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What should a (neuro) logopaedic therapist know about feeding the youngest patients (0-3) with feeding disorders. Part i. Feeding (nutrition) – meaning, types, functions

Abstract: Renata Marciniak-Firadza, *What should a (neuro) logopaedic therapist know about feeding the youngest patients (0-3) with feeding disorders. Part i. Feeding (nutrition) – meaning, types, functions*. Interdisciplinary Contexts of Special Pedagogy, No. 32, Poznań 2021. Pp. 27-50. Adam Mickiewicz University Press. ISSN 2300-391X. eISSN 2658-283X. DOI: https://doi.org/10.14746/ikps.2021.32.02

Food intake is an essential element to maintain homeostasis of the body, and the way of feeding. Whereas the type of feeding in the neonatal and infancy stages influence on one side the health of children and teenagers, and next adults, and on the other side, the way of feeding newborns, infants and toddlers has great impact on the development of the orofacial area being a biomechanical base of articulation.
Feeding is also a basic environmental factor having crucial influence on the development of a child's brain. Not providing the child with all of the necessary elements and energetic needs in the prenatal stage and on the further stages of development, especially in infancy, can have a negative effect on the brain's structural development (e.g., insufficient myelination of neurons), as well as interfere with its functions, for example, in terms of neurotransmitters.
In this article, I will undertake selected aspects of feeding disorders understood as both giving food and providing food, as well as feeding the offspring with their own milk.

Key words: feeding, nutrition, (neuro)logopaedic

Introduction

In case of the youngest patients (0-1 or 0-3) with feeding difficulties/disorders there are multi-specialist and multi-disciplinary teams to care for such children with doctors (neonatologist, paediatrist, GP, gastroenterologist), dieticians, psychologists and (neuro) logopaedic therapists. The latter, in terms of feeding disorders, is responsible for: a) assessment of anatomical conditions of the orofacial area; b) assessment of oral reflex reactions connected with food intake; c) assessment of primary activities, that is, assessment of food and drink intake as biomechanical base of articulation; d) assessment of parallel development of feeding actions (primary) and articulation (secondary activities); e) assessment of skills in terms of food intake (sucking, spoon feeding, drinking, biting); f) activation and regulation of orofacial functions (sucking, swallowing, control of salivation, chewing, mimicry, articulation); g) ceasing of incorrect patterns connected with food intake; h) learning correct motoric patterns during feeding; i) assessment of a child's readiness to undertake feeding – selection of consistency and structure of foods appropriate for the child's competencies; j) assessment of sensory processing in terms of feeding; k) differentiating feeding disorder from swallowing disorder.

The subjects of primary activities, oral reflex reactions important for the process of food intake or feeding function disorder were described in logopaedic literature[1].That is why the subject of this article

[1] (see e.g. D. Pluta-Wojciechowska, *Połykanie jako jedna z niewerbalnych czynności kompleksu ustno-twarzowego*, „Logopedia" 2009, 38, s. 123-151; D. Pluta-Wojciechowska, *Od czynności prymarnych do czynności sekundarnych*, [w:] Pluta-Wojciechowska Danuta, *Mowa dzieci z rozszczepem wargi i podniebienia*, Wydawnictwo Naukowe Uniwersytetu Pedagogicznego w Krakowie, Kraków 2011, s. 128–129; D. Pluta-Wojciechowska, *Zaburzenia czynności prymarnych i artykulacji. Podstawy postępowania logopedycznego*, Wydawnictwo Ergo-Sum. Bytom 2013; S. Masgutowa, A. Regner, *Rozwój mowy dziecka w świetle integracji sensomotorycznej*, Wydawnictwo Continuo, Wrocław 2009; A. Obrębowski, B. Wiskirska-Woźnica, Z. Obrębowska, *Zaburzenia połykania w praktyce neurologopedycznej*, [w:] Wprowadzenie do neurologopedii, red. A. Obrębowski, Wydawnictwo Termedia Wydawnictwa Medyczne i Specjalistycz-

will be based on feeding disorders of newborns, infants, and children up to the age of 3. This wide topic, rarely presented in logopaedic literature, seems to be vital for the (neuro) logopaedic practice.

In this text, I will use terms such as *feeding* and *nutrition*. According to the definitions found in the *Dictionary of the Polish language PWN,* the verb *feed* has a slightly wider scope of meaning than the verb nourish, as *feed* means: 1. 'give food or provide food'; 2. 'about a woman or a female mammal: feeding offspring with own milk', whereas nourish is 'provide food'[2].

In this article, I will undertake selected aspects of feeding disorders understood as both giving food and providing food, as well as feeding the offspring with their own milk. In parts where I will be describing the process of providing food, I will also use the term *nutrition*.

Feeding (nutrition)-meaning, types, functions

As stated by Marian Krawczyński, feeding is one of the most important environmental factors of human development, having a vital influence on human development as early as the prenatal period[3].

