

STUDY REPORT

COMPREHENSIVE EVALUATION OF FEEDING
PRACTICES IN CHILDREN AGED 5 TO 36
MONTHS - POLISH NATIONWIDE STUDY 2016

PITNUTS 2016





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I. Introduction

Scientific research on the relationship between the nutritional factor and the nutritional status indicate that the optimal psychomotor development of the child is significantly dependant on such nutrient supply achieved with the adequate feeding practice, which complies with its individual requirement. Therefore, the profile of children's diet requires quantitative and qualitative composition of macro- and micronutrients to be adequate.

Both short- and longterm observations concerning the relationships between the nutritional status and the feeding practice revealed that the pregnancy period as well as the first two years of child's life (first 1000 days of life) play a key role in its normal development and may be responsible for the risk of obtaining diet-related diseases in adult life.

The first Polish study aiming at comprehensive evaluation of feeding practices in children aged 13–36 months on representative group of 400 children was performed in 2011. The study was held as a research project financed by Nutricia Foundation. The obtained results made it possible to check whether the nutrition of small children in Poland correlate with the models of safe nutrition, i.e. recommendations, principles and medical nutritional standards. The obtained data revealed that the body mass index (z-score BMI) was abnormal in 54.4% of the examined children, the diet of 80% of children contained excessive amount of sugar, while calcium and vitamin D deficiencies were observed, and that 90% of children consumed excessive amounts of salt (from different sources) when compared with the recommendations. Small children in Poland did not consume the recommended amount of vegetables (200 g) and dairy products.

In 2012, the Children's Memorial Health Institute carried out a study entitled: "The evaluation of diets and nutritional status of children aged 6 and 12 months in Polish population". The study was supported by Nutricia Foundation, SKG/KRC Millward Brown and Lux Med. The aim of this study was to evaluate the feeding practice and nutritional status of infants aged 6 and 12 months and to establish relationship between these two factors. The study population consisted of the representative randomly selected sample.

The results of these studies led to extensive educational action aiming at promoting verified models of safe nutrition, including breastfeeding and correct weaning of small children.

In 2016, the population study addressing the issue of feeding practices in the youngest children was performed again. It was a part of the project entitled: „The comprehensive

assessment of feeding practices and nutritional status of children aged 5 to 36 months - a nation-wide polish study 2016”.

The scientific analyses of the results reveal that promotion of breastfeeding, effective nutritional education of parents on weaning and balancing their childrens’ diets is still required.

The report presents the results of the research concerning the nutritional status of children aged 5 to 36 months and respective feeding practices in Poland, as well as possible modifications of current nutritional recommendations for infants and small children.

II. Theoretical background*

1. Models of child nutrition

The results of the studies performed in many significant centres worldwide clearly emphasise the impact of genetic and environmental factors, including nutritional, on the development of child and its potential health, including in the adult life.

Normal fetal development determined by adequate nutrition of the pregnant women, together with adequate feeding of the child after birth and during first years of life is one of the most important factors determining its optimal development, both somatic and mental.

Both excessive body mass gains, as well as body mass deficiencies may be associated with the risk of obesity in adulthood, as well as various diet-related diseases. There are studies, which confirm the existence of a relationship between low birth weight resulting from the intrauterine growth restriction and the occurrence of circulatory disorders in adulthood, type 2 diabetes mellitus, osteoporosis and some neoplasms.

It was also noted that it is possible to influence the fetal metabolism in the early phase of ontogenetic development by adequate nutrition, the process is called nutritional programming. Breastfeeding is one of the factors associated with this process. Many studies indicate that feeding an infant with other food than breast milk, especially in the first 6 months, increases the risk of obesity, allergies, circulatory disorders and problems associated with cognitive development.

Adequate nutrition not only delivers energy that meets child's requirement, but every single nutrient as well. The requirement for energy and nutrients depends mainly on the body size and composition, growth rate and physical activity and is different in every developmental stage.

Researchers emphasise that excessive consumption of energy, protein and fat, especially fat rich in saturated fatty acids, promotes abnormal distribution of serum lipoproteins, increased cholesterol concentration, which accompanied by excessive energy supply and lack of physical activity - poses a risk of developing disease characteristic for the adult age (ischemic heart disease), but earlier may become a risk factor for obesity. Similar risk for the occurrence of osteoporosis is observed for calcium-deficient diets. It is also important to prevent such results of inadequate nutrition in children as iron-deficiency anaemia, which may exert a detrimental effect on mental and somatic development.

*The references for this section are listed at the end of the section.

Several periods during the developmental age are most commonly referred to as being critical for the development of overweight and obesity. They are prenatal period, early childhood (0-3 years of age), adiposity rebound (approx. 6 years old) and puberty. It is therefore very important to make sure that the diet of children and adolescents complies with the recommendations referred to as nutritional models.

The term model of safe nutrition of children and adolescents refers to the system of nutritional recommendations developed on the basis of the objectivised studies in the field of medical nutrition. This system, when implemented in practice, determines the optimal mental and somatic development of the child, decreases the risk of some diseases, infections and diet-related conditions, including obesity in the adulthood.

The basic elements of the model of safe nutrition of children and adolescents, which according to currently recognised theories should be associated with prophylaxis of obesity include: meal frequency, selection of products for the daily diet and meeting the guidelines for energy and nutritional values and other familial and environmental factors including dietary habits and behaviours, knowledge on the adequate nutrition as well as physical activity

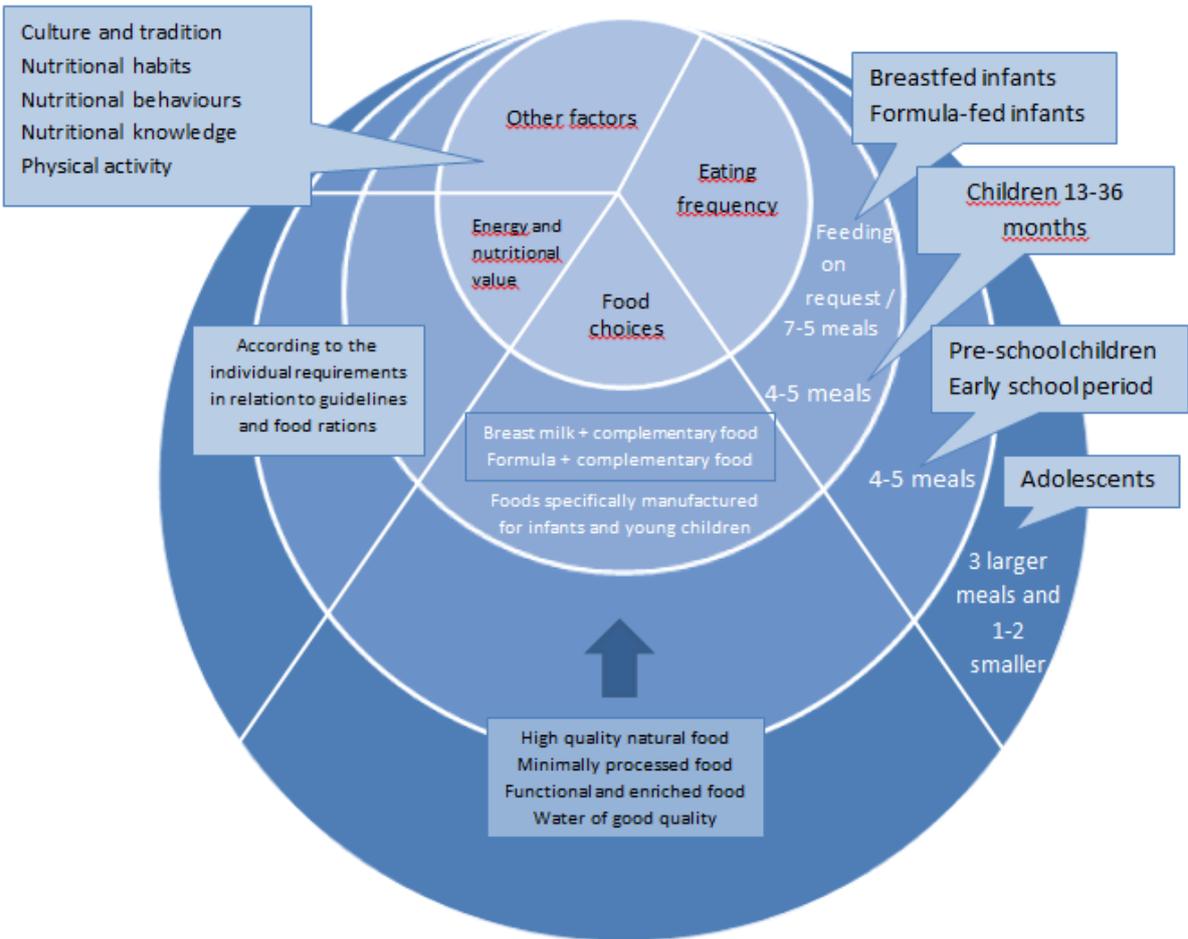


Figure 1. Models of safe nutrition in children and adolescents

2. Energy and nutrient requirement in children in their first year of life

Breastfeeding or feeding the child with breast milk are the gold standard in both neonate and infant nutrition. According to the position paper of the World Health Organisation (WHO), exclusive breastfeeding should last till the end of the 6. month of life, while partial breastfeeding should be continued in further months and be accompanied by the introduction of complementary food. Due to the above-mentioned statement, the volume and composition of the breast milk define a reference point for energy and nutrient requirement in the first 6 months of the child's life. Breast milk, which is produced in adequate quantities by the healthy and well-nourished mother, completely meets the infants' requirement for energy and all nutrients, insuring optimal development in the first months of their life.

Currently recognised guidelines concerning the requirement for energy and nutrients were developed by the European Food Safety Authority (EFSA) (Table 1).

Polish guidelines concerning the supply of energy and nutrients for infants were developed by the National Food and Nutrition Institute in 2008 and updated in 2012. These guidelines differ significantly from European ones, which were presented by EFSA in terms of e.g. macro- and micronutrients hence require further updates. Table 2 presents Polish nutritional guidelines for children in their first year of life. The above-mentioned norms were accepted as the basis for the evaluation of the nutrient profile in children's diets, as they are a significant element of the Dieta5 software.

However, new medical standard of children nutrition in their first year of life, which is presented in Table 3, was based on EFSA guidelines.

Table 1. Requirement for nutrients in the first year of life (according to EFSA 2013, 2014)

