

**Ministry of Public Health of Ukraine
National O.O. Bohomolets Medical University**

**METHODICAL GUIDE
to practical classes for students**

<i>Educational discipline</i>	Propaedeutics of Pediatrics including nursing practice, basic medical skills in the pediatric department
<i>Training direction</i>	22 " Public Health ", II (master's) educational and qualification level
<i>Specialty</i>	222 «Medicine»
<i>Department</i>	Paediatrics # 2
<i>Thematic module 3</i>	Types of infant feeding. Nutrition of children older than one year. Peculiarities of metabolisms in children.
<i>Topic:</i>	Artificial and mixed feeding of babies. Classification and characteristics of milk mixtures for artificial and mixed feeding. Techniques of artificial and mixed feeding, criteria for evaluating their effectiveness. Complementary feeding and correction of nutrition during artificial and mixed feeding.
<i>Course</i>	3

Approved on methodic meeting of department of pediatrics №2 from «28» august 2023., protocol №1

Considered and approved: CMC on pediatric disciplines from «28» august 2023., protocol №1

1. Goal: the student acquires knowledge about:

1. Basic statements for determining the indications and principles of mixed and artificial feeding of children.
2. Proper organization of these types of feeding for children of the 1st year of life, taking into account modern requirements developed by leading nutritionists of the WHO (UNICEF).
3. Analysis of the daily diet of a child on mixed and artificial feeding, depending on the degree of hypogalactia and age.
4. Making an approximate ration scheme for a child of the 1st year of life who is on mixed or artificial feeding.

2. Competencies:

1. Identify factors that lead to the development of hypogalactia in a mother.
2. Diagnose hypogalactia in the mother, prescribe measures for its prevention and treatment.
3. Observation of mixed and artificial feeding of infants.
4. Carrying out control feeding (weighing).
5. Choose a literature for mixed and artificial feeding depending on the age and state of health of the child.
6. Based on clinical and anamnestic data, evaluate the quality of mixed and artificial feeding with the aim of their further correction.
7. Calculate the needs for the main ingredients in mixed and artificial feeding.
8. Calculate the child's diet, depending on the degree of hypogalactia and the child's age.

Equipment: tables of the content of the main food ingredients in baby food products, instructions for using literature for artificial feeding of babies, a notebook, a pen.

2. Plan and organizational structure of the lesson

The name of the stage	Description of the stage	Mastery Levels*	Time (min)
Preparatory stage	Organizational measures Setting educational goals, student motivation		10
The main stage	Test control on the subject of the lesson, checking and announcing the results.	**	20
	- theoretical survey; - demonstration of practical skills, clarification of the most important points regarding the preparation of a daily diet for a healthy child of the first year of life with artificial and mixed feeding. - students' work on acquiring skills in preparing a daily diet for a healthy child of the first year of life with artificial and mixed feeding. - acquisition by students of the skills of evaluating the results of the prescribed diet and, if necessary, making its adjustments.	*, **, ***	55

	Solving problems according to the subject of the lesson	** , ***, ****	20
Final	Analysis and assessment of student work results. Announcement of the topic of the next lesson, an indicative map for independent work with literature.		10
	Together	2,5 academic hours	115

* Introductory, **reproducible, *** reconstructive, **** creative learning levels.

3. Content of educational material

3.1. A list of the main terms, parameters, and characteristics that the student should learn when preparing for the class:

Term	Визначення
1. Nutritiology	- science of feeding early age children and nutrition of healthy and sick children.
2. Lactation	- the physiological ability of the female body to secrete breast milk
3. Agalactia	- lack of formation and secretion of breast milk in the postpartum period.
4. Hypogalactia	- pathological decrease in secretion of mammary glands.
5. Artificial and mixed feeding	- feeding, in which in the first six months of life, the child does not receive mother's milk at all or partially.

4.2. Topic content:

ARTIFICIAL FEEDING

Artificial feeding is feeding in which, in the first 5-6 months of life, the child does not receive mother's milk at all or its amount is less than 1/5 of the necessary daily ration. This type of feeding cannot be considered equivalent to natural, despite the significant achievements of modern children's dietetics, the presence of a large number of formulas for feeding infants.

Artificial feeding is recommended only in specifically defined cases:

1. When the mother has no milk at all (**agalactia**);
2. **Maternal illness:** (WHO recommendations [WHO Regional Office for Europe, 2002]):
 - active tuberculosis
 - chronic diseases in the stage of decompensation
 - malignant neoplasms and blood diseases (leukemia, aplastic anemia),
 - mental illnesses
 - severe infectious diseases (tetanus, anthrax, natural smallpox),
 - syphilis acquired in the last weeks of pregnancy or after childbirth
 - HIV infection

3. Illness of the child:

- congenital anomalies of metabolism (galactosemia, phenylketonuria, "maple syrup" disease)

For artificial feeding, formulas made mainly on the basis of cow's milk (CM) and its components (whey) or goat's milk are used.