Food intake is an essential element to maintain homeostasis of the body, and the way of feeding. Whereas the type of feeding in the neonatal and infancy stages influence on one side the health of children and teenagers, and next adults[4], and on the other side, the way of feeding newborns, infants and toddlers has great impact on

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ne, Poznań 2013, s. 369-374; E. Stecko, *Logopedia małego dziecka*, Wydawnictwo ES, Warszawa 2013; J. Skrzek, *Diagnoza i terapia funkcji pokarmowych w obrębie okolicy orofacjalnej – połykania, gryzienia i żucia*, [w:] *Wczesna interwencja logopedyczna*, red. K. Kaczorowska-Bray, Stanisław Milewski, Harmonia, Gdańsk 2016, s. 337-355.

[2] https://sjp.pwn.pl/slowniki/ [15.04.2021].

[3] *Żywienie dzieci w zdrowiu i chorobie*, 2015, red. M. Krawczyński, wyd. II, WydawnictwoHeplMed, Kraków 2015, p.V.

[4] A. Blask-Osipa, J. Walkowiak Jarosław, *Błędy i nieprawidłowe nawyki żywieniowe*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 145.

the development of the orofacial area being a biomechanical base of articulation.

Feeding is also a basic environmental factor having crucial influence on the development of a child's brain. Not providing the child with all of the necessary elements and energetic needs in the prenatal stage and on the further stages of development, especially in infancy, can have a negative effect on the brain's structural development (e.g., insufficient myelination of neurons), as well as interfere with its functions, for example, in terms of neurotransmitters[5].

In medical, gastroenterological literature there are different types of feeding described. Based on food types the following can be distinguished: breast feeding (in other words natural feeding), mixed feeding and feeding with formula, the so-called artificial feeding, and based on the gastrointestinal tract the following are listed: oral alimentation, so called physiological (per os), enteral and parenteral.

Breast feeding, also called natural feeding, described as a golden nutrition standard in the first six months of a newborn, not only does it cover the demand for nutrients necessary for proper growth and development but also has a beneficial influence on developing feeding habits. Infants fed naturally learn more flavors which has a positive impact on the acceptance of specific produce in their later lives[6]. This type of nutrition, being the only physiological way of feeding infants, is currently considered to be the only correct way of nourishing infants, providing them with optimal health and development conditions[7]. It needs to be emphasized that natural feeding is vital for the physical development of the child (the components

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[5] M. Krawczyński, *Choroby ośrodkowego układu nerwowego*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p 287.

[6] JA Mennella, GK Beauchamp, *Flavor experiences during formula feeding are related to preferences during childhood*, "Early Human Development" 2002, 68, p.71-82; CA Forestell, JA Mennella, *Early determinants of fruit and vegetable acceptance*, "Pediatrics" 2007, 120, p.1247-1254.

[7] I. Ignyś, W. Cichy, *Karmienie sztuczne niemowląt*, (w:) *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. Marian Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 92.

of the mother's milk are adjusted to the individual needs of a child), it supports the child's immune system (mother's milk aids the immune system functions), and apart from that, it has an impact on the correct emotional (close contact with the mother) and intellectual (child stimulation) development. Breast feeding is also the best training for the articulation apparatus[8].

Hanna Szajewska lists the following benefits for the child resulting from natural feeding: 1. smaller occurrence or milder course of: a) respiratory system infection; b) gastroenteritis; c) acute otitis media; d) bacterial meningitis; e) sepsis; f) urinary tract infection; g) necrotizing enterocolitis; 2. probably smaller risk of (inconclusive data from literature): a) infant sudden death syndrome; b) type 1 diabetes; c) type 2 diabetes; d) lymphoma, leukemia, non-Hodgkin lymphoma; e) overweight and obesity; f) hypercholesterolaemia; g) allergies[9].

For the natural feeding to be effective, the child needs to cover with its mouth the whole nipple with the areola. If during feeding the tips of the child's ears twitch gently, that means the breast is caught correctly and sucking is effective[10].

During breastfeeding all facial muscles are activated because:

a) the child, covering the nipple with its lips, exercises the risorius muscle thanks to which the lips prepare for pronunciation of such rounded vowels as [o], [u] and labial consonants [p], [p'], [b], [b'], [m], [m'];
b) the tongue pressures the nipple against the palate and tilts the tip up. This is the beginning of tongue elevation necessary for articulation of dental sounds [t], [d], [n], dento-alveolar

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[8] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

[9] H. Szajewska, *Karmienie piersią*, [w:] *Żywienie dzieci zdrowych i chorych*, red. H. Szajewska, Wydawnictwo Warszawskiego Uniwersytetu Medycznego, Warszawa 2009, p. 12.

[10] H. Szajewska, *Karmienie piersią*, [w:] *Żywienie dzieci zdrowych i chorych*, red. H. Szajewska, Wydawnictwo Warszawskiego Uniwersytetu Medycznego, Warszawa 2009, p. 8.

sounds [t′], [d′], alveolar sounds [š], [ž], [č], [ǯ], [l], [r] and postalveolar sounds [š′], [ž′], [č′], [ǯ′], [l′], [r′];

c) thejaw moves up and rhythmically moves forward which develops a correct bite. Adding to this, the child perfects chewing skills necessary for eating solid foods, and then while talking;

d) the child breathes only through the nose, does not stop sucking in order totake a breath which affects the correct shaping of breathing needed for proper speech. Thanks to this the child has higher chances to speak clearly and with a good pace[11].