| Nutrient | 1. to < 6. month of life | | | | | 6. to < 12. month of life | | | | |
|----------------------------|--------------------------|------------|-----------|------------|-----------|---------------------------|------------|-----------|------------|-----------|
| | month | body mass* | boys | body mass* | girls | month | body mass* | boys | body mass* | girls |
| Energy [kcal (MJ) per day] | 0-<1 | 3.3/4.5 | 359 (1.5) | 3.2/4.2 | 329 (1.4) | 6-<7 | 8.3 | 599 (2.5) | 7.6 | 546 (2.3) |
| | 1-<2 | 5.6 | 505 (2.1) | 5.1 | 449 (1.9) | 7-<8 | 8.6 | 634 (2.7) | 7.9 | 572 (2.4) |
| | 2-<3 | 6.4 | 531 (2.2) | 5.8 | 472 (2.0) | 8-<9 | 8.9 | 661 (2.8) | 8.2 | 597 (2.5) |
| | 3-<4 | 7.0 | 499 (2.1) | 6.4 | 459 (1.9) | 9-<10 | 9.2 | 698 (2.9) | 8.5 | 628 (2.6) |
| | 4-<5 | 7.5 | 546 (2.3) | 6.9 | 503 (2.1) | 10-<11 | 9.4 | 724 (3.0) | 8.7 | 655 (2.7) |
| | 5-<6 | 7.9 | 583 (2.4) | 7.3 | 538 (2.3) | 11-<12 | 9.6 | 742 (3.1) | 8.9 | 674 (2.8) |
| Protein [g/d] | 0-<1 | | – | | – | 6-<7 | | 9 | | 8 |
| | 1-<2 | | 8 | | 7 | 7-<8 | | 11 | | 10 |
| | 2-<3 | | 8 | | 8 | 8-<9 | | 11 | | 10 |
| | 3-<4 | | 9 | | 8 | 9-<10 | | 11 | | 10 |
| | 4-<5 | | 9 | | 8 | 10-<11 | | 11 | | 10 |
| | 5-<6 | | 9 | | 8 | 11-<12 | | 11 | | 10 |
| Fats [% en.] | 50–55 | | | | | 40 | | | | |
| LA [% en.] | 4 | | | | | 4 | | | | |
| ALA [% en.] | 0.5 | | | | | 0.5 | | | | |
| DHA [mg/d] | 100 | | | | | 100 | | | | |
| DHA+EPA [mg/d] | – | | | | | – | | | | |
| ARA [mg/d] | 140 | | | | | – | | | | |
| Carbohydrates [% en.] | 40–45 | | | | | 45–55 | | | | |
| Dietary fibre [g/d] | – | | | | | – | | | | |
| Water [ml/d] | 700–1000 | | | | | 800–1000 | | | | |
| Calcium [mg/d] | 200 | | | | | 400 | | | | |
| Phosphorus [mg/d] | 100 | | | | | 300 | | | | |
| Magnesium [mg/d] | 25 | | | | | 80 | | | | |
| Sodium [mg/d] | 120 | | | | | 170–370 | | | | |
| Chlorine [mg/d] | 300 | | | | | 270–570 | | | | |
| Potassium [mg/d] | 400 | | | | | 800 | | | | |
| Iron [mg/d] | 0.3 (breastfed) | | | | | 8 | | | | |
| Zinc [mg/d] | 2 (breastfed) | | | | | 4 | | | | |
| Copper [mg/d] | 0.3 | | | | | 0.3 | | | | |
| Selenium [µg/d] | 12.5 | | | | | 15 | | | | |
| Iodine [µg/d] | 90 | | | | | 90 | | | | |
| Molybdenum [µg/d] | 2 | | | | | 10 | | | | |
| Manganese [mg/d] | 0.003 | | | | | 0.02–0.5 | | | | |
| Fluorine [mg/d] | 0.08 | | | | | 0.4 | | | | |
| Vitamin A [µg RE/d] | 350 | | | | | 350 | | | | |
| Vitamin D [µg/d] | 10 | | | | | 10 | | | | |
| Vitamin E [µg TE/d] | 3 | | | | | 5 | | | | |
| Vitamin K [µg/d] | 5 | | | | | 8.5 | | | | |
| Thiamine [mg/d] | 0.2 | | | | | 0.3 | | | | |
| Riboflavin [mg/d] | 0.3 | | | | | 0.4 | | | | |
| Niacin [mg NE/d] | 2 | | | | | 5 | | | | |
| Pantothenic acid [mg/d] | 2 | | | | | 3 | | | | |
| Pyridoxine [mg/d] | 0.1 | | | | | 0.4 | | | | |
| Biotin [µg/d] | 4 | | | | | 6 | | | | |
| Folic acid [µg DFE/d] | 65 | | | | | 80 | | | | |
| Cobalamin [µg/d] | 0.4 | | | | | 0.5 | | | | |
| Vitamin C [mg/d] | 20 | | | | | 20 | | | | |
| Choline [mg/d] | 130 | | | | | 150 | | | | |

Abbreviations:

*body mass 50 centile according to WHO (2006)

LA – linoleic acid (18:2, n-6)

ALA – alpha-linolenic acid (18:3, n-3)

ARA – arachidonic acid (20:4, n-6)

DHA – docosahexaenoic acid (22:6, n-3)

EPA – eicosapentaenoic acid (20:5, n-3)

LCPUFA – long-chain polyunsaturated fatty acids

Table 2. Guidelines for energy and nutrient consumption by infants

| Nutrients | | Recommended Dietary Allowances (RDA) [National Food and Nutrition Institute 2012] | |
|--|-------------|--|-------|
| | | Infants | |
| | | 0-0.5 | 0.5-1 |
| Basic food nutrients | | | |
| Energy [kcal] | | 600 | 700 |
| Protein[g] | EAR | - | - |
| | RDA | - | - |
| | AI | 10 | 14 |
| Fat | total[g] | - | - |
| | % of energy | - | 40 |
| Saturated fatty acids | % of energy | - | - |
| Polyunsaturated fatty acids | % of energy | - | - |
| Omega-6 fatty acid | % of energy | - | - |
| Omega-3 fatty acid | % of energy | - | - |
| Long-chain polyunsaturated fatty acids | % of energy | - | - |
| Trans fatty acid isomers | % of energy | - | - |
| Cholesterol | mg | - | - |
| Carbohydrates [g] | EAR | - | - |
| | RDA | - | - |
| | AI | 60 | 95 |
| Recommended carbohydrates [g] | | - | - |
| Added sugar | % of energy | - | - |
| Dietary fibre [g] | AI | - | - |
| Fat-Soluble Vitamins | | | |
| Vitamin A [µg RE] | EAR | - | - |
| | RDA | - | - |
| | AI | 400 | 500 |
| Vitamin D [µg] | AI | 5 | 5 |
| Vitamin D [µg]* | EAR | - | - |
| | RDA | - | - |
| | AI | 10 | 10 |
| Vitamin E [mg-α-TE] | AI | 4 | 5 |
| | EAR | - | - |
| | RDA | - | - |
| Vitamin K [µg] | AI | 5 | 10 |
| Water-Soluble Vitamins | | | |
| Vitamin C [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 40 | 50 |
| Vitamin B ₁ [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 0.2 | 0.3 |
| Vitamin B ₂ [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 0.3 | 0.4 |
| Vitamin PP [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 2 | 4 |
| Vitamin B ₆ [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 0.1 | 0.3 |
| Vitamin B ₉ [µg] | EAR | - | - |
| | RDA | - | - |
| | AI | 65 | 80 |
| Vitamin B ₁₂ [µg] | EAR | - | - |
| | RDA | - | - |
| | AI | 0.4 | 0.5 |
| Pantothenic acid [mg] | AI | 1.7 | 1.8 |
| Biotin [µg] | AI | 5 | 6 |
| Choline [mg] | AI | 125 | 150 |

Continuation of Table 2

| Minerals | | | |
|-----------------|-----|------|-----|
| Calcium [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 200 | 260 |
| Phosphorus [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 150 | 300 |
| Magnesium [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 30 | 70 |
| Iron [mg] | EAR | - | - |
| | RDA | - | 11 |
| | AI | 0.3 | - |
| Zinc [mg] | EAR | - | - |
| | RDA | - | 3 |
| | AI | 2 | - |
| Iodine [µg] | EAR | - | - |
| | RDA | - | - |
| | AI | 110 | 130 |
| Selenium [µg] | EAR | - | - |
| | RDA | - | - |
| | AI | 15 | 20 |
| Copper [mg] | EAR | - | - |
| | RDA | - | - |
| | AI | 0.2 | 0.3 |
| Fluorine [mg] | AI | 0.01 | 0.5 |
| Potassium [mg] | AI | 400) | 700 |
| Sodium [mg] | AI | 120 | 370 |
| Chlorine [mg] | AI | 190 | 570 |

Abbreviations:

EAR - Estimated Average Requirement

RDA - Recommended Dietary Allowances

AI - Adequate Intake

Table 3. Feeding pattern in children aged 0-1 years. Update 2016

| Age (months) | Abilities | Number of meals per day (approximate) | Ration size (ml) (approximate) | Breastfeeding or formula (modified milk) ¹ | Meals type and consistency | Examples ² | |
|--|---|---------------------------------------|--------------------------------|---|---|---|--|
| 1 | Sucking and swallowing | 7* | 110 | | Breastfeeding or formula (modified milk) ¹ | 1. Fluids | 2. Breast milk or formula |
| 2-4 | | 6* | 120-140 | | | | |
| 5-6 | <ul style="list-style-type: none"> Initial mincing of meals with the tongue Strong sucking reflex Pushing the food out of the mouth with tongue (temporary reaction) Opening mouth when the spoon is brought closer | 5* | 150-160 | | | <ul style="list-style-type: none"> Smooth purée 4 milk meals | <ul style="list-style-type: none"> Cooked and mixed vegetables (e.g. carrots) or fruits (e.g. apples, bananas), meat, eggs or potato puree, gluten-free porridge/gruel Cereal products, including small amounts of gluten in any period after the child reaches the age of 4 months (17 week of life), until the age of 12 months |
| 7-8 | <ul style="list-style-type: none"> Drawing food with the lips from the spoon Biting, chewing and lateral tongue movements Developing the abilities and coordination to eat independently | 5* | 170-180 | | | <ul style="list-style-type: none"> Increased diversity of minced or chopped products Products given to child's hand | <ul style="list-style-type: none"> Mixed, finely chopped meat and fishes Mashed cooked vegetables and fruits Chopped fresh vegetables and fruits (apples, pears, tomatoes) Soft parts of vegetables, fruits, meat given to the hand Cereals, bread Full fat cow's milk³ after the 11-12 month of life Natural yoghurt, cheese, kefir |
| 9-12 | | 4-5* | 190-220 | | | | |
| PARENT/GUARDIAN decides WHAT, WHEN AND HOW the child eats CHILD decides, WHETHER and HOW MUCH will it eat | | | | | | | |

*Estimated number of meals in formula fed infants, it is possible that the number of meals is greater in breastfed children, resulting from breastfeeding episodes.

¹ Exclusive breastfeeding for the first 6 months of life.

² The milk is given from the breast, bottle with nipple or open mug. Other foods are given using the spoon.

³ Small amounts may be used to prepare complementary products, yet cow's milk should not be used as main milk product for the first 12 months of life.

DRINKS: water ad libitum. Juices (100%, pureed, no sugar added, pasteurised), maximum 150 ml/day (the ration is calculated along with the amount of consumed fruits)

Vitamin D and K supplementation according to the recommendations

3. Feeding pattern for children in their first year of life - the principles of weaning

In 2014, Expert Workgroup and Polish Society for Paediatric Gastroenterology, Hepatology and Nutrition developed a feeding pattern for children in their first year of life, which presents recommendations for nutrition of children aged 0-6 months and 7-12 months. Significant role was attributed to the principles of weaning.

The 2016 update addressed breastfeeding issues (Table 3). In January 2017, European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) presented recommendations for infant feeding and weaning process. The most significant issues are listed below:

1. Exclusive or full breast-feeding should be promoted for at least 4 months, and exclusive or predominant breast-feeding for approximately 6 months is considered a desirable goal.
2. Complementary foods of different tastes and texture should not be introduced before 4 months but should not be delayed beyond 6 months.
3. Iron-rich complementary foods or iron-fortified foods should be introduced.
4. Allergenic foods should not be introduced before 5 months of age
5. Consumption of large quantities of gluten should be avoided after its introduction between 4 and 12 months of age
6. Cow's milk is not recommended as the main drink before 12 months of age - small volumes may, however, be added to complementary foods.
7. No sugar or salt should be added to complementary foods, while fruit juices or sugar-sweetened beverages should be avoided.
8. The texture and consistency of foods should be appropriate for the infant's developmental stage, prolonged use of pureed foods should be discouraged beyond 8 to 10 months of age. By 12 months, infants should drink mainly from a cup rather than a bottle.
9. Parents should be encouraged to recognise their infant's hunger and satiety queues and to avoid feeding as a reward or for own convenience.
10. Non-conventional diets (e.g. vegan) should be used under appropriate supervision to ensure nutritional adequacy.

4. Nutritional standards for children aged 1-3 years

Nutritional standards for the Polish population updated in 2012, which were developed by the National Food and Nutrition Institute, define the energy and nutrient requirement for small children (defined as children aged 1-3 years, 13-36 months old). The energy guidelines were defined as Estimated Energy Requirement (EER), whereas there were three different indices used to define the macronutrient requirement, i.e. Estimated Average Requirement (EAR), Recommended Dietary Allowance (RDA) or Adequate Intake (AI).

During the post-infancy period the requirement for energy and most of the nutrients calculated per 1 kg body mass decreases, whereas the relatively unchanged requirement is observed for certain nutrients. Table 4 presents the energy and nutrient requirement for children aged 1-3 years old (National Food and Nutrition Institute guidelines and medical standard), whereas Table 5 presents the European nutritional guidelines developed for this population.

Due to the fact, that Dieta5 software (nutritional software) utilises the nutritional guidelines developed by the National Food and Nutrition Institute in 2012, the evaluation of nutrient profile in the diets of the children aged 1-3 years was based on these guidelines.

