant has artificial feeding, uses diluted cow's milk in proportion 1:1. Deficit of the body mass is 25%. At admission to the hospital the protein of the blood is 48 g/l.

The prior diagnose is:

a) Hypotrophy II degree, hyperproteinemia
b) Hypotrophy II degree, hypoproteinemia
c) Hypotrophy I degree, hyperproteinemia
d) Hypotrophy III degree, hypoproteinemia
e) Hypotrophy III degree, hyperproteinemia

7. A 7-month-old infant starts to have the dysfunction of the intestines, distention of the abdomen, watery stool after introduction of the semolina and bread. The infant lost 800 g of weight. At admission to the hospital the infant was examined, HT was 62%, protein – 42 g/l.

The prior diagnose is:

a) Hypotrophy II degree, gastroeneritis
b) Hypotrophy II degree, dehydratation syndrome
c) Celiac disease
d) Gastroeneritis, hypovolemia
e) Hypotrophy II degree, hypoproteinemia

Answers: 1 – B, 2-C, 3-B, 4-C, 5-C, 6-B, 7-C.

The list of study materials:

Main:

1. Propaedeutics of Paediatrics: Manual for foreign students / V. A. Fjoklin, V. A. Klymenko, O. M. Plakhotna, T. V. Sirenko, A. I. Kojemiaka, O. V. Sharikadze. – Kharkiv: 2010. – 356 p.
2. Kapitan T. Propaedeutics of children's diseases and nursing of the child / T. Kapitan. – The state cartographical factory, 2006. – 734p.

Additional:

1. Nelson textbook of pediatrics.—19th ed./ [edited by] Robert M. Kliegman… [at. ol], p. SM
2. Ghai O.P. Essential pediatrics (fourth edition). – New Delhi, India: Interpint, 1996.–476 p.
3. Gupte S. The short textbook of pediatrics, 8th edition. – New Deli, India.: Iaypee Brthe others. Medical publishers (P) hTD, 1998. – 617 p.

Bickley L.S., Hockelman R.A. Physical examination and History Taking. – Philadelphia, New York, Baltimor.: Lippincott, 1999. – 789 p.

Graflogic sructure for topic "Features of metabolism in children"

The scheme of digestion and absorption of protein

Organ	Albuminous substratum	Enzymes	Operation of the enzyme
Stomach	Native protein	Pepsin, gastrin	Lysing of peptides links
In small bowel under the operation of enzymes of pancreas	Polypeptides	Trypsin, chemotpypsin, carbopeptidase, elastase	Lysing of internal peptides links
Mucosa of small bowels	Amino acids	Oligosacharidase, disacharidase, aminopeptidase and others (more than 20), and also enzymes of digestive glands	The completion of hydrolysis and the absorption into blood and lymphatic systems
Liver	Amino acids	Decarboxilase, eransaminase	Utilization, splitting, distribution all over the organism

The differential diagnosis of hyperglycemia and hypoglycemia

Clinical signs	Hyperglycemia	Hypoglycemia
Skin and mucous membranes	Dry The turgidity is reduced	Skin is moist, profuse sweating The turgidity is maintained
Tone of muscles	Decreased	Increased, often trembling, seizures

Feelings of the patient	Loss of appetite, nausea, vomiting, thirst, weakness, apathy, drowsiness	Severe hunger, active confusion disturbance
Abdominal pain	Often acute	-
BP	Always decreased	Normal or increased
Breathing	Kussmaul's	Normal
The smell of acetone from the mouth	Is present	Is not present
Disorders in urination	Is not present	Frequent (pollakiuria), the amount is higher than normal (polyuria)

The features of an amount of water in an organism

Age	Common water	Extracellular fluid	Entracellular fluid
Neonatal period:	75-80	50	30
6 months	70	40	30
1 year	65	30	35
S years	65	25	40
The adult man	60-65	22	40

Age **metrics of fluid maintenance (10 ml/kg of body weight)**

Age	Fluid maintenance
3 days	80-100
6 months	130-150
1 year	120-140
2 years	115-125
5 years	90-100
10 years	70-85
15 years	50-60
18 years	40-50

A state of aqueous exchange judge on the value **hematocrit,** calculated on such formula:

Ht = Volume of red blood cells Blood plasma /Blood plasma

Normative age metrics of hematocrit

Age	**Unit** of **measurements**	
	%	Fractions
Early neonatal	52-54	0,52-0,54
2 months	42	0,42
3-5 months	36	0,36
1 year	35	0,35

3-5 years	36-37	0,36-0,37
10-15 years	39	0,39

Degrees of exsicosis, clinical manifestations

Symptoms	Degree of exsiccosis		
	I (mild)	II (moderate)	III (severe)
The losses of fluid (% of body weight) for the patients of 1-3 years	4-5%	6-9%	10% and are more
Deficit of fluid (mL/kg of body weight)	40-50	60-90	100-110
The thirst	Is sharply expressed	Is sharply expressed	The child refuses from fluid
The fontanel (of patients of breast feeding age)	Is not changed	Little bit sunk down	Sunk down
The elasticity of skin	Normal	Decreases	Plica is aligned more rather than through 2 sec.
The eye balls	Are not changed	'Soft'	Sharply sunk down
Pulse	Normal	Tachycardia, weak pulse	Tachycardia, thready
The heart sounds	Are amplified	Moderately weakened	Considerably weakened
BP	Normal	Is reduced	Less than 90 mmHg
Urine color	Normal	Yellowish	Dark yellow
Diuresis	Normal	Less than norm	Practically absent
Common state	Anxiety	Anxiety or sleepiness, hyperesthesia	Sleepiness, flaccidity, skin wet and cold, acrocyanosis, at the heaviest state - comatose state

Groups of vitamins

Groups	Physical and chemical qualities	Features

C (Ascorbic acid) B_1 (Thiamin) B_2 (Riboflavin) B_3 (Nicotinic acid, PP) B_4 (Choline) B_5 (Pantothenic acid) Bg (Pyridoxine) Bg (H, bioozes) BQ (Folic acid) B.J2 (Cyanocobalamin) B.,g(Oroticacid) B_{15} (Pangamic acid) P (Rutinum)	Are dissolved In water	• Thermolabile • Capable to be destroyed in the main environment • Steady in acid environment • Not cumulated in an organism
A (Retino) *t>2* 3 (Ergocalciferol and cholecalciferol) K.j 2 (Antihemorrhagic) E (b-Tocopherol) Q (Ubiquinone) F (Polyunsaturated fat acids) U (Methylmethioninsulfoni i chloridum) _N (Lipoic acid)----------	Fat-soluble vitamin's	• Thermostabile • Steady in the main and acid environments • Can accumulate in an organism

Навчальне видання

Особливості обміну речовин у дітей

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Комп'ютерна верстка

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