If both the child and the mother are healthy, there are practically no objections tobreastfeeding. Such objections are, on the mother's side, for example, untreated infectious tuberculosis, HSV 1 infection, taking some medications, severe mental illness, drug addiction. Objections on the child's side are divided into: a) so called physical inability to ingest food (by which I understand anatomical disfunctions such as a cleft lip and palate, a serious health condition of the child, heart defects, prematurity); b) metabolic inability (galactosemia, congenital lactose deficiency)[12].

When it comes to a cleft lip and palate where there are no physical conditions for effective sucking, breastfeeding should be ceased, and expressed or pumped milk should be given indirectly. Such food does not irritate the mucous membrane and gives a chance for proper speech development, avoids overbite and acute otitis media. In terms of clefts, a half vertical or vertical position is being used, as well as special nipple plates or help using a finger to cover the leak[13].

Problems with natural nutrition can also be present among children with Down Syndrome. Obstacles such as tiredness connected

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[11] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

[12] I. Ignyś, 2015, *Karmienie naturalne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p 81, 83.

[13] I. Ignyś, 2015, *Karmienie naturalne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p 81.

with heart defects, big tongue (macroglossia) and flaccid upper respiratory system making the feeding difficult can be overcome by increasing frequency of feeding. Present food allergies can be eased by eliminating exogenous proteins from the mother's diet[14].

The role of (neuro)logopaedic therapists in such cases can be, apart from those listed in the beginning, focusing the attention on: a) peaceful atmosphere during feeding; b) feeding technique. (Neuro) logopaedic therapists can also suggest a visit in a lactation or gastroenterological clinic.

Mixed nutrition is feeding additionally with formula in cases when natural feeding is not sufficient or despite trying to breastfeed on demand the child still shows signs of hunger such as: a) screaming after feeding; b) sucking fingers: c) waking up often; d) lack of weight gain.

Feeding with formula, so-called artificial nutrition is introduced when, for some reasons (listed as examples with natural feeding), breastfeeding is not possible both on the mother's and the child's side.

It is important to successively eliminate bottle feeding together with introducing other, more mature forms of food intake.

During mixed nutrition, as well as artificial nutrition, it is important to choose proper feeding accessories, in this case a bottle and a nipple. The bottle should have a wide nipple base because with a bigger diameter the lips lay strongly on the bottle collar and the tongue must grip the nipple correctly to suck. This way both the tongue and the lips are stimulated to cooperate which leads to proper training of oral cavity motor skills. The nipple at the same time should be dynamic, that means such that it allows the food to flow only when the child wants it. Its anatomical shape and material which the nipple is made from are important. As Ewa Kaptur and Jolanta Sławek write:

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[14] I. Ignyś, 2015, *Karmienie naturalne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p 83-84.

The perfect nipple should be similar in shape to the breast nipple. It is important that the sizes of holes were adjusted to the age of the child and type of food given. It is best when the nipple is short, made of silicone and the hole in it is small enough for the child to put some effort into sucking. Thanks to this exercise it trains the lip, palate, and jaw muscles in a similar way to breast sucking[15].

In case of using the wrong nipple for the bottle during feeding the work of mostly tongue and lips is being disrupted, as well as sucking, swallowing, and breathing – see table 1.

Table 1. Differences between artificial and natural feeding from a logopaedic perspective (designed based on D. Pluta-Wojciechowska, *Zaburzenia czynności prymarnych i artykulacji. Podstawy postępowania logopedycznego*, Wydawnictwo Ergo-Sum. Bytom 2013; E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, s. 37-41).

	Artificial feeding	**Natural feeding**
Tongue	Lays flat in the oral cavity and is pressed by the nipple	Is raised towards the palate and is tensed
Lips	Are apart, the nipple is held by the gums	Are closed and tightly wrapped around the breast
Sucking	Food is being squeezed out from the nipple with vertical jaw movements, the child lowers the jaw and intakes the food, raising it – blocks the nipple, there is no typical food suction	Sucking-chewing movements, jaw is moved up, and also works towards the front and moves back, additionally there is evening out of retrusive occlusion
Swallowing	The child often does not keep up with swallowing the food that abundantly flows through the nipple, that is why the excessive food is spat out; there is possibility of choking	The child sucks as much food as it is able to swallow; swallowing directed towards the palate has a beneficial effect on the development of the palate and jaws which visibly prevents teeth and jaw anomalies
Breathing	Breathing through the mouth, the child stops eating to get some air; it fosters later breathing through the mouth	Breathing through the nose, possible even during sucking

[15] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

An important issue when feeding infants is the problem of reflux of the stomach content.

It needs to be remembered that the reflux, so called posseting, in a small baby is a natural occurrence that subsides on its own at about 6-8 months of age.