Table 4. Guidelines for nutrition of children aged 1-3 years

| Nutrients | | Recommended Dietary Allowances for children aged 1-3 years (RDA) [National Food and Nutrition Institute 2012] | Nutritional guidelines for children aged 1-3 years [Medical Standards 2012] |
|--|-------------|---|---|
| Basic food nutrients | | | |
| Energy [kcal] | | 1000 | 1000 |
| Protein[g] | EAR | 12 | 12 |
| | RDA | 14 | 14 |
| | AI | - | - |
| Fat | total [g] | 33-44 | - |
| | % of energy | 20-35 | 30-35; max 40 |
| Saturated fatty acids | % of energy | - | <10 |
| Polyunsaturated fatty acids | % of energy | - | min. 6 (6.7 g) optimal >10 (11.1 g) |
| Omega-6 fatty acid | % of energy | - | linoleic acid min. 5 (5.5 g) |
| Omega-3 fatty acid | % of energy | - | alpha-linolenic acid min. 1 (1.1 g) |
| Long-chain polyunsaturated fatty acids | % of energy | - | min. 100 mg DHA < 2 yrs old and min. 250 mg DHA + EPA ≥2 yrs old |
| Trans fatty acid isomers | % of energy | - | max <1 (1.1 g) |
| Cholesterol | mg | - | <300 mg |
| Carbohydrates [g] | EAR | - | 100 |

| | | | |
|----------------------------------|-------------|-----|---------|
| | RDA | 130 | 130 |
| | AI | - | - |
| Recommended carbohydrates [g] | | - | 140-150 |
| Added sugar | % of energy | - | <10 |
| Dietary fibre [g] | AI | 10 | 19 |
| Fat-Soluble Vitamins | | | |
| Vitamin A [µg RE] | EAR | 280 | - |
| | RDA | 400 | - |
| | AI | - | - |
| Vitamin D [µg] | AI | 5 | - |
| Vitamin D [µg]* | EAR | 10 | 10 |
| | RDA | 15 | 15 |
| | AI | - | - |
| Vitamin E [mg-α-TE] | AI | 6 | - |
| | EAR | - | 5 |
| | RDA | - | 6 |
| Vitamin K [µg] | AI | 15 | - |
| Vitamins soluble in water | | | |
| Vitamin C [mg] | EAR | 30 | - |
| | RDA | 40 | - |
| | AI | - | - |
| Vitamin B ₁ [mg] | EAR | 0.4 | - |
| | RDA | 0.5 | - |
| | AI | - | - |
| Vitamin B ₂ [mg] | EAR | 0.4 | - |
| | RDA | 0.5 | - |
| | AI | - | - |
| Vitamin PP [mg] | EAR | 5 | - |
| | RDA | 6 | - |
| | AI | - | - |
| Vitamin B ₆ [mg] | EAR | 0.4 | - |
| | RDA | 0.5 | - |
| | AI | - | - |
| Vitamin B ₉ [µg] | EAR | 120 | - |
| | RDA | 150 | - |
| | AI | - | - |
| Vitamin B ₁₂ [µg] | EAR | 0.7 | - |
| | RDA | 0.9 | - |
| | AI | - | - |
| Pantothenic acid [mg] | AI | 2 | - |
| Biotin [µg] | AI | 8 | - |
| Choline [mg] | AI | 200 | - |

Continuation of Table 4

| Minerals | | | |
|-----------------|-----|------|-----|
| Calcium [mg] | EAR | 500 | 500 |
| | RDA | 700 | 700 |
| | AI | - | - |
| Phosphorus [mg] | EAR | 380 | |
| | RDA | 460 | |
| | AI | - | |
| Magnesium [mg] | EAR | 65 | |
| | RDA | 80 | |
| | AI | - | |
| Iron [mg] | EAR | 3 | |
| | RDA | 7 | |
| | AI | - | |
| Zinc [mg] | EAR | 2.5 | |
| | RDA | 3 | |
| | AI | - | |
| Iodine [µg] | EAR | 65 | |
| | RDA | 90 | |
| | AI | - | |
| Selenium [µg] | EAR | 17 | |
| | RDA | 20 | |
| | AI | - | |
| Copper [mg] | EAR | 0.25 | |
| | RDA | 0.3 | |
| | AI | - | |
| Fluorine [mg] | AI | 0.7 | |
| Potassium [mg] | AI | 2400 | |
| Sodium [mg] | AI | 750 | |
| Chlorine [mg] | AI | 1150 | |

Abbreviations:

EAR - Estimated Average Requirement

RDA - Recommended Dietary Allowances

AI - Adequate Intake

Table 5. Requirement for energy and nutrients in children aged 12-36 month (according to EFSA 2013)

| Nutrient | 12. to < 36. month of life / months old | | | | |
|---|---|-------------------------|-------------|-------------------------|-------------|
| | month | body mass ^{a)} | boys | body mass ^{a)} | girls |
| ^{c)} Energy[kcal (MJ) day] | 12 ^b | 9.6 | 777 (3.3) | 8.9 | 712 (3.0) |
| | 24 ^b | 12.2 | 1028 (4.3) | 11.5 | 946 (4.0) |
| | 36 ^b | 14.3 | 1174 (4.9) | 13.9 | 1096 (4.6) |
| ^{c)} Energy [kcal (MJ)/kg m.c. per day] | 12 ^b | 9.6 | unavailable | 8.9 | unavailable |
| | 24 ^b | 12.2 | unavailable | 11.5 | unavailable |
| | 36 ^b | 14.3 | unavailable | 13.9 | unavailable |
| Protein [g/d] ^{d)} (PRI) | 12 | 9.6 | 11 | 8.9 | 10 |
| | 18 | 10.9 | 11 | 10.2 | 11 |
| | 24 | 12.2 | 12 | 11.5 | 11 |
| | 36 | 14.3 | 13 | 13.9 | 13 |
| Protein [g/kg m.c. per day] ^{d)} (PRI) | 12 | 9.6 | 1.14 | 8.9 | 1.14 |
| | 18 | 10.9 | 1.03 | 10.2 | 1.03 |
| | 24 | 12.2 | 0.97 | 11.5 | 0.97 |
| | 36 | 14.3 | 0.9 | 13.9 | 0.9 |
| Fats [% en.] | 35-40 | | | | |
| LA [% en.] | 4 | | | | |
| ALA [% en.] | 0,5 | | | | |
| DHA [mg/d] | 100 (<24 m.o.l). | | | | |
| DHA+EPA [mg/d] | 250 (>24 m.o.l) | | | | |
| ARA [mg/d] | - | | | | |
| Carbohydrates [% en.] | 45-60 | | | | |
| Dietary fibre [g/d] | 10 | | | | |
| Water [ml/d] | 1100-1300 | | | | |
| Calcium [mg/d] | 600 | | | | |
| Phosphorus [mg/d] | 460 | | | | |
| Magnesium [mg/d] | 85 | | | | |
| Sodium [mg/d] | 170-370 | | | | |
| Chlorine [mg/d] | 270-570 | | | | |
| Potassium [mg/d] | 800 | | | | |
| Iron [mg/d] | 8 | | | | |
| Zinc [mg/d] | 4 | | | | |
| Copper [mg/d] | 0,4 | | | | |
| Selenium [µg/d] | 20 | | | | |
| Iodine [µg/d] | 90 | | | | |
| Molybdenum [µg/d] | 15 | | | | |
| Manganese [mg/d] | 0.5 | | | | |
| Fluorine [mg/d] | 0.6 | | | | |

Continuation of Table 5

| | |
|------------------------------------|-----|
| Vitamin A [$\mu\text{g RE/d}$] | 400 |
| Vitamin D [$\mu\text{g/d}$] | 10 |
| Vitamin E [$\mu\text{g TE/d}$] | 6 |
| Vitamin K [$\mu\text{g/d}$] | 12 |
| Thiamine [mg/d] | 0.5 |
| Riboflavin [mg/d] | 0.8 |
| Niacin [mg NE/d] | 9 |
| Pantothenic acid [mg/d] | 4 |
| Pyridoxine [mg/d] | 0.7 |
| Biotin [$\mu\text{g/d}$] | 20 |
| Folic acid [$\mu\text{g DFE/d}$] | 100 |
| Cobalamin [$\mu\text{g/d}$] | 0.9 |
| Vitamin C [mg/d] | 20 |
| Choline [mg/d] | 200 |

^{a)} body mass 50 centile according to WHO (2006)

^{b)} PAL, 1,4 – moderate physical activity^{c)}

AR - Average Requirement

^{d)} PRI - Population Reference Intakes

Abbreviations:

LA - linoleic acid (18:2, n-6)

ALA - alpha-linolenic acid (18:3, n-3)

ARA - arachidonic acid (20:4, n-6)

DHA - docosahexaenoic acid (22:6, n-3)

EPA - eicosapentaenoic acid (20:5, n-3)

LCPUFA - long-chain polyunsaturated fatty acids

5. Model food rations for the post-infancy period

The previous (2001) food rations were modified according to the updated Polish nutritional guidelines for children aged 13-36 months old, which reduced the intake of energy and macronutrients, such as protein and fats, and increased the intake of some vitamins (vitamin D, folic acid), minerals (calcium, potassium, iodine) and fibre. The development of model food ration for this children population in 2013 was based on the exemplary menus (medical standard). It was assumed that the child's daily food ration should include all product groups intended to be served as a meal. The food products were assigned into particular groups with regard to their characteristic features and nutritional value. Table 6 presents the model food ration and compares them with different recommendations.

Table 6. Model food ration, expressed as products intended for children aged 1-3 years calculated using exemplary menus and related to various norms

| No. | Product group | Units | Average daily food ration calculated from the exemplary menus | Model food ration | Amount of products according to different recommendations | | |
|-----|---|-------|---|-------------------|---|--|--|
| | | | x 13-36 m.o.l (13-24 m.o.l.:25-36 m.o.l.) | | Institute of Mother and Child (1998) | National Food and Nutrition Institute (2001) | American Academy of Pediatrics (2005.) |
| 1. | Cereal products (equivalent to flour) | g | | | | | |
| | bread | g | 20 (13-27) | 20 | 80 | 70 | 85 |
| | flour, noodles | g | 25 (27-23) | 25 | 20 | 20 | |
| | groats, rice, cereals | g | 31.5 (34-29) | 30 | 20 | 20 | |
| 1A. | Potatoes | g | 81 (77-85) | 80-100 | 150 | 150 | |
| 2. | Vegetables and fruits | g | 429.5 (422-437) | 450 | 650 | 600 | 2 cups (500 g) |
| | vegetables | g | 196 (160-232) | 200 | 350 | 350 | 1 cup (250 g) |
| | fruits | g | 234 (205-263) | 250 | 300 | 250 | 1 cup (250 g) |
| 3. | Milk and milk products (equivalent to milk) | g | | | | | 2 cups (500 g) |
| | milk and fermented dairy beverages | g | 535 (519-551) | 450/100 | 500 | 600 | - |
| | cottage cheese | g | 11.5 (6-17) | 10-15 | 40 | 40 | - |
| | rennet cheese | g | 1.75 (1.5-2) | 2 | 5 | - | - |
| 4. | Meat, sliced meats and fishes (equivalent to meat without bones) | g | | | | | 56 |
| | meat, poultry | g | 20.5 (17-24) | 20 | 35 | 30 | - |
| | sliced meats | g | | | 15 | 20 | - |
| | fish | g | 8.25 (8-8.5) | 10 | - | - | - |
| 4A. | Eggs | g/pc. | 25 / 1/2 | 1/2 | 3/4 | 3/4 | - |
| 5. | Fats | g | 16 (12-20) | 16 | 25 | 25 | - |
| | animal: butter and cream | g | 6.5 (4.5-8.5) | 6 | 20 | 16 | - |
| | vegetable: oils | g | 8.5 (7-10) | 10 | 5 | 9 | - |
| 6. | Sugar and sweets | g | 21.5 (20-23) | 20 | 45 | 30 | - |

- no guideline/consensus are available

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III. Comprehensive evaluation of the feeding practices in children aged 5-36 months - Polish, nation-wide study 2016

1. Aim

The aim of this study was:

- to comprehensively evaluate the feeding practices in children aged 5-12 months with reference to their nutritional status
- to comprehensively evaluate the feeding practices in children aged 13-36 months with reference to their nutritional status as well as nutritional recommendations and standards
- to analyse the modifications in feeding practices during post-infancy period (13-36 months old) in relation to the results of the nation-wide Polish study on feeding practices in children aged 13-36 months, which was carried out in 2010-2011.