CM is different from women's. It has a high osmolality, contains three times more protein and almost three times more minerals, it has a lot of casein, which has a toxic effect on intestinal enterocytes, and a low content of albumin and globulin. The proteins of cow's milk are foreign to the child's body, while the proteins of human milk are similar in composition to the proteins of children's blood.

Taking into account the differences in the composition and biological value of cow's and women's milk, as well as the peculiarities of the child's digestive tract, the high need for plastic material, for feeding infants, CM, like the milk of other animals, is not used in its natural form, it is prepared from it milk formulas that are similar in composition to breast milk. These mixtures are called adapted, because with the help of various industrial technologies they are adapted to the peculiarities of digestion and metabolism of infants.

The most optimal formula for artificial feeding of a child is one that "provides children with the same indicators of development, immune reactions and metabolic profile as in children on natural feeding" (conclusion of ESPGHAN - European Society for Pediatric Gastroenterology, Hepatology and Nutrition - European Society of Specialists in fields of children's gastroenterology, hepatology and nutritionology).

Classification of milk formulas

1. According to the degree of approximation to breast milk, adapted milk formulas are divided into:

- **highly adapted** - the closest to breast milk: in terms of the amount and ratio of proteins (whey proteins: casein = 60: 40); content and structure of essential fatty acids (linoleic, linolenic and their family omega-3, omega-6); carbohydrates, balanced content of vitamins, micro- and macroelements. Highly adapted mixtures also contain biologically active substances: taurine, choline, lecithin, inositol, L-carnitine, which play a very important role in a number of biological processes of the child's body, especially in the first months of life (maturation of the retina of the eye, conduction system of the heart, etc.).

Nucleotides are included in highly adapted milk formulas. Nucleotides are the building material for nucleic acids, necessary for the synthesis of DNA and RNA of cells, which regulate protein synthesis in cells and determine their activity. Nucleotides are necessary for the growth and recovery of all cells of the body, participate in the formation of antibodies, in exchange processes, ensure the ability of the body to work most efficiently.

Formulas containing nucleotides: HiPP Kombiotic, Similak premium, Frisolak with NC, Nutrilon, Enfamil premium.

- **less adapted** mixtures are called casein formulas. This name is due to the fact that in the ratio of whey proteins: casein prevails. This group of formulas meets the needs of children of the second half of the year in terms of their protein composition, content of polyunsaturated fatty acids, vitamins and minerals.

- **partially adapted** formulas are also casein-based, their composition is only partially close to the composition of breast milk, they do not contain biologically active substances (taurine, choline, L-carnitine) and do not have a full complex of polyunsaturated fatty acids.

2. According to the age of use:

- **"initial formulas" ("starters")** - for feeding children of the first six months of life. They are marked with the number "1" in the name ("Bellakt-1", "Semper Baby -1", "Hipp-1", "Frisolak-1", "Malyutka premium 1", "Nutrilon-1") or the designation of months, in which the child should be fed with this mixture ("Similak Gold 0-6"). Usually, they are highly adapted.

- **"following formulas"** - for feeding children from 5-6 months to a year. They have a higher level of total protein due to casein, carbohydrates, total energy value, and an increased level of iron. The addition of taurine and L-carnitine is not always provided. They are marked with the number "2" in the name ("Bellakt-2", "Semper Baby-2", "Hipp-2", "Frisolak-2", "Malyutka Premium-2", "Nutrilon-2" ("Nutrition" , Holland), "HiPP-2" ("HiPP", Austria), "Humana-2", ("Humana", Germany), "Enfamil-2" ("Mead Johnson", Holland/USA) or months, in which should be fed to the child with this mixture ("Nan 6-12", "Nestle", Switzerland).

- **universal** - for feeding children from 2-3 months of life to a year. Their composition is only partially close to the composition of human milk. Their name contains the numbers "0-12". These can be formulas with a predominance of casein protein ("Nestozhen 3-12", "Bellakt 0-12, Malyutka 0-12, etc.) or with a predominance of whey proteins ("Enfamil 0-12", etc.).

- **formulas for feeding children after one year** ("Bellakt-3", "Frisolak-3", "Nestle Junior-1", "Nestle Junior-2", "Nan-3", "Nutrilon-3", "Malyutka-3" ", "Hipp Kombiotic-3", "Friso-3", "Nestozhen-3", etc.).