It is not a result of some disorderbut is a consequence of some immaturity of the digestive system. The lower oesophageal sphincter is not yet efficient enough to fully stop the reflux of stomach content.

The pH level of the oesophagus oscillates around 5-6, and the pH of the stomach is 1-2. If the acidic content of the stomach is out completely, then it is not a major problem for the child. If, however, the content just slightly moves back, then it will remain in the oesophagus and irritate the mucous membrane, as well as cause burning and pain.

Protective reaction to the irritation caused by the reflux of acidic stomach content can be: a) hyper muscle tension manifested by, for example, the child flexing; b) tightening fists; c) high positioning of the shoulders in order to avoid/eliminate pain while flexing the stomach; d) stiffening lower limbs and unwillingness to raise them above the ground; e) sensation of constant flexing; f) annoyance.

Symptoms that need to be paid attention to are: a) visible chewing of something even though the child is not being fed at the moment; b) chokingon food content (even at night) even though the child was fed earlier; c) frequent cough despite no infection present; d) burping even up to a few hours after feeding; e) visible swallowing; f) reluctance towards some activities, for example, laying on the tummy or playing with feet (these activities can increase unpleasant symptoms); g) lack of appetite, difficulties with feeding or quite the opposite, too big an appetite to ease the ailments; h) annoyance, nervousness, however, the child calms down when picked up or in any higher position; i) difficulties sleeping.

For the reflux to occur or to increase the following can contribute: a) too fast and too rapid food intake; b) 'swallowing' air during feeding; c) meal too big; d) feeding additionally with formula; e) laying down too quickly after feeding.

According to subject literature, the following are the ways to prevent or minimize reflux: a) carrying the child in a vertical position for about 30 minutes after feeding and next laying the child down on the left side or on the tummy (but not for sleep!); b) laying the child down for sleep on the back and on a hard, flat base; c) allowing the child to burp not only after the feeding but also during; d) for a child with reflux not using equipment which makes the child's head press towards the chest, for example, a car seat. The bent legs in the car seat increase the pressure in the abdominal cavity.

On the other hand, literature devoted to the subject of feeding cites research that suggests laying the child down on the right side may help to empty the stomach, thus the following course of action should be: feeding, holding the child vertically for 30 minutes and next for 30-40 minutes on its right side, turning to the left side, sleep on the back, flat.

Based on the feeding tract we can distinguish the following types of nutrition – traditional, oral (per os) and enteral and parenteral. The latter two concern so-called nutritive treatment.

The term *nutritive treatment* refers to the supply of nutritional ingredients (energy, proteins, electrolytes, microelements, and vitamins) in I.V. fluids or clinical diets, in native form (natural food) or artificially produced (clinical diets) to those ill who cannot be fed orally, physiologically due to the character of their initial illness or secondary malnutrition resulting from the illness. Indications for nutritive treatment are: a) weight loss over 10% with the co-existing ailment preventing the compensation of deficiencies; b) no possibility for oral feeding for longer than 3-5 days; c) raised demand for nutritive ingredients that cannot be fulfilled orally[16].

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[16] P. Dziechciarz, A. Horvath, *Leczenie żywieniowe – enteralne i pozajelitowe*, (w:) *Żywienie dzieci zdrowych i chorych*, red. Hanna Szajewska, Wydawnictwo Warszawskiego Uniwersytetu Medycznego, Warszawa 2009, p. 225; I. Ignyś, T. Demitrescu, *Żywienie enteralne i parenteralne*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 23.

The choice of nutrition and type of diet depend on the functional condition of the oesophagus and the connected basic functions.

Enteral nutrition refers to food intake through the gastrointestinal tract which is using liquid clinical diets. This method is preferred more as it is more physiological, safer and has fewer accompanying side effects[17].

If the planned enteral nutrition is less than 2 months, then it can be done with the usage of a special probe placed in the stomach or duodenum. In case the enteral nutrition is to last more than 2 months it is recommended to use percutaneous endoscopic gastrostomy (PEG) or jejunostomy (PEJ)[18].

The following, among others, are indications for enteral nutrition: a) swallowing and choking disorders (neurological diseases, cerebral palsy, children after head injuries, hypoxic ischemic encephalopathy, prematurity); b) facial bones defects; c) cancer (brain tumor); d) polytrauma and craniocerebral trauma; e) metabolic disease (cystic fibrosis)[19]. However, for PEG, the criteria are: a) oncological disease – laryngological (nasal, throat, and larynx cancers) upper digestive tract disease; b) neurological diseases – dysphagia (craniocerebral traumas, brain tumors, Amyotrophic lateral sclerosis ASL, cerebral palsy[20].

Parenteral nutrition is intravenous administration of nutrients used when gastrointestinal nutrition is not possible or insufficient, that is, it does not completely satisfy the demand for nutrients. Par-

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[17] I. Ignyś, T. Demitrescu, *Żywienie enteralne i parenteralne*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 23.

[18] P. Dziechciarz, A. Horvath, *Leczenie żywieniowe – enteralne i pozajelitowe*, (w:) *Żywienie dzieci zdrowych i chorych*, red. Hanna Szajewska, Wydawnictwo Warszawskiego Uniwersytetu Medycznego, Warszawa 2009, p. 226.