Detailed aims:

1. Evaluation of nutritional status in children aged 5-12 months in relation to the WHO standards based on selected features and anthropometric indices.
2. Evaluation of feeding practices - feeding patterns, including nutrient profiles in children aged 5-12 months in relation to present nutritional recommendations (feeding pattern for children in their first year of life 2016).
3. Evaluation of nutritional status of children aged 13-36 months in relation to the WHO standards based on selected features and anthropometric indices.
4. Evaluation of feeding practices in children aged 13-36 months in relation to present nutritional recommendations (National Food and Nutrition Institute 2012, Medical Standards 2013).
5. Comparison between the feeding practices - feeding patterns, including nutrient profiles in children aged 13-36 months in relation to the results of the Polish nation-wide study (carried out in 2010-2011) on the feeding pattern in children within the same age group.

2. Material and methods

The nutritional status and feeding practices were studied according to the principles of medical and nutritional sciences.

2.1. Study design

Figure 2 presents the design of the performed study.



Figure 2. Study design

2.2. Sample selection

To comply with the need to select a representative sample, a random selection of infants and children from the nationwide population was carried out (using personal identification numbers PESEL). Stratification was based on age, voivodeship and district type. The study population was selected by TNS Polska.

The study sample consisted of 450 infants 5-12 months of age and 600 children at the age of 13-36 months. Within the infant group three additional substrata were defined (5-6, 7-9, 10-12 months old), whereas the group of older children was divided into four substrata (13-18, 19-24, 25-30 i 31-36 months old). Despite the fact that the distribution of births in particular months was not even, samples of 150 infants/children were randomly selected in each strata.

Table 7. Age distribution in the studied children sample

| No. | Groups / subgroup (month of life) | Age range (in full months) | Count |
|-----------|--------------------------------------|----------------------------|------------|
| 1. | Infants | 4-11 | 450 |
| a. | Infants 5-6 months old | 4-5 | 150 |
| b. | Infants 7-9 months old | 6-8 | 150 |
| c. | Infants 10-12 months old | 9-11 | 150 |
| 2. | Children 13-36 months | 12-35 | 600 |
| a. | Children 13-18 months old | 12-17 | 150 |
| b. | Children 19-24 months old | 18-23 | 150 |
| c. | Children 25-30 months old | 24-29 | 150 |
| d. | Children 31-36 months old | 30-35 | 150 |

The selection of children was based on the assumption that on the study day they completed their 4., 6., 9., 12., 18., 24. and 30. month of life, respectively..

As the study had to be completed in a very short period of time, due to the fact that the sample could have quickly become outdated (the age of the children had to comply with the selected 2- or 6-month periods) it was crucial to randomly select appropriately bundled sample and provide a suitable reserve sample in case the consent for the participation in the study could not be obtained or the child/caregiver was unavailable on the day of the study. It was accepted that one couple of parents in each age cohort will be interviewed for each realisation bundle, i.e. a total of 7 interviews. It was decided to randomly select 10-fold reserve. It led to the random selection of 150 realisation bundles being primary sampling unit.

The bundling (grouping of 7 interviews in one district) resulted in the increase of cost- and time-effectiveness of the project by reducing travel length compared to the situation when the interview location for each age cohort had been sampled independently.

The district was selected to be the primary sample unit. Due to the narrow age bracket of the cohorts, the number of children in the specific age was not sufficient in some districts. In such case, the closest district of the same type was included into the bundle.

Sixty-four strata were created from the studied population (set of districts) to randomly select primary sampling units. The following factors were taken into account: voivodeships (16) and classification of district types: rural, mixed urban-rural, urban up to 100 thousand inhabitants and urban over 100 thousand inhabitants. Such stratification allowed us to achieve territorial representativeness for every age cohort. The number of bundles in each stratum was proportional to the number of small children in the population (according to data presented by the Central Statistical Office of Poland).

Table 8 presents the territorial structure of the bundles.

Table 8. Territorial structure of the sampled children

| Voivodeship | Rural district | Mixed urban-rural district | Urban district (up to 100 000 inhabitants) | Urban district (over 100 000 inhabitants) |
|---------------------|----------------|----------------------------|--|---|
| Lower Silesian | 2 | 3 | 2 | 3 |
| Kuyavian-Pomeranian | 2 | 2 | 1 | 2 |
| Lublin | 4 | 1 | 2 | 1 |
| Lubusz | 1 | 2 | 1 | 1 |
| Łódź | 3 | 1 | 2 | 2 |
| Lesser Poland | 5 | 4 | 1 | 3 |
| Masovian | 6 | 4 | 4 | 9 |
| Opole | 1 | 2 | - | 1 |
| Podkarpackie | 4 | 2 | 2 | 1 |
| Podlaskie | 1 | 1 | 1 | 1 |
| Pomeranian | 3 | 1 | 3 | 3 |
| Silesian | 4 | 1 | 5 | 7 |
| Świętokrzyskie | 2 | 1 | 1 | 1 |
| Warmian-Masurian | 2 | 2 | 1 | 1 |
| Greater Poland | 4 | 6 | 2 | 3 |
| West Pomeranian | 1 | 2 | 1 | 2 |

According to the accepted stratification (voivodeship x district type) 150 districts were sampled with probability proportional to the population studied in each district (utilising data provided by the Central Statistical Office of Poland). Should the sampled district be so small that there were no children in the adequate age, the territorially closest district of the same stratum was included into the bundle (voivodeship x district type). Subsequently, in each of the randomly selected districts one child in each cohort was sampled. Only the age of the child was taken into account, not its gender. The sampled children constituted a primary sample. The reserve samples were selected in the same manner (another 9 children in each age cohort).

The interviewees were the parents of the sampled children, who provided care over children and influenced their nutrition. It was not presupposed that the parent is a mother. It was also possible to interview other guardians who provided actual and direct care over the child and influenced their nutrition (e.g. grandmother).

Inability to interview the parent/guardian of the child from the primary sample and replacing it with the child from the reserve sample did not eventually influence the total number of interviews in each stratum for each age-cohort. Final territorial structure of the completed sample remained unchanged and was uniform with the assumed one. Therefore, not only territorial representativeness for the entire study was obtained, but also for each individual age cohort.

An attempt was made to establish contact with 7260 families out of 10 464 sampled infants and children and the study procedure (questionnaire, nutrition diary and anthropometric measurements) was completed in 1059 cases. The representativeness of the infants and children up to 3 years of age in Poland was therefore obtained. The response rate in our study was approximately 15%.

Only healthy children receiving physiological diets were included into the study (inclusion criteria).

2.3. Research tools

The feeding practices, including the analysis of the feeding patterns (i.e. frequency of meals, product selection in the diet, feeding behaviours) were evaluated using original questionnaire filled in by the parent/guardian of the studied children. It also included Feeding Frequency Questionnaire (FFQ) and the form to note down the three-day menu.

The questionnaire consists of following parts:

- Part A - data on familial and environmental conditions of children enrolled in the study
- Part B - data on nutritional status - anthropometric data (body mass, body length/height), obtained using current measurements and body mass index standardized to match percentile charts of the WHO (Child Growth Standards, 2005)
- Part C.I - qualitative evaluation of feeding practices, including feeding patterns of children aged 5-12 months.
- Part C.II - qualitative evaluation of feeding practices, including feeding patterns of children aged 13-36 months.
- Part D - a form to record the child's menu for a period of 3 days (nutritional diary) to quantitatively evaluate the feeding practice with instruction describing how to record the mother's diet.

The size of the food rations/meals was estimated based on the daily diet records and the "Album of photographs of food products and dishes" (National Food and Nutrition Institute).

The average daily food ration was calculated based on the 3-day menu records of each child in the studied population, i.e. the median of quantity of products from 6 basic groups. The nutritional value of daily food rations of children was calculated once the 3-day menu records were estimated using the Dieta 5.0 software.

The obtained results were compared to the values presented in the nutritional standards for age-adjusted groups (M. Jarosz (ed.), 2012).

The children's nutritional status was assessed based on the following features and anthropometric indices:

- body mass [kg]

- body length/height [m]
- body mass to body length/height ratio
- normalised body mass to body length/height ratio

The anthropometric measurements, which characterise the children's nutritional status were performed in the General Physician's Office according to the generally accepted method or by parents according to the presented instruction and with help from the trained interviewers/dieticians (Appendix III). The obtained results were referred to WHO reference percentile charts).

2.4. Methodology

The study was actually a survey carried out by trained interviewers, employees of the external research provider, among parents and guardians of the children, who were selected to form a nationwide random sample.

The interviewers visited selected families twice within a period of 4 to 7 days. During the first visit the parent's/guardian's informed consent was obtained (Appendix I - Respondent Information and Informed Consent Form), followed by the computer-assisted survey (Appendix II - Questionnaire). Interviewers asked parents to carry out anthropometric measurements of their children (body mass and length/height) in the General Physician's Office or on their own according to the developed measurement instruction with help of the trained interviewer/dietician (Appendix III) and to note down the menus, i.e. to record the child's diet for three subsequent days, including one holiday (i.e. Thursday, Friday, Saturday or Sunday, Monday and Tuesday) according to the supplied Instruction (Appendix IV). During the second visit the interviewers collected the filled-in diaries from the parents/guardians. They performed an initial verification of the entries to check whether they complied with the instruction and the "Album of photographs of food products and dishes" (National Food and Nutrition Institute), as well as the results of anthropometric measurements of body mass and length/height (Appendix V - Anthropometric measurements chart).

2.5. Statistical analysis

Different statistical methods were applied according to the raised research issues (Table 9). Due to the non-normal distribution of the variables, the quantitative variables were expressed as the median and interquartile ranges.

The statistical significance was set at $\alpha=0.05$.

Table 9. Statistical analyses

| Analyses | Statistical methods |
|---|---|
| Characteristic of the groups. | Descriptive statistics, variable distribution analysis, survey frequencies |
| Evaluation of nutritional status and feeding practices. | Descriptive statistics, variable distribution analysis, survey frequencies, tests for significance of differences |
| Evaluation of the relationship between the feeding practice and nutritional status in children including the impact of covariate (familial and environmental conditions). | Descriptive statistics, variable distribution analysis, survey frequencies, tests for significance of differences, correlative analysis |
| Comparison of two studies performed in 2016 and 2010-2011 with regard to nutritional status and feeding practices in children aged 13-36 months. | tests for significance of differences, tests for significance of structure indices |

3. Characteristic of the studied children

Tables 10 and 11 present the characteristic of the studied infants and small children.

Table 10. Characteristic of the studied group of children aged 5-12 months (n=447)

| Variables | Infants 5-12 month of life (n=447) | |
|---|------------------------------------|--------|
| Age [months] median (range 1-3 quartile) | 7.7 (5.8-10.2) | |
| Gender [%] boys girls | 49.4 50.6 | |
| Parents' educational background [%] | Mother | Father |
| primary | 2.0 | 4.5 |
| vocational | 13.4 | 22.6 |
| secondary | 38.9 | 38.0 |
| higher | 45.6 | 29.1 |
| Place of residence [%] | | |
| agglomerations | 13.0 | |
| large city | 13.4 | |
| city | 10.1 | |
| town | 25.1 | |
| rural areas | 38.5 | |
| BMI [% of parents] | Mother | Father |
| underweight (BMI<18.5) | 5.1 | 0.7 |
| normal (BMI \geq 18.5 i <25) | 62.9 | 32.2 |
| overweight (BMI \geq 25 i <30) | 21.7 | 45.9 |
| obesity (BMI \geq 30) | 9.8 | 14.1 |

Table 11. Characteristic of the studied group of children aged 13-36 months (n=612)

| Variables | Children 13-36 month of life (n=612) | |
|---|--------------------------------------|--------|
| Age [months] median (range 1-3 quartile) | 24.1 (17.8-30.0) | |
| Gender [%] boys girls | 50.0 50.0 | |
| Parents' educational background [%] | Mother | Father |
| primary | 4.7 | 3.8 |
| vocational | 12.6 | 22.2 |
| secondary | 35.0 | 36.6 |
| higher | 47.4 | 29.2 |
| Place of residence [%] | | |
| agglomerations | 12.3 | |
| large city | 13.1 | |
| city | 8.8 | |
| town | 25.3 | |
| rural areas | 40.5 | |
| BMI [% of parents] | Mother | Father |
| underweight (BMI<18.5) | 4.6 | 0.2 |
| normal (BMI≥18.5 i <25) | 61.9 | 29.6 |
| overweight (BMI≥25 i <30) | 22.2 | 47.9 |
| obesity (BMI≥30) | 9.0 | 12.9 |

There were 50.6% of girls and 49.4% of boys in the studied population of children aged 5-12 months (n=447), whereas the number of girls and boys in the age group of 13-36 months was the same.