3. Fresh (non-fermented milk) and fermented milk

Adapted fermented milk formulas are made with the help of industrial bacterial fermentation or adding acids to their composition. In terms of composition, they are close to human milk, but the protein in them is in a folded state, which contributes to its easier assimilation. These formulas are evacuated from the stomach more slowly, which increases the secretory function of the gastrointestinal tract and ensures faster digestion and absorption in the intestines. In the large intestine, these formulas show antibiotic activity against pathogenic microflora, contributing to the formation of normal intestinal biocenosis. Sour-milk formulas contribute to the secretion of pancreatic and intestinal enzymes, increase bile secretion, which facilitates the digestion process. In addition, they normalize metabolism, stimulate hematopoiesis, and have a beneficial effect on immunity.

Increasing the physiological value of artificial mixtures formulas for feeding children is associated with the addition of probiotics and (or) prebiotics.

Probiotics are administered with the aim of modifying the microflora of the child's digestive tract to normalize it and have a positive effect on the body. Probiotics are alive bacterial cultures. The strains of lactic acid bacteria and bifidum flora are mainly used.

Prebiotics are food components that, without being digested, support the most favorable microflora for the child in the digestive tract. Most often, these are dietary fibers, oligo- and polysaccharides, immunoglobulins.

Formulas enriched with pre- and probiotics:

"NAN fermented milk" and "NAN with bifidobacteria", "Semper bifidus", "Hipp Kombiotic", "Hipp Comfort", "Nutrilon fermented milk", "Nutrilon Comfort".

4. Unadapted milk mixtures are mixtures prepared from fresh or dry milk of animals that have not undergone special processing.

Cow's milk (CM) differs significantly from breast milk in its composition, which makes an adequate and complete replacement impossible. CM is, in fact, the milk of another biological species that was not intended by nature for feeding children.

High protein content in CM and features of its composition are associated with the development of obesity, high blood pressure, cardiovascular and allergic diseases. The inconsistency of the protein component of the CM can indirectly lead to:

- suppression of the function of the thymus, lymphocytes, spleen;
- hypogammaglobulinemia;
- decrease in the number of T-lymphocytes;
- reduction of interferon production;
- slowing down of chemotaxis of phagocytes, insufficiency of phagocytosis.

Feeding with such formulas is categorically not acceptable for children of the first year of life, but sometimes they are used for economic reasons in underdeveloped countries. In our country, cow's milk was most often used, which was diluted with 5% cereal broth (rice or buckwheat) before feeding.

5. Medicinal mixtures

1. For children with severe allergy history and mild forms of food intolerance - hypoallergenic: *these are partial hydrolyzates of whey proteins* (NAN NA, Frisolak NA, Humana NA, Nutrilon GA, HiPP NA combiotik).
2. For children with moderate and severe manifestations of food allergy - *deep hydrolyzates of whey proteins*: Alfare, Frisopep and *deep hydrolysates of casein*: Frisopep AC, Enfamil Nutramigen
3. For children with lactase deficiency - *low- and lactose-free* (Nutrilon lactose-free, Nutrilon comfort, NAN lactose-free)
4. With morphofunctional immaturity:
regurgitation - with carob gluten (Frisov, Nutrilon AR), rice starch (Enfamil AR).
colic - low- and lactose-free (Nutrilon lactose-free, Nutrilon comfort, NAN lactose-free), protein hydrolysates, mixtures with pre- and probiotics (Humana bifidus, Humana with prebiotics)
constipations - contain lactulose (Semper bifidus), carob gluten, fructooligosaccharides, probiotics.

MIXED FEEDING

This is a type of feeding babies when, in addition to human milk, they receive artificial milk formulas in the first 5-6 months of life.

Indications for this type of breastfeeding are insufficient amount of milk in the mother (**hypogalactia**), chronic diseases of the mother, reluctance of the mother to breastfeed, violation of the diet and rest regime, mother's departure for work, as well as social reasons.

Hypogalactia can be primary and secondary, early and late, depending on the reasons that caused it and the time of occurrence after the birth of the child.

Primary hypogalactia is observed in 4-10% of mothers. It arises as a result of various neuroendocrine disorders in a woman's body, more often hypothalamic-pituitary-ovarian regulation. These disorders are congenital or acquired as a result of women taking such hormonal drugs as progesterone and diethylstilbestrol during pregnancy and childbirth.

Secondary hypogalactia is observed more often. It develops in case of extragenital pathology, adverse living conditions, mental trauma, unsatisfactory nutrition, overwork of the mother

Early - appears in the first 10 days after birth, **late** - after 10 days.

If the child is malnourished 30-40 minutes after feeding, he is restless, the frequency of urination and defecation is less frequent, and an unstable increase in body weight is observed.

To determine the insufficiency of breast milk in the mother, it is necessary to carry out control weighing of the child before and after breastfeeding. It is advisable to conduct it three times, after that calculate the required amount of milk formula.

Algorithm for forming a child's diet on mixed and artificial feeding.