[19] I. Ignyś, T. Demitrescu, *Żywienie enteralne i parenteralne*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 24.

[20] I. Ignyś, T. Demitrescu, *Żywienie enteralne i parenteralne*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 26.

enteral nutrition products are administered directly to the blood through peripheral or central veins[21].

When it comes to oral feeding, after natural, mixed, or artificial it is time to introduce to the child's diet supplementary, solid foods. The position of the AHA (American Heart Association) supported by the American Academy of Pediatrics suggests that newborns and infants should be breastfed solely through the first 6 months and continue after introduction of supplementary products up to the 12th month of the child's life. The World Health Organisation recommends the child to be fed only with the mother's milk till the 6th month. Next, it is advised to introduce supplementary foods with the continuation of feeding with the mother's milk[22]. According to ESPGHAN's and EFA's recommendations, supplementary products should be introduced before the child finishes the 17th week, but no later than the 26th week of life. It is necessary due to the rising energy demand and the preparation of the child to a more diverse diet in later life. Introduction of solid foods into the infant's diet takes several months[23].

During this period almost all infants achieve such performance and maturity of digestive mechanisms and absorption of nutrients that allows the introduction of new foods. This is also the time when, with most infants, the skill of accepting solid foods is developed. Children can sit with support, they also reach nerve and muscle maturity allowing them to control their head and neck movements, as well as eating from a spoon. This is also the time when the instinct to remove foreign objects (typical for newborns and infants) from the

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[21] I. Ignyś, T. Demitrescu, *Żywienie enteralne i parenteralne*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 30.

[22] I. Ignyś, W. Cichy, *Karmienie sztuczne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 92.

[23] I. Ignyś, W. Cichy, *Karmienie sztuczne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 92.

mouth subsides as it makes it difficult to feed with other foods than liquids[24].

An optimal indicator of time to introduce solid foods can be symptoms presented by the youngest: a) when breastfed the infant demands feeding 8-10 times a day; b) despite regular feeding the infant seems to be hungry; c) an infant fed artificially drinks about 1 liter of formula; d) the monthly weight increase does not exceed 400g.[25].

It also needs to be remembered that the digestive tract must achieve the level of maturity essential for solid food intake. It refers to teething, the ability to grind and swallow solid foods[26].

From a medical point of view, it is advised to: a) introduce new products gradually and separately observing the child's reaction and starting from small amounts, for example, 3-4 spoons; b) not introducing several new products at the same time; c) the order of introducing new products is definitely less important, however, literature suggests starting to expand the diet with vegetables[27]. After about 2 weeks from introducing vegetables, we give fruit to the child[28].

One of the suggestions for the order of introducing solid products in the nutrition of infants is shown in table 2.

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[24] H. Szajewska,*Wprowadzanie pokarmów uzupełniających*, (w:) *Żywienie dzieci zdrowych i chorych*, red. Hanna Szajewska, Wydawnictwo Warszawskiego Uniwersytetu Medycznego, Warszawa 2009, p. 31.

[25] A. Stolarczyk, *Karmienie sztuczne*, [w:] *Żywienie dzieci zdrowych i chorych*, red. J. Socha, Wydawnictwo Lekarskie PZWL, Warszawa 1998.

[26] I. Ignyś, W. Cichy, *Karmienie sztuczne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 93.

[27] H. Szajewska,*Wprowadzanie pokarmów uzupełniających*, (w:) *Żywienie dzieci zdrowych i chorych*, red. Hanna Szajewska, Wydawnictwo Warszawskiego Uniwersytetu Medycznego, Warszawa 2009, p. 31.

[28] I. Ignyś, W. Cichy, *Karmienie sztuczne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 92.

Table 2. Order of introducing solid products in infant's nutrition (designed based on *Poradnik żywienia niemowląt. Krok po kroku od narodzin do pierwszych urodzin*, red. J. Mrukowicz, wyd. Medycyna Praktyczna, Kraków 2014; *Żywienie niemowląt i małych dzieci. Zasady postępowania w żywieniu zbiorowym*, red. H. Weker, M. Barańska, Wyd. Instytut Matki i Dziecka, Warszawa 2014).

Month of life	Solid products
4 m.	– gluten free wheat (rice and corn) – fruit and vegetable juices (carrot, apples, currants, apricots, raspberries, berries, gooseberries, grapes)
5 m.	– fruit purees, vegetable mush – vegetable soup cooked on vegetable stock (potato, carrot, parsley, cauliflower, beet root, pumpkin, kohlrabi, leek, celery, onion)
6 m.	– meat (10g) – initially white (chicken, turkey, rabbit), next all types of lean and high-quality meat
5-6 m.	– wheat products containing gluten
7 m.	– egg yolk
8 m.	– meat stocks (vegetable soup cooked using chicken broth)
11 m.	– cottage cheese
After finishing 12 m.	– highly allergic products (citruses, wild strawberries, strawberries, egg whites, fish)

Together with a new stage of nutrition, that is,the solid foods stage in a child's diet, there is a new way of delivering the meal – spoon feeding. The spoon must be round, flat, small because it should fit on the tongue's mass, hard – non-silicone, and should have rounded edges.