Most of the children lived in cities. Their parents had mostly higher education, while mothers had higher education more frequently. There were twice as many overweighted fathers than overweighted mothers (first year of life: 45.9% vs. 21.7%, post-infancy period: 47.9% vs. 22.2%).

4. Discussion

4.1. The evaluation of nutritional status of children aged 5-35 months with reference to current WHO standard for physical development of children aged 0-5 years

The nutritional status of the studied children was evaluated using the normalised weight-for-height ratio (weight-for-height z-score) recommended by the WHO. This index was found adequate to present our results, as it is the only one with established cut-off points allowing distinguishing children with poor, normal and excessive nutritional status. Despite the fact that BMI defines the overweight, including obesity, quite well, we were not able to include it in our study, as WHO does not recommend using this index to evaluate body mass deficiency in children below the age of 5 years. Table 12 summarises the classification of nutritional status indices along with cut-off points recommended by the WHO, which was used to evaluate the nutritional status of the studied children (De Onis, 2013).

Table 12. Classification of nutritional status in children and adolescents using anthropometric indices according to WHO

| Classification | Condition | Age: Birth to 60 months Indicator and cut-off | Age: 61 months to 19 years Indicator and cut-off |
|--------------------------------|-----------------------------|--|---|
| Based on body mass index (BMI) | Possible risk of overweight | BMI-for-age (or weight-for-height) >1 SD to 2 SD | |
| | Overweight | BMI-for-age (or weight-for-height) >2 SD to 3 SD | BMI-for-age >1 SD (equivalent to BMI 25 kg/m ² at 19y) |
| | Obese | BMI-for-age (or weight-for-height) >3 SD | BMI-for-age >2 SD (equivalent to BMI 30 kg/m ² at 19y) |
| | Thin | | BMI-for-age <-2 SD to -3 SD |
| | Severely thin | | BMI-for-age <-3 SD |
| Based on weight and height | Stunted | Height-for-age <-2 SD to -3SD | Height-for-age <-2 SD to -3SD |
| | Severely stunted | Height-for-age <-3 SD | Height-for-age <-3 SD |
| | Underweight | Weight-for-age <-2 SD to -3SD | Weight-for-age (up to 10y) <-2 SD to -3SD |
| | Severely underweight | Weight-for-age <-3 SD | Weight-for-age (up to 10y) <-3 SD |
| | Wasted | Weight-for-height <-2 SD to -3SD | |
| | Severely wasted | Weight-for-height <-3 SD | |

Source: De Onis M (2015). World Health Organization Reference Curves. In M.L. Frelut (Ed.), The ECOG'seBook on Child and Adolescent Obesity. Retrieved from ebook.ecog-obesity.eu.

Tables 13-16 present current (2016) nutritional status of the studied children aged 5-12 months, whereas the same results for the group aged 13-36 months old are summarised in tables 17-20. Tables 21-22 compare the results obtained in current study with the one carried out in 2010.

These results indicate that more than 2/3 of the studied children (n=1059) presented good nutritional status (Tables 13 and 17). Body mass deficiency was observed in 14.5% of infants and 4.1% of children aged 13-36 months. The risk of overweight, as well as overweight and obesity was observed in 17.9% of infants and 28.1% of children aged 13-36 months.

4.1.1. Nutritional status of infants

Table 13 presents the data on the distribution of the weight-for-height index (z-score) standardised to match WHO growth charts in the studied group of infants. It was used to evaluate the studied group of infants, because it was the only one that allows describing the entire population.

Table 13. Nutritional status of the studied infants defined with normalised weight-for-height z-score - Polish, nationwide representative sample

A. Infants

| Nutritional status | Cut-off points Weight-for-height z-score (acc. to WHO) | Infants 5-12 month of life (n=447) |
|---|---|---|
| Possible risk of overweight | >1SD to 2 SD | 61 (13.7%) |
| Overweight | >2SD to 3SD | 13 (2.9%) |
| Obese | >3SD | 6 (1.3%) |
| Total | | 80 (17.9%) |
| Body mass deficit in relation to body length/height (Wasted) | <-2 SD to -3 SD | 42 (9.4%) |
| Severe body mass deficit in relation to body length/height (Severely wasted) | <-3 SD | 23 (5.1%) |
| Total | | 65 (14.5%) |
| Good nutritional status | ≥-2 SD to +1 SD | 302 (67.6%) |

The distribution of other standardised nutritional status indices recommended by the WHO for evaluation of nutritional status in children in their first year of life is summarised in Tables 14-16.

Table 14. Excessive body mass in children aged 5-12 months evaluated using normalised body mass index BMI

| Nutritional status | Cut-off points BMI z-score | Infants 5-12 months (n=447) |
|-----------------------------|--------------------------------------|-----------------------------|
| Possible risk of overweight | >1SD to 2 SD | 55 (12.3%) |
| Overweight | >2SD to 3SD | 10 (2.2%) |
| Obese | >3SD | 6 (1.3%) |
| Total | | 71 (15.8%) |

Table 15. Body mass deficiency in children aged 5-12 months evaluated using normalised body mass index, age-adjusted

| Nutritional status | Cut-off points Weight-for-age z-score (acc. to WHO) | Infants 5-12 months (n=447) |
|----------------------|--|-----------------------------|
| Underweight | <-2 SD to -3 SD | 8 (1.8%) |
| Severely underweight | <-3 SD | 3 (0.7%) |
| Total | | 11 (2.5%) |

Table 16. Stuntedness aged 5-12 months evaluated using normalised body length/height index, age-adjusted

| Nutritional status | Cut-off points Height-for-age z-score (acc. to WHO) | Infants 5-12 months (n=447) |
|--------------------|--|-----------------------------|
| Stunted | <-2 SD to -3 SD | 7 (1.6%) |
| Severely stunted | <-3 SD | 8 (1.8%) |
| Total | | 15 (3.4%) |

4.1.2. Nutritional status of children aged 13-36 months

Table 17 presents the data on the distribution of the weight-for-height index (z-score) standardised to match WHO growth charts in the studied group of children aged 13-36 months. It was used to evaluate the studied group of post-infancy children, because it was the only one that allows describing the entire population.

Table 17. Nutritional status of the studied children defined with normalised weight-for-height z-score - Polish, nationwide representative sample

B. Children aged 13-36 months

| Nutritional status | Cut-off points Weight-for-height z-score (acc. to WHO) | Children 13-36 months (n=612) |
|---|---|--|
| Possible risk of overweight | >1SD to 2 SD | 113 (18.4%) |
| Overweight | >2SD to 3SD | 42 (6.9%) |
| Obese | >3SD | 17 (2.8%) |
| Total | | 172 (28.1%) |
| Body mass deficit in relation to body length/height (Wasted) | <-2 SD to -3 SD | 14 (2.3%) |
| Severe body mass deficit in relation to body length/height (Severely wasted) | <-3 SD | 11 (1.8%) |
| Total | | 25 (4.1%) |
| Normal nutritional status | ≥-2 SD to +1 SD | 415 (67.8%) |

The distribution of other standardised nutritional status indices recommended by the WHO for evaluation of nutritional status in children aged 13-36 months is summarised in tables 18-20.

Table 18. Excessive body mass in children aged 13-36 months evaluated using normalised body mass index BMI

| Nutritional status | Cut-off points BMI z-score | Children 13-36 months (n=612) |
|------------------------------------|---------------------------------------|--|
| Possible risk of overweight | >1SD to 2 SD | 113 (18.5%) |
| Overweight | >2SD to 3SD | 41 (6.7%) |
| Obese | >3SD | 19 (3.1%) |
| Total | | 173 (28.3%) |

Table 19. Body mass deficiency in children aged 13-36 months evaluated using normalised body mass index, age-adjusted

| Nutritional status | Cut-off points Weight-for-age z-score (acc. to WHO) | Children 13-36 months (n=612) |
|-----------------------------|--|--|
| Underweight | <-2 SD to -3 SD | 5 (0.8%) |
| Severely underweight | <-3 SD | 2 (0.3%) |
| Total | | 7 (1.1%) |

Table 20. Stuntedness in children aged 13-36 months evaluated using normalised body length/height index, age-adjusted

| Nutritional status | Cut-off points Height-for-age z-score (acc. to WHO) | Children 13-36 months (n=612) |
|--------------------|---|-------------------------------|
| Stunted | <-2 SD to -3 SD | 17 (2.8%) |
| Severely stunted | <-3 SD | 9 (1.5%) |
| Total | | 26 (4.3%) |

4.1.3. Nutritional status of children aged 13-36 months – comparison of studies performed in 2010 and 2016

Table 21 summarises the data on nutritional status of representative samples of Polish children aged 13-36 months, who were studied in 2010 and 2016.

Table 21. Nutritional status of the studied children defined with normalised weight-for-height z-score

C. Children aged 13-36 months – comparison of studies performed in 2010 and 2016

| Nutritional status | Cut-off points Weight-for-height z-score (acc. to WHO) | Study 2010 Children 13-36 months old (n=400) | Study 2016 Children 13-36 months old (n=612) |
|---|---|---|---|
| Possible risk of overweight | >1SD to 2 SD | 56 (14.00%) | 113 (18.4%) |
| Overweight | >2SD to 3SD | 31 (7.75%) | 42 (6.9%) |
| Obese | >3SD | 22 (5.50%) | 17 (2.8%) |
| Total | | 109 (27.25%) | 172 (28.1%) |
| Body mass deficit in relation to body length/height (Wasted) | <-2 SD to -3 SD | 31 (7.75%) | 14 (2.3%) |
| Severe body mass deficit in relation to body length/height (Severely wasted) | <-3 SD | 15 (3.75%) | 11 (1.8%) |
| Total | | 46 (11.50%) | 25 (4.1%) |
| Normal nutritional status | ≥-2 SD to +1 SD | 245 (61.25%) | 415 (67.8%) |

The comparison of nutritional status allowed us to conclude that the nutritional status of children aged 13-36 months old calculated using normalised weight-for-height index improved for the population studied in 2016 in comparison with the population studied in 2010. There is a higher percentage of children with normal body mass (67.8% vs. 61.3% in 2010), three times fewer children with body mass deficiency (4.1% vs. 11.5% in 2010), almost twice fewer children with obesity (2.8% vs. 5.5% in 2010). The percentage of children at risk of excessive body mass is, however, higher than in 2010, which justifies the need for further nutritional education among parents/guardians of children to prevent obesity.

Due to the fact that the 2010 study utilised the BMI z-score to evaluate the nutritional status, the additional Table 22 includes the distribution of BMI calculated to match WHO

percentile charts in the representative sample of Polish children aged 13-36 months old, who were examined in 2010 and 2016.

Table 22. Distribution of BMI z-score in children aged 13-36 months - comparison of studies performed in 2010 and 2016

| BMI z-score | Study 2010 Children 13-36 months old (n=400) | Study 2016 Children 13-36 months old (n=612) |
|-----------------------|--|--|
| >+3SD | 26 (6.5%) | 19 (3.1%) |
| >+2SD to +3SD | 26 (6.5%) | 41 (6.7%) |
| >+1SD to +2 SD | 58 (14.5%) | 113 (18.5%) |
| \geq -1 SD to +1 SD | 182 (45.5%) | 356 (58.2%) |
| <-1 SD to -2 SD | 50 (12.5%) | 48 (7.8%) |
| <-2 SD to -3 SD | 36 (9.0%) | 19 (3.1%) |
| <-3 SD | 22 (5.5%) | 16 (2.6%) |

4.2. Evaluation of feeding practices in studied infants and post-infancy children

4.2.1. Nutrition of children aged 5-12 months - retrospective data on feeding practices during first 6 months of life

4.2.1.1. Breastfeeding

The study on feeding practices in infants, which was performed in 2016 (with exclusion of children aged 5-6 months, as it was uncertain whether they would continue to be breastfed) revealed that 54.1% of children aged 0-6 months old were breastfed and 5.9% exclusively breastfed.

Figure 3 shows the number of children aged 7-12 months old, both not breastfed and breastfed, including exclusively, during the period of first 6 months of life.