- The selection of milk formula for feeding a child is carried out taking into account age, individual characteristics, and heredity. **Preference is given to highly adapted milk formulas.** The child should receive only one formula.
- Feeding should be introduced gradually, starting with 10-15 ml, so that the child gradually adapts to a new type of food.
- Taking into account the fact that milk formulas are kept longer in the stomach, the intervals between feedings are slightly increased (compared to breastfeeding) and the number of feedings decreases. **Children's feeding regimen:** before the introduction of supplementary food - 6-7 times, after the introduction - 5 times.
- The daily need for proteins (when using adapted milk mixtures), as well as fats and carbohydrates, is the same as when breastfeeding.
- To determine the need of the child in the amount of milk formula, the same methods are used as in the case of natural feeding. It should be remembered that a child of the first year of life can receive no more than 1 liter of food per day, and the volume of one feeding cannot exceed 200 ml.
- Before feeding the child, the formula must be heated to 35-40 degrees.
- Duration of feeding should be within 10-15 minutes.
- The formula is given from the bottle through the nipple- pacifier, from which it should flow in drops. The bottle with the formula should be kept so that the neck of the bottle is always filled. If the position of the bottle is incorrect, the child swallows a lot of air during sucking, which contributes to regurgitation.
- **Corrective additives and complementary foods in mixed and artificial feeding using highly adapted milk mixtures are introduced in the same terms as in natural feeding (from 4-6 months).**
- Corrective additives (fruit juice, fruit puree, egg yolk) are not included in the total daily amount of food.

Methods:

Classic - supplementary feeding after each breastfeeding, giving the child the amount of milk formula that is established during the control weighing, expedient - up to 3 months.

Alternation - breastfeeding is alternated with feeding with milk mixture, after 3 months.

Formula's selection algorithm

Depends on a complex of factors, including:

1. Age of the child
2. Full-term or premature child
3. Socio-economic conditions of the family
4. Allergoanamnesis
5. Signs of morphofunctional immaturity
6. Individual tolerance

Errors in artificial and mixed feeding may include:

- frequent change of mixtures,
- increasing the single volume of the mixture,
- non-compliance with the rules for preparing the mixture,

- failure to take into account the individual characteristics of the child

If the mixture does not suit the child, this can be understood by the following signs:

- the baby becomes restless;
- cries after feeding;
- regurgitates;
- constipation occurs;
- redness of the skin and a rash appear.

This is a strong reason to think about changing the mixture.

Indicators of the effectiveness of artificial feeding are:

- normal physical and neuropsychological development of the child,
- skin and mucous membranes of normal color,
- satisfactory tissue turgor, muscle tone, thickness of the subcutaneous base,
- timely teething,
- normal functioning of the digestive tract.

1. Theoretical questions for the lesson:

1. What types of infant feeding do you know?
2. What are the reasons for transferring a child to mixed or artificial feeding?
3. Classification of hypogalaxia and its causes. Prevention and treatment.
4. Classification of mixtures used for mixed and artificial feeding of babies.
5. Approximate composition and rules for prescribing basic milk mixtures.
6. Adapted formulas, features of composition and use for feeding infants.
7. Nucleotides and their meaning.
8. List of the most used milk mixtures for mixed and artificial feeding.
9. What is the technique of mixed and artificial feeding?
10. What is the regime of feeding a baby with mixed and artificial feeding?
11. What is control feeding (weighing) of the child?
12. Technique of preparing milk formula.
13. Possible errors during mixed and artificial feeding.
14. What are the main ingredient requirements for mixed and artificial feeding?
15. Rules for preparing the diet of a 1-year-old child receiving mixed or artificial feeding.
16. Rules for introduction of complementary feeding and corrective supplements.

Recommended literature.

Basic:

Nelson textbook 21th Edition by Robert M. Kliegman, MD, Joseph St. Geme, Nathan J. Blum, Samair S. Shan, Robert C. Tasker, Karen M. Wilson, Richard E. Behrman Видавництво: Elsevier, 2019. P. 542-544.

Additional:

1. Fundamentals of pediatrics according to Nelson. Karen J. Marcante, Robert M. Kligman; translation of the 8th Eng. edition in 2 volumes. Scientific editors of the translation V.S. Berezenko, T.V. Rest Kyiv: VSV "Medicine", 2020.

2. Katilov O.V., Dmitriev D.V., Dmitrieva K.Yu., Makarov S.Yu. Clinical examination of a child. 2nd edition. Vinnytsia: Nova Kniga, 2019. 520 p.
3. Pediatrics: textbook. T.O. Kryuchko, O.Y. Abaturov, T.V. Kushnereva et al.ed. by T.O. Kryuchko, O.Y. Abaturov. Kyiv: AUS Medicine Publishing, 2016. 208 p. (p.39-49) ISBN 978-617-505-485-7.