Spoon feeding should be started with small portions (2-3) spoons. It enables proper development of swallowing skills, biting, tongue's work and, indirectly, it also influences the skill of speech, development of the upper respiratory tract and proper breathing. The infant should be made used to spoon feeding before teething occurs as painful gums can be a reason for failure at this stage[29].

[29] A. Stolarczyk, *Karmienie sztuczne*, [w:] *Żywienie dzieci zdrowych i chorych*, red. J. Socha, Wydawnictwo Lekarskie PZWL, Warszawa 1998; H. Szajewska, P. Socha,

During spoon feeding:

a) the child opens the lips and lowers the jaw, next after putting in the spoon horizontally to the mouth cavity and placing it in the middle of the tongue, closing the mouth, food is gathered with the lips (work of the upper lip is extremely essential), the food is being moved towards the back of the oral cavity – thanks to these activities the child perfects the work of the risorius muscle needed for pronunciation of labial sounds [p], [p'], [b], [b'], [m], [m'], labio-dental [f], [f'], [v], [v'], rounded vowels [o], [u] and practices tongue-tip elevation;
b) the child coordinates eating with breathing out (through the mouth – introducing the food to the oral cavity) and breathing in (through the nose – preparing the food for swallowing and gulping) at the same time preparing for correct speaking, with the correct pace[30];
c) if the child does not remove the food gently, pressure the middle of the tongue with the spoon which will result in closing the lips;
d) never wipe the spoon against the upper lip to remove the food!

As highlighted by Kaptur and Sławek, not using the spoon when feeding can result in problems with articulating most of the sounds in the future[31], as proper work of the lips (especially the upper lip), their closing and rounding, as well as work of the cheek muscles and the tongue in the oral cavity connected with transferring food have essential influence on both the level of muscle tension of articulation organs and their functions[32].

A. Horvath et al, *Zasady żywienia zdrowych niemowląt. Zalecenia Polskiego Towarzystwa Gastroenterologii, Hepatologii i Żywienia Dzieci*. „Standardy Medyczne. Pediatria" 2014, 11 (3), p. 321-338.

[30] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

[31] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

[32] D. Pluta-Wojciechowska, *Zaburzenia czynności prymarnych i artykulacji. Podstawy postępowania logopedycznego*, Wydawnictwo Ergo-Sum. Bytom 2013, p. 69-70.

When introducing solid foods, it needs to be remembered that it should have proper consistency, as well as its grinding and proper position while feeding. A child knowing only liquid foods up till now starts learning new consistencies, acquires the skill to move the food from the front to the back of the tongue to swallow it.

It often happens that the parents: a) give the child food that does not require any activity from the articulatory organs, especially the risorius muscle; b) introduce later products with lumpy consistency; c) are afraid to spoon feed because they see the child chokes easily, does not manage well with biting and chewing[33]. However, the child's meals should not be in the form of a mush (see the jar with children's meals) because mushy food reinforces infantile swallowing.

Until the moment the infant masters the skill of swallowing without choking, meals with the consistency of a mush should be given. Next, we move on to mush with lumps, pieces of different products. For example, crumbled crackers, bread sticks, small pieces of raisins, dried wheats, rice, corn, cheerios can be added to a yoghurt or a mushy dessert. A more liquid base with things of different structure such as soup with noodles can be introduced. The level of food crumbling depends on the child's age: when teething starts products requiring biting and chewing should be given (initially meals containing a small quantity of little, palpable, soft bits, next meals smashed with a fork, cut into small pieces)[34].

Proper feeding position provides not only safety (prevents, e.g., choking) but also helps to sustain proper muscle tension responsible for chewing, sucking, and swallowing. A sitting position requires support of key body parts – in such a way that all muscles involved in vocalization, muscle tension of the mouth and facial region, tem-

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[33] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

[34] I. Ignyś, W. Cichy, *Karmienie sztuczne niemowląt*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 93.

poromandibular joints and respiratory muscles can function properly[35].

The body position for feeding is: straight back, head aligned with the torso, chin slightly moved back, legs leaning against a base. The child should sit with hip, knee, and ankle joints at a 90° angle. Children should not tilt to the sides, thus, until being able to sit firmly they should be secured on the sides with blankets, pillows, etcetera. Proper positioning of the head affects the work of temporomandibular joints which are responsible for closing the mouth, chewing, sucking, and swallowing[36]. Incorrect positioning of the head causes the omohyoid and tongue muscles to block, and in return all this affects proper breathing through the nose, ectypal sucking disorder, physiological swallowing, biting, and chewing[37]. A child with the head tilted back will open the mouth easier, however, it will close it with more difficulties. Neck tension will be felt in such a position. This tension will transfer also to the tongue, making its movement upwards difficult. Swallowing will then be difficult and not effective. The child will swallow better (better tongue and lip work) when we gently hold the child's chin towards the front. It will prevent pushing the food out with the tongue.