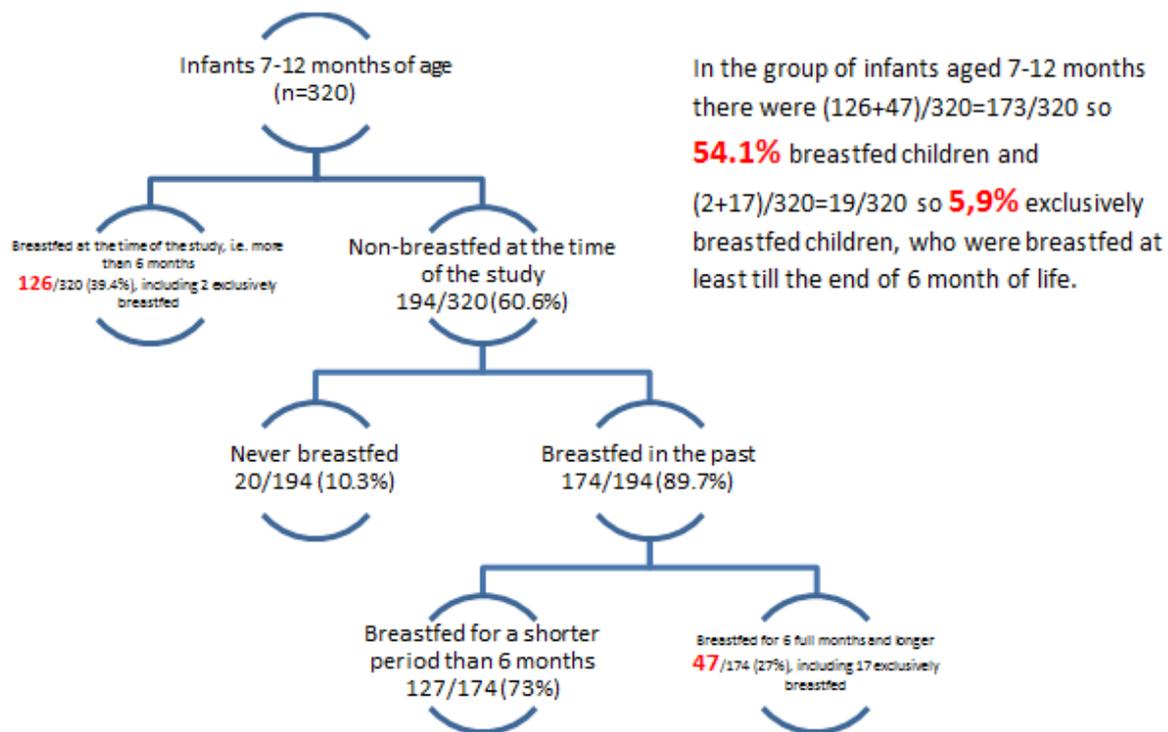


Figure 3. Breastfeeding during first six months of life in the studied infants (retrospective data, survey, question. C.I.1)

4.2.1.2. Weaning

Breastfeeding and weaning in line with the recommendations determine the normal mental and somatic development of the child.

Table 23 presents the data on weaning in the first six months of life of the studied infants.

Table 23. Timing of introduction of different products/complementary food in studied infants (retrospective data; survey, question C.I.9)

| No. | Product selection | Percentage of infants (n=447), who had complementary food introduced in consecutive months of life [%] | | | | | |
|-----|--|--|-----------|-----------|-----------|-----------|-----------|
| | | 1. m.o.l. | 2. m.o.l. | 3. m.o.l. | 4. m.o.l. | 5. m.o.l. | 6. m.o.l. |
| 1. | Formula | 27.3 | 10.7 | 9.2 | 6.3 | 3.8 | 4.9 |
| 2. | Gluten-free porridge/gruel (rice, corn) | 0.9 | 1.3 | 5.1 | 2.8 | 21.0 | 13.4 |
| 3. | Gluten-containing porridge/gruel (semolina, wheat, multigrain) | 0.4 | 1.1 | 2.9 | 11.4 | 17.7 | 16.3 |
| 4. | Fruit juices | 0.2 | 0.7 | 2.9 | 21.0 | 14.3 | 14.5 |
| 5. | Water | 25.3 | 10.3 | 12.5 | 13.9 | 12.3 | 9.6 |
| 6. | Tea for children | 16.1 | 6.5 | 7.4 | 12.3 | 8.1 | 5.1 |
| 7. | Tea | 0.9 | 2.7 | 1.8 | 4.9 | 3.6 | 3.6 |
| 8. | Crust / bread / roll | 0.0 | 0.4 | 0.4 | 5.8 | 8.5 | 13.2 |
| 9. | Fruit purees | 0.0 | 0.0 | 2.7 | 30.6 | 23.9 | 14.8 |
| 10. | Purees / vegetable soups | 0.2 | 0.0 | 1.3 | 30.9 | 28.9 | 17.4 |
| 11. | Meat | 0.2 | 0.0 | 0.2 | 7.8 | 20.8 | 21.3 |
| 12. | Fishes | 0.0 | 0.0 | 0.2 | 3.4 | 13.2 | 16.6 |
| 13. | Egg yolk | 0.0 | 0.0 | 0.2 | 3.1 | 4.7 | 15.9 |
| 14. | Whole egg | 0.0 | 0.0 | 0.0 | 1.8 | 2.2 | 7.8 |
| 15. | Yoghurt / cottage cheese / cheese | 0.2 | 0.0 | 0.2 | 5.4 | 8.1 | 12.3 |
| 16. | Cow's milk | 0.2 | 0.4 | 0.0 | 0.9 | 2.5 | 1.1 |
| 17. | Biscuits / sponge fingers | 0.0 | 0.0 | 0.9 | 6.7 | 11.2 | 15.7 |

61.1% of children received different food products supplementing the diet (excluding formula and water) before the 5 month of age, whereas only 30.2% infants received first food - porridge/gruel, fruit and/or vegetable purees, juices and teas in compliance with the recommendations, i.e. between 17 and 26 week of age (aggregated data analysis).

Table 24 shows the data on the presence of certain complementary foods in the infant's diet at the time the study was performed.

Table 24. Percentage of infants, in whom the certain complementary foods had been already introduced at the time of the study (survey, question C.I.9. – recoded data)

| Complementary foods | Infants 5-6 months old (n=127) | Infants 7-9 months old (n=162) | Infants 10-12 months old (n=158) |
|--|--------------------------------------|--------------------------------------|--|
| Formula | 58.3 | 66.7 | 74.7 |
| Gluten-free porridge/gruel (rice, corn) | 38.6 | 82.1 | 87.3 |
| Gluten-containing porridge/gruel (semolina, wheat, multigrain) | 20.5 | 64.8 | 82.9 |
| Fruit juices | 37.8 | 67.3 | 81.0 |
| Water | 77.2 | 88.9 | 98.1 |
| Tea for children | 50.4 | 55.6 | 72.2 |
| Tea | 7.9 | 21.6 | 41.1 |
| Crust / bread / roll | 10.2 | 48.1 | 86.1 |
| Fruit purees | 55.1 | 84.6 | 95.6 |
| Purees / vegetable soups | 57.5 | 90.7 | 96.8 |
| Meat | 25.2 | 73.5 | 95.6 |
| Fishes | 13.4 | 50.6 | 75.9 |
| Egg yolk | 6.3 | 42.6 | 77.8 |
| Whole egg | 3.1 | 24.7 | 60.8 |
| Yoghurt / cottage cheese / cheeses | 17.3 | 43.8 | 79.1 |
| Cow's milk | 3.9 | 11.1 | 26.6 |
| Biscuits / sponge fingers | 11.8 | 53.1 | 86.7 |

4.2.2. Evaluation of feeding practices in infants aged 5-12 months

To evaluate the feeding practices, i.e. to analyse the food ration and nutrient profile in infants' diet the distinction was made between breastfed and non-breastfed infants, adjusted according to the menu records. There were 199 (44.5% out of n=447) breastfed infants, including 22 (4.9 out of n=447) exclusively breastfeed and 177 (39.6% out of n=447) non-exclusively breastfed, and 248 (55.5% out of n=447) who were not breastfed at all (Table 25).

Table 25. Current breastfeeding practice according to mothers' declaration and adjusted with the menu records

| Is the child breastfed currently ? | Mothers' declarations found in the questionnaire (number and share of answers) | | Numbers adjusted according to the diet records | |
|---|--|------|--|------|
| | N | % | N | % |
| YES, exclusively, no other fluids (including water) nor solid food are given to the child | 19 | 4,2 | 22 | 4,9 |
| YES, the child is breastfed and additionally receives water | 26 | 5,8 | 1 | 0,2 |
| YES, but it additionally receives formula, no other food is given to the child. | 11 | 2,5 | 5 | 1,1 |
| YES, but the complementary food was introduced | 112 | 25,1 | 148 | 33,1 |
| YES, but it additionally receives formula and complementary food was introduced | 25 | 5,6 | 23 | 5,2 |
| NO | 254 | 56,8 | 248 | 55,5 |

4.2.2.1. Feeding practices in breastfed infants (n=199)

In the study period (May-July 2016) the percentage of breastfed children was 44.5% (n=199/447), including 4.9% of exclusively breastfed infants (n=22/447)

Table 26 presents the data on the number of breastfed children in particular age groups, including the number of meals a day, number of meals consumed at night and the duration of the single feeding episode.

Table 26. Number of breastfeeding episodes and duration of a single breastfeeding episode in breastfed infants (n=199)

| Breastfeeding | Infants 5-6 months old (n=67/127) | | Infants 7-9 months old (n=75/162) | | Infants 10-12 months old (n=57/158) | | total count of breastfed infants (n=199/447) | |
|--|-----------------------------------|--------------------|-----------------------------------|--------------------|-------------------------------------|--------------------|--|--------------------|
| | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile |
| No. of feeding episodes per day | 8 | 6-9 | 6 | 5-8 | 5 | 3-7 | 6 | 5-8 |
| No. of feeding episodes at night | 2 | 1-3 | 2 | 1-3 | 2 | 1-3 | 2 | 1-3 |
| Duration of a single feeding episode [min] | 10.0 | 10-15 | 10 | 10-15 | 10 | 10-15 | 10 | 10-15 |

The presented data reveal that although there is a reduction in the number of meals the child become daily, the number of feeding episodes at night remains constant. The duration of a single feeding episodes ranges from 10 to 15 minutes.

Table 27 presents the data on the feeding arrangement in the studied infants.

Table 27. Feeding practices in breastfed infants (n=177*) -feeding arrangement (survey, questions C.I.2.; C.I.6.)

| Feeding arrangement | Percentage of infants consuming varied meals every day or at least 2-4 times a week* | | |
|---|--|-------------------------------|---------------------------------|
| | Infants 5-6 months old (n=47) | Infants 7-9 months old (n=73) | Infants 10-12 months old (n=57) |
| Recommended meals | | | |
| Morning meal / first breakfast | - | 90.4 | 93.0 |
| Forenoon meal / second breakfast | - | 89.0 | 94.7 |
| Early noon meal / soup | - | 82.2 | 87.7 |
| Noon meal / main course | - | 65.8 | 75.4 |
| Afternoon meal / tea time | - | 80.8 | 89.5 |
| Evening meal / supper | - | 83.6 | 89.5 |
| Additional meals | | | |
| bedtime meal | - | 68.5 | 56.1 |
| eating/drinking at night | - | 80.8 | 75.4 |
| snacks | - | 39.7 | 64.9 |
| Feeding type | | | |
| family meals | 0.0 | 15.1 | 40.4 |
| meals prepared separately for the child | 40.4 | 67.1 | 70.2 |
| Meals based on foods specifically manufactured for infants and young children | 17.0-48.9 | 19.2-61.6 | 22.8-71.9 |

* Exclusively breastfed infants were not included (n=22)
 - the data are insufficient to interpret them explicitly

The meal arrangement of the breastfed infants is associated with the age of the child and the amount of breast milk the child consumes. The significant percentage of children receiving meals based on foods specifically manufactured for infants and young children (food of special nutritional purpose), the percentage of children fed at night and receiving snacks between main meals as well as the number of older infants receiving normal adult food are also noteworthy.

Table 28 shows the data on the consumption of products/food from various groups in particular age groups.

Table 28. Food consumption in breastfed infants (n=177) - by age groups

| | Product group | Units | Infants 5-6 months old (n=47) | | Infants 7-9 months old (n=73) | | Infants 10-12 months old (n=57) | |
|----|-----------------------------------|-------|-------------------------------|--------------------|-------------------------------|--------------------|---------------------------------|--------------------|
| | | | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile |
| 1. | Cereal products and potatoes | | | | | | | |
| | mixed bread | gr | - | - | - | - | 13.3 | 0.3-35.0 |
| | flour, noodles | gr | - | - | 1.7 | 0.1-4.7 | 7.8 | 4.0-15.3 |
| | groats, rice, cereals | gr | - | - | 9.9 | 1.7-20.4 | 19.2 | 7.7-34.9 |
| 1A | Potatoes | gr | 5.8 | 0.0-15.9 | 15.2 | 6.3-40.0 | 28.5 | 16.3-62.1 |
| 2. | Vegetables and fruits | | | | | | | |
| | vegetables | gr | 67.8 | 30.7-93.3 | 179.3 | 65.7-253.6 | 200.7 | 134.9-276.9 |
| | fruits | gr | 32.3 | 0.0-67.8 | 66.3 | 37.9-100.7 | 87.2 | 52.3-119.3 |
| | fruits | gr | 13.8 | 0.0-52.6 | 88.7 | 19.4-161.0 | 106.7 | 56.7-178.8 |
| 3. | Milk and milk products | | | | | | | |
| | milk and fermented milk beverages | gr | - | - | 23.7 | 0.0-126.7 | 115.3 | 21.4-243.3 |
| | including fluid milk: | gr | - | - | 10.9 | 0.0-121.9 | 102.7 | 4.4-222.5 |
| | -cow's milk | gr | - | - | - | - | 76.4 | 1.0-138.3 |
| | -formula | gr | - | - | - | - | - | - |
| | fermented milk beverages | gr | - | - | - | - | - | - |
| | cottage cheese | gr | - | - | - | - | - | - |
| | rennet cheese | gr | - | - | - | - | - | - |
| 4. | Meat, sliced meats, fish and eggs | | | | | | | |
| | meat, poultry, sliced meats | gr | - | - | 6.7 | 1.7-14.7 | 23.6 | 10.0-39.6 |
| | fish | gr | - | - | - | - | - | - |
| 4A | Eggs | gr | - | - | - | - | 4.7 | 0.7-19.1 |
| 5. | Fats | | | | | | | |
| | animal: butter and cream | gr | - | - | 2.2 | 0.9-4.3 | 9.6 | 4.5-12.5 |
| | vegetable: oils | gr | - | - | - | - | 5.4 | 2.3-9.3 |
| 6. | Sugar and sweets | gr | - | - | - | - | 11.0 | 3.5-16.4 |

- average consumption <2 g

The older the child becomes, the wider the spectrum of consumed products gets. The oldest infants consume products from all food groups, which is associated with the increasing share of family meals in their diet.

Tables 29-31 present data on the average energy and nutritional value of complementary food in the diet of breastfed infants.

Table 29. Energy and nutritional value of complementary food in the diet of breastfed infants (n=177) - by age groups

| Macronutrients | Units | Infants 5-6 months old breastfed (n=47) | | Infants 7-9 months old breastfed (n=73) | | Infants 10-12 months old breastfed (n=57) | |
|---|-------|---|--------------|---|--------------|---|---------------|
| | | Median | 1-3 quartile | Median | 1-3 quartile | Median | 1-3 quartile |
| Energy | kJ | 324.1 | 180.0-803.5 | 1045.6 | 629.5-1653.3 | 2477.1 | 1691.0-3392.8 |
| Energy | kcal | 77.5 | 43.0-192.3 | 249.9 | 150.6-395.3 | 592.0 | 403.9-810.4 |
| Protein total | g | 2.5 | 0.8-4.5 | 7.8 | 4.0-12.8 | 20.0 | 15.3-25.9 |
| Fat | g | 2.6 | 0.5-8.5 | 5.5 | 2.6-11.0 | 15.3 | 11.6-23.4 |
| LCPUFA | mg | 1.2 | 0.0-35.8 | 7.3 | 0.0-42.8 | 15.4 | 5.0-47.6 |
| Carbohydrates total | g | 13.3 | 8.8-29.4 | 44.5 | 27.5-72.0 | 97.3 | 56.4-129.4 |
| Digestible carbohydrates | g | 13.0 | 7.0-28.3 | 40.7 | 25.4-65.7 | 91.9 | 51.1-123.6 |
| Sucrose | g | 2.1 | 1.0-4.4 | 6.0 | 2.7-10.5 | 12.7 | 7.3-19.7 |
| Lactose | g | 0.0 | 0.0-7.7 | 0.2 | 0.0-5.6 | 3.0 | 0.3-9.8 |
| Starch | g | 2.0 | 0.3-4.3 | 8.7 | 4.3-13.4 | 27.0 | 14.2-38.1 |
| Dietary fibre | g | 1.8 | 0.7-2.8 | 4.4 | 2.0-6.2 | 6.0 | 4.2-8.0 |
| Percentage of energy from proteins | % | 9.0 | 7.1-11.9 | 11.7 | 9.3-14.9 | 13.3 | 11.7-15.2 |
| Percentage of energy from fats | % | 25.4 | 8.0-38.1 | 20.1 | 15.9-30.3 | 23.9 | 19.9-29.0 |
| Percentage of energy from carbohydrates | % | 61.1 | 50.3-81.3 | 66.2 | 58.9-72.9 | 63.1 | 55.4-66.6 |

Table 30. Minerals in complementary food in the diet of breastfed infants (n=177) - by age groups

| Minerals | Units | Infants 5-6 months old breastfed (n=47) | | Infants 7-9 months old breastfed (n=73) | | Infants 10-12 months old breastfed (n=57) | |
|------------|-------|---|--------------|---|--------------|---|--------------|
| | | Median | 1-3 quartile | Median | 1-3 quartile | Median | 1-3 quartile |
| Sodium | mg | 48.4 | 13.6-85.5 | 171.4 | 63.1-334.6 | 558.7 | 322.5-850.2 |
| Potassium | mg | 221.2 | 143.0-381.7 | 555.6 | 381.7-809.1 | 922.3 | 726.8-1193.2 |
| Calcium | mg | 37.1 | 11.7-139.5 | 98.4 | 38.4-234.0 | 304.8 | 126.8-448.4 |
| Phosphorus | mg | 47.1 | 20.8-90.9 | 141.3 | 77.1-214.5 | 322.5 | 221.8-415.8 |
| Magnesium | mg | 13.6 | 9.1-26.3 | 42.8 | 25.6-64.6 | 77.8 | 57.8-104.3 |
| Iron | mg | 0.63 | 0.28-1.52 | 1.82 | 1.17-3.46 | 4.29 | 2.55-5.51 |
| Zinc | mg | 0.43 | 0.18-1.44 | 1.22 | 0.75-2.22 | 2.87 | 2.05-4.12 |
| Copper | mg | 0.07 | 0.04-0.15 | 0.20 | 0.11-0.28 | 0.30 | 0.23-0.42 |
| Manganese | mg | 0.13 | 0.06-0.25 | 0.43 | 0.23-0.66 | 0.75 | 0.44-1.07 |
| Iodine | µg | 6.08 | 1.91-29.69 | 20.12 | 7.05-50.14 | 55.56 | 27.57-78.99 |

Table 31. Vitamins in complementary food in the diet of breastfed infants (n=177) - by age groups

| Vitamins | Units | Infants 5-6 months old breastfed (n=47) | | Infants 7-9 months old breastfed (n=73) | | Infants 10-12 months old breastfed (n=57) | |
|---|-------|---|--------------|---|--------------|---|--------------|
| | | Median | 1-3 quartile | Median | 1-3 quartile | Median | 1-3 quartile |
| Vitamin A (retinol equivalent) | µg | 301.8 | 114.3-573.3 | 541.1 | 309.4-920.1 | 625.3 | 399.5-1098.6 |
| Vitamin E (alpha-tocopherol equivalent) | mg | 0.90 | 0.41-2.49 | 1.76 | 0.91-2.84 | 3.30 | 1.58-4.31 |
| Thiamine | mg | 0.07 | 0.03-0.20 | 0.19 | 0.12-0.44 | 0.54 | 0.28-0.68 |
| Riboflavin | mg | 0.07 | 0.03-0.30 | 0.23 | 0.12-0.42 | 0.50 | 0.35-0.79 |
| Niacin | mg | 1.02 | 0.33-1.88 | 2.61 | 1.40-3.98 | 5.37 | 3.50-6.99 |
| Vitamin B6 | mg | 0.13 | 0.09-0.21 | 0.38 | 0.22-0.57 | 0.68 | 0.45-0.86 |
| Vitamin B12 | µg | 0.14 | 0.00-0.46 | 0.38 | 0.09-0.79 | 1.07 | 0.66-1.66 |
| Vitamin D | µg | 0.3 | 0.0-2.2 | 0.8 | 0.1-3.1 | 2.1 | 0.9-4.0 |
| Vitamin C | mg | 17.1 | 5.2-29.7 | 36.4 | 13.0-63.2 | 48.9 | 27.8-66.8 |
| Folate (diet equivalent) | µg | 32.5 | 12.1-55.2 | 63.9 | 33.8-92.5 | 99.1 | 65.4-150.9 |
| Folic acid | µg | 0.0 | 0.0-20.3 | 2.4 | 0.0-15.4 | 8.1 | 0.0-42.2 |

The energy value of the complementary food did not differ from the recommendations (130/310/570 kcal – WHO 2005). It is noteworthy that the diet of the studied children contained low amounts of long-chain polyunsaturated fatty acids and vitamin D.

4.2.2.2. Feeding practices in non-breastfed infants (n=248)

The study revealed that the percentage of infants, who were never breastfed was 4,9% (n=22/447), whereas the percentage of those non-breastfed at the time of the study was 51.2% (n=248/447).

Table 32 presents the data on the feeding practices in non-breastfed infants.

Table 32. Feeding practices in non-breastfed infants (n=248) - feeding arrangement (survey, questions C.I.2.; C.I.6.)

| Meal organisation | Percentage of infants consuming varied meals every day or at least 2-4 times a week* | | |
|---|--|-------------------------------|----------------------------------|
| | Infants 5-6 months old (n=60) | Infants 7-9 months old (n=87) | Infants 10-12 months old (n=101) |
| Recommended meals | | | |
| Morning meal / first breakfast | 95.0 | 95.4 | 96.0 |
| Forenoon meal / second breakfast | 65.0 | 86.2 | 95.0 |
| Early noon meal / soup | 65.0 | 86.2 | 95.0 |
| Noon meal / main course | 51.7 | 78.2 | 88.1 |
| Afternoon meal / tea time | 83.3 | 90.8 | 95.0 |
| Evening meal / supper | 93.3 | 94.3 | 97.0 |
| Additional meals | | | |
| bedtime meal | 63.3 | 51.7 | 50.5 |
| eating/drinking at night | 71.7 | 55.2 | 58.4 |
| snacks | 38.3 | 62.1 | 77.2 |
| Feeding type | | | |
| family meals | 10.0 | 24.1 | 61.4 |
| meals prepared separately for the child | 63.3 | 69.0 | 67.3 |
| Meals based on foods specifically manufactured for infants and young children | 50.0-96.7 | 50.6-90.8 | 32.7-89.1 |
| meals not prepared at home | 10.0 | 6.9 | 6.9 |

Most of the non-breastfed children received 5-6 meals during the day. The percentage of children receiving snacks between main meals increased with age, which was accompanied by the reduction in the percentage of children fed or receiving drinks at night. Approximately 2/3 of the children received meals prepared separately for the child, whereas a significant increase in the percentage of children receiving family meals was observed. Almost every child consumed meals based on foods specifically manufactured for infants and young children.

Table 33 presents data on the selection of products in the diet of non-breastfed infants.