The feet should be placed against the ground. That is why we should choose a feeding chair with the possibility to adjust the feet support or we place a rolled blanket, block etcetera underneath the child's feet. Following the authors of an article dedicated to proper body posture during logopaedic exercises:

> Proper support and feet positioning during, feeding, eating, drinking, and performing other activities in a sitting or half lying position should alert logopaedic therapists. This is the area where the speech chain starts that runs through the front part of the abdomen, partially through the

[35] J. Sadowska, G. Dragun, A. Gutowska, R. Szczepaniak, *Znaczenie prawidłowej postawy ciała podczas ćwiczeń logopedycznych*, „Forum Logopedyczne" 2016, 24, p. 66.

[36] J. Sadowska, G. Dragun, A. Gutowska, R. Szczepaniak, *Znaczenie prawidłowej postawy ciała podczas ćwiczeń logopedycznych*, „Forum Logopedyczne" 2016, 24, p. 61.

[37] J. Sadowska, G. Dragun, A. Gutowska, R. Szczepaniak, *Znaczenie prawidłowej postawy ciała podczas ćwiczeń logopedycznych*, „Forum Logopedyczne" 2016, 24, p. 67.

> diaphragm, part of the intercostal muscles, the front part of the neck, larynx, risorius muscle and finishes at the tip of the tongue. This chain runs also through the hand to the thumb. Thus, if we wish to modify the positioning of the tongue, we can start with working with the big toe which is a part of the muscular speech chain. Its proper stimulation can help with elevating the tongue and regulating its tension[38].

And then following:

> Proper functioning of the muscle chains in correct body positions affects optimal work of the orofacial muscles which results in: isolated and properly functioning cranial nerves, proper feeling and positioning of the tongue, closed mouth and habit of breathing through the nose, correct functioning of senses of taste and smell, and correct bite. For the primary functions to develop correctly, the child should have a correct body position during breastfeeding, eating, and drinking in a sitting position[39].

Correct jaw position can be worked out by helping when the child is, for example, putting objects into the mouth, licking fingers, toys, etcetera (which is typical in a child's development). Help is based on directing the toy (object) and moving it first horizontally and next vertically.

An optimal feeding position should be ensured especially with people with dysphagia (post-stroke, as a result of neurodegenerative illnesses, cerebral palsy), laryngectomized people, with muscle tension disorder, stuttering, vocal disorders (after overloading the vocal cords as a result of occupational diseases, people with mental illnesses, neurosis, etc.)[40].

Feeding position also affects the way a child eats. If we stand above the child, the head and chin are positioned incorrectly. The

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[38] J. Sadowska, G. Dragun, A. Gutowska, R. Szczepaniak, *Znaczenie prawidłowej postawy ciała podczas ćwiczeń logopedycznych*, „Forum Logopedyczne" 2016, 24, p. 66.

[39] J. Sadowska, G. Dragun, A. Gutowska, R. Szczepaniak, *Znaczenie prawidłowej postawy ciała podczas ćwiczeń logopedycznych*, „Forum Logopedyczne" 2016, 24, p. 67.

[40] J. Sadowska, G. Dragun, A. Gutowska, R. Szczepaniak, *Znaczenie prawidłowej postawy ciała podczas ćwiczeń logopedycznych*, „Forum Logopedyczne" 2016, 24, p. 67-68.

child should also not be fed from behind. Sitting on the side of the child or in front of the face depending on the situation and movement capabilities is also accepted.

Apart from spoon feeding, the nutritional scheme suggests drinking from an open cup (about the 8th month) and next learning to eat independently.

Proper spoon feeding prepares the child for learning how to drink from an open cup. While drinking, the child's tongue is positioned in the same way when spoon feeding (lowered medi dorsum). Learning how to drink should be started when the child knows how to eat from the spoon, sits in a stable way, and controls their head. Practicing drinking from a cup should be started from drinking dense liquids, for example,jell-o, buttermilk, thickened juice, tomato puree, thickened milk, etcetera. From the 6th-9th to 12th month of life a child should drink from a cup held by an adult. From the 12th to 16ththe child should hold it independently, but could still spill, and from the 20th month should drink on its own.

While drinking from an open cup:

a) the child learns the difficult skill of specific movement sequences connected with closing the lips, taking in the liquid, moving it around and swallowing (when drinking from an open cup after each sip there is swallowing unlike when sucking the breast);
b) when getting the liquid from the brim of the cup the child perfects the work of the risorius muscle[41];
c) the rhythm of activities: breathing in through the nose – opening the mouth, positioning the cup on the lower lip (not on the teeth), tilting the cup, getting the liquid by bilabial closure, swallowing – breathingout;
d) the initial strategy is 'sip after sip', but we are aiming at drinking without a break, in a sequential way, that is breathe in – few sips – breathe out.

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[41] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

When talking about drinking from an open cup we exclude the usage of so-called non-drip cups. Drinking from such cups slows down development of the upright reflex of the apex because a 'foreign object' in the oral cavity results in its flattening. When a raised tongue meets an obstacle, it is forced to move to the front and remain in a flat position in the bottom of the oral cavity[42].

When the child does not want to drink from an open cup, Kaptur and Sławek suggest temporally using,and as a mid-stage, a so-called 360° cup (the drink does not spill out and the soft, silicone edges stimulate the lips to work while drinking), profiled cups (with an appropriately exposed edge allowing the child to hold it with the lips), or drinking bottles with straws which enhance and activate specific muscles of the orofacial area (especially the lips and cheeks), stimulating it for active work[43].

After a child mastersdrinking from an open cup we can introduce a straw. However, it should be observed if while drinking it is not placed between the teeth.

In the calendar of food functions of a small child we also have:

a) biting off, which is parting a piece of food – the stage when the upper and lower incisors appear;
b) biting, the so-called sequence of movements, lateral tongue movements to transfer food, mix it with saliva and formation of food bolus – the stage when premolars are appearing;
c) chewing, which is smashing, grinding of hard food using force, bringing the jaw back and forth; we chew what we are unable to bite – the stage when molars appear (up to the 18th month).

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[42] B. Mackiewicz, *Znaczenie pionizacji końca języka dla poprawnej artykulacji głosek*, [w:] *Opieka logopedyczna od poczęcia*, red. B. Rocławski, Glottispol, Gdańsk 1993, p. 74.

[43] E. Kaptur, J. Sławek, *Od karmienia do mówienia. Wpływ funkcji prymarnych na rozwój mowy*, „Forum Logopedy" 2017, 22, p. 37-41.

As training we bite cubes/belts, fruit/vegetables given in a gauze. There are different opinions as to where products for biting should be given: some neurologopaedic therapists believe that they should be placed on the molar teeth, and some underline that the child should train biting in different places of the oral cavity (compare Aleksandra Łada and Marta Szmaj).

Training of biting should be done in several stages. In the 1st stage we give the child corn puffs, crispbread like *Vasa,* matzah, crackers. The 2nd stage is the fruit and vegetables stage: we serve the child juicy, soft fruit, boiled vegetables. In the 3rd stage it can be bread cut into pieces, bread crust, and in the 4th stage – layered sandwiches (bread + slices). Last, the 5th stage, for biting training, we introduce dried fruit and hard, dried sausage which requires chewing.

A vital role in the process of feeding is polysensoric stimulation, which is visual stimulation (introduction of foods and accessories for eating that are visually attractive for the child), flavor (introducing products not only of different flavors but also stimulation of the sense of taste (also smell) with different herbs, spices, etc.), thermal (stimulation with foods of different temperatures) or auditory (encouraging the child to chew foods that make a noise, using accessories for eating that make a noise).

Conclusion

Proper child nutrition is not only satisfying hunger but also providing an appropriate amount of energy and growth components while proper feeding is adjusting its type to the needs and capabilities of the child.

Based on food types the following can be distinguished: breastfeeding (in other words natural feeding), mixed feeding, and feeding with formula, the so-called artificial feeding, and based on the gastrointestinal tract the following are listed: oral alimentation, so-called physiological (per os), enteral and parenteral.

In the process of feeding the child it is important to avoid basic mistakes.

In the neonatal period the basic mistake is not putting the baby to the breast and isolating the mother, giving extra food and/or giving not only tea, but what is worse, water with sugar[44].

In the infant stage the most common errors can result from wrong feeding technique, too rare or too often breastfeeding, non-effective feeding, too short or too long time of feeding[45]. Other mistakes are a) introduction of solid foods too late in life; b) smashing the products too much; c) irregular times of eating, meals not liked by the child, not given neatly, re-heated; d) nervous atmosphere during meals, distracting the child, not enough time, impatience.

Other feeding mistakes can result from putting the child away from the breast too late due to the child declining to eat other foods, which can result in a reluctance to eat products requiring chewing. Another mistake is introducingproducts other than milk too early. It is also stressed that a lying position during feeding can attribute to hidden otitis media among infants, which can lead to temporary hearing loss[46].

When feeding the child, it needs to be remembered that: a) if possible, breastfeed the newborn and the infant; b) introduce to the child's diet solid foods in the right moment; c) adjust the type and consistency of the food to the age and abilities of the child; d) introduce drinking from the cup and spoon feeding in the right moment.

Proper feeding and avoiding nutritional mistakes will be very beneficial for the child, especially for the development of the orofacial area which is a biomechanical base of articulation.

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[44] A. Blask-Osipa, J. Walkowiak Jarosław, *Błędy i nieprawidłowe nawyki żywieniowe*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 145.

[45] A. Blask-Osipa, J. Walkowiak Jarosław, *Błędy i nieprawidłowe nawyki żywieniowe*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 145.

[46] A. Blask-Osipa, J. Walkowiak Jarosław, *Błędy i nieprawidłowe nawyki żywieniowe*, [w:] *Żywienie dzieci w zdrowiu i chorobie*, wyd. II, red. M. Krawczyński, Wydawnictwo HeplMed, Kraków 2015, p. 145.

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