Table 33. Average daily food ration in non-breastfed infants (n=248) - by age groups

| | Product group | Units | Infants 5-6 months old (n=60) | | Infants 7-9 months old (n=87) | | Infants 10-12 months old (n=101) | |
|----|--------------------------------------|-------|-------------------------------------|-----------------------|-------------------------------------|-----------------------|-------------------------------------|-----------------------|
| | | | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile |
| 1. | Cereal products and potatoes | | | | | | | |
| | mixed bread | g | - | - | 1.0 | 0.0-6.7 | 9.7 | 1.0-30.0 |
| | flour, noodles | g | - | - | 5.0 | 1.8-10.1 | 8.7 | 5.2-14.8 |
| | groats, rice, cereals | g | 7.4 | 0.0-20.5 | 16.0 | 7.0-30.0 | 24.0 | 8.0-34.7 |
| 1A | Potatoes | g | 9.4 | 0.0-18.5 | 25.5 | 7.8-53.2 | 35.6 | 16.6-71.3 |
| 2. | Vegetables and fruits | | | | | | | |
| | vegetables | g | 112.8 | 63.8-187.9 | 181.5 | 131.4-253.4 | 228.4 | 157.4-316.3 |
| | fruits | g | 62.6 | 26.2-89.5 | 83.3 | 53.8-112.7 | 90.4 | 55.6-135.5 |
| | | g | 55.9 | 4.4-97.6 | 91.7 | 54.4-150.6 | 123.3 | 78.0-187.9 |
| 3. | Milk and milk products | | | | | | | |
| | milk and fermented milk beverages | g | 682.9 | 596.5-794.8 | 593.3 | 483.6-717.4 | 516.2 | 409.3-613.3 |
| | including fluid milk: | g | 668.3 | 588.1-782.5 | 582.5 | 483.0-709.2 | 488.7 | 400.7-588.7 |
| | - cow's milk | g | | | 21.4 | 0.0-67.4 | 59.7 | 8.1-112.6 |
| | -formula | g | 653.3 | 543.3-774.2 | 558.3 | 400.0-693.3 | 420.0 | 276.7-540.0 |
| | fermented milk beverages | g | - | - | - | - | 13.3 | 0.0-31.0 |
| | cottage cheese | g | - | - | - | - | 3.2 | 0.0-12.7 |
| | rennet cheese | g | - | - | - | - | - | - |
| 4. | Meat, sliced meats, fish and eggs | | | | | | | |
| | meat, poultry, sliced meats | g | 3.8 | 0.0-7.9 | 10.4 | 4.7-24.1 | 30.5 | 16.3-67.4 |
| | fish | g | - | - | - | - | - | - |
| 4A | Eggs | g | - | - | - | - | 9.1 | 1.6-20.5 |
| 5. | Fats | | | | | | | |
| | animal: butter and cream | g | - | - | - | - | 2.0 | 0.0-4.7 |
| | vegetable: oils | g | - | - | 2.4 | 1.0-4.4 | 4.5 | 2.2-6.7 |
| 6. | Sugar and sweets | g | 2.5 | 0.0-6.5 | 8.6 | 2.2-16.4 | 12.4 | 5.3-18.9 |

- average consumption <2 g

The selection of product groups for the average daily food ration for non-breastfed infants was diversified and variable. The amount of food products increased with age. The increasing amount of sugar and sweets consumed with the infant's diet, lack of fish meat and small amount of fat is noteworthy.

Tables 34-36 summarise the energy and nutritional value of the diet of non-breastfed infants in three age groups. Table 37 compares in turn the nutrient profile received by the non-breastfed infants with the population based consumption standards (EAR/AI).

Table 34. Energy and nutritional value of the diet of non-breastfed infants (n=248) - by age groups

| Macronutrients | Units | Infants 5-6 months old non-breastfed (n=60) | | Infants 7-9 months old non-breastfed (n=87) | | Infants 10-12 months old non-breastfed (n=101) | |
|-----------------------------------|-------|---|---------------|---|---------------|--|---------------|
| | | Median | 1-3 quartile | Median | 1-3 quartile | Median | 1-3 quartile |
| Energy | kJ | 2570.2 | 2184.7-2956.3 | 3095.1 | 2576.0-3694.4 | 3602.2 | 3101.5-4240.0 |
| Energy | kcal | 614.0 | 520.6-707.2 | 741.0 | 615.0-862.9 | 857.6 | 741.4-1014.6 |
| Protein total | g | 14.3 | 11.6-17.5 | 18.9 | 15.5-24.3 | 25.8 | 21.3-33.0 |
| Fat | g | 26.8 | 23.3-29.3 | 25.2 | 21.3-30.4 | 27.7 | 23.5-33.2 |
| LCPUFA | mg | 66.6 | 0.1-94.4 | 40.4 | 6.6-96.1 | 25.8 | 9.9-75.8 |
| Carbohydrates total | g | 79.9 | 67.6-98.3 | 107.6 | 88.9-131.0 | 129.7 | 112.8-153.0 |
| Digestible carbohydrates | g | 76.3 | 65.5-95.9 | 104.3 | 83.3-126.1 | 122.9 | 106.9-146.3 |
| Sucrose | g | 4.4 | 2.3-8.4 | 11.7 | 6.7-19.3 | 17.8 | 11.7-28.6 |
| Lactose | g | 39.7 | 21.0-53.3 | 27.7 | 17.2-39.1 | 25.7 | 16.8-36.4 |
| Starch | g | 3.7 | 1.4-13.1 | 11.7 | 6.5-24.8 | 23.4 | 15.1-36.5 |
| Dietary fibre | g | 5.2 | 2.8-7.3 | 7.8 | 5.4-9.1 | 8.2 | 6.7-9.3 |
| Percent of energy from proteins | % | 9.0 | 8.1-9.9 | 10.3 | 9.2-11.6 | 12.3 | 10.5-13.7 |
| Percent energy from fats | % | 39.9 | 32.8-43.6 | 32.4 | 28.6-36.1 | 29.5 | 26.2-32.4 |
| Percent energy from carbohydrates | % | 50.8 | 47.4-57.6 | 56.9 | 52.5-62.0 | 58.4 | 53.6-62.0 |

Table 35. Minerals in the diet of non-breastfed infants (n=248) - by age groups

| Minerals | Units. | Infants 5-6 months old non-breastfed (n=60) | | Infants 7-9 months old non-breastfed (n=87) | | Infants 10-12 months old non-breastfed (n=101) | |
|------------|--------|---|--------------|---|--------------|--|---------------|
| | | Median | 1-3 quartile | Median | 1-3 quartile | Median | 1-3 quartile |
| Sodium | mg | 210.0 | 181.9-289.0 | 388.7 | 242.8-578.6 | 712.8 | 435.8-1083.0 |
| Potassium | mg | 842.5 | 680.0-1009.3 | 1121.2 | 881.9-1301.4 | 1332.8 | 1132.3-1558.7 |
| Calcium | mg | 425.9 | 364.6-502.7 | 553.4 | 453.2-636.4 | 541.8 | 445.6-647.8 |
| Phosphorus | mg | 272.7 | 228.4-342.3 | 431.7 | 320.5-505.9 | 516.5 | 413.3-610.9 |
| Magnesium | mg | 65.5 | 51.5-75.8 | 81.9 | 65.6-100.0 | 108.3 | 87.1-126.8 |
| Iron | mg | 5.42 | 4.47-6.67 | 7.91 | 6.43-9.21 | 7.94 | 6.58-9.00 |
| Zinc | mg | 4.35 | 3.72-5.16 | 4.68 | 4.01-5.60 | 5.04 | 4.42-5.95 |
| Copper | mg | 0.42 | 0.35-0.49 | 0.45 | 0.39-0.53 | 0.50 | 0.43-0.56 |
| Manganese | mg | 0.34 | 0.20-0.62 | 0.56 | 0.40-0.88 | 0.86 | 0.65-1.18 |
| Iodine | µg | 92.33 | 77.97-109.08 | 100.65 | 81.90-122.39 | 100.51 | 79.76-120.68 |

Table 36. Vitamins in the diet of non-breastfed infants (n=248) - by age groups

| Vitamins | Units | Infants 5-6 months old non-breastfed (n=60) | | Infants 7-9 months old non-breastfed (n=87) | | Infants 10-12 months old non-breastfed (n=101) | |
|---|-------|---|--------------|---|--------------|--|--------------|
| | | Median | 1-3 quartile | Median | 1-3 quartile | Median | 1-3 quartile |
| Vitamin A (retinol equivalent) | µg | 955.8 | 630.3-1216.0 | 1126.3 | 788.8-1358.7 | 1018.1 | 808.7-1344.5 |
| Vitamin E (alpha-tocopherol equivalent) | mg | 7.97 | 6.88-8.89 | 7.87 | 6.61-9.17 | 8.04 | 6.03-9.52 |
| Thiamine | mg | 0.56 | 0.43-0.66 | 0.62 | 0.49-0.82 | 0.72 | 0.58-0.89 |
| Riboflavin | mg | 0.91 | 0.75-1.09 | 0.97 | 0.74-1.15 | 1.01 | 0.89-1.21 |
| Niacin | mg | 5.66 | 4.06-6.90 | 6.77 | 5.18-8.08 | 7.77 | 6.44-9.37 |
| Vitamin B6 | mg | 0.50 | 0.39-0.61 | 0.69 | 0.58-0.92 | 0.91 | 0.74-1.14 |
| Vitamin B12 | µg | 1.42 | 1.14-1.62 | 1.51 | 1.22-2.05 | 1.59 | 1.37-1.95 |
| Vitamin D | µg | 7.9 | 7.0-9.4 | 8.5 | 6.5-10.2 | 8.1 | 5.7-9.7 |
| Vitamin C | mg | 86.1 | 71.1-104.5 | 95.3 | 77.6-114.6 | 87.4 | 77.4-106.8 |
| Folate (diet equivalent) | µg | 156.8 | 132.2-191.8 | 165.9 | 140.5-192.7 | 171.5 | 144.5-196.4 |
| Folic acid | µg | 71.6 | 44.7-91.7 | 62.6 | 48.3-83.5 | 49.4 | 27.6-71.5 |

Table 37. Compliance with guidelines in non-breastfed infants (n=248)

| No | Nutrient | Units | Infants 5-12 months old non-breastfed (n=248) | | Reference | Reference value 0-6 m.o./7-12 m.o.l. | Percentage of children with insufficient intake |
|----|--------------------------|-------|---|--------------------|-----------------|--------------------------------------|---|
| | | | Median | Range 1-3 quartile | | | |
| 1 | Energy | kcal | 753.1 | 623.3-908.1 | EAR | 600/700 | 34.27 |
| 2 | Protein | g | 20.6 | 15.4-26.9 | AI | 10/14 | 10.48 |
| 3 | Fat | g | 26.4 | 22.9-31.3 | EAR | 37/43 | 95.16 |
| 4 | LCPUFA | mg | 0.0 | 0.0-0.1 | AI (>24 m.o.l.) | -- | -- |
| 5 | Digestible carbohydrates | g | 107.0 | 85.3-130.2 | AI | 60/95 | 22.18 |
| 6 | Dietary fibre | g | 7.4 | 5.4-8.9 | | lack | |
| 7 | Calcium | mg | 519.6 | 416.7-621.2 | AI | 200/260 | 1.61 |
| 8 | Phosphorus | mg | 427.5 | 318.1-536.5 | AI | 150/300 | 8.87 |
| 9 | Magnesium | mg | 86.5 | 67.3-115.0 | AI | 30/70 | 14.11 |
| 10 | Iron | mg | 7.5 | 5.5-8.8 | AI/EAR | 0.3/7 | 24.6 |
| 11 | Zinc | mg | 4.8 | 4.0-5.6 | AI/EAR | 2/2.5 | 0.81 |
| 12 | Copper | mg | 0.5 | 0.4-0.5 | AI | 0.2/0.3 | 4.84 |
| 13 | Iodine | µg | 98.8 | 79.4-118.7 | AI | 110/130 | 82.26 |
| 14 | Sodium | mg | 410.6 | 247.8-768.9 | AI | 120/370 | 30.24 |
| 15 | Potassium | mg | 1139.0 | 894.2-1400.6 | AI | 400/700 | 6.45 |
| 16 | Vitamin A | µg | 1021.2 | 764.8-1318.5 | AI | 400/500 | 4.03 |
| 17 | Thiamine (B1) | mg | 0.6 | 0.5-0.8 | AI | 0.2/0.3 | 1.61 |
| 18 | Riboflavin (B2) | mg | 1.0 | 0.8-1.2 | AI | 0.3/0.4 | 1.21 |
| 19 | Niacin | mg | 6.9 | 5.4-8.4 | AI | 2/4 | 6.85 |
| 20 | Vitamin B6 | mg | 0.7 | 0.6-1.0 | AI | 0.1/0.3 | 0.81 |
| 21 | Vitamin B12 | mg | 1.5 | 1.2-1.9 | AI | 0.4/0.5 | 0.81 |
| 22 | Vitamin C | mg | 88.4 | 75.0-110.3 | AI | 40/50 | 6.05 |
| 23 | Vitamin D | µg | 8.2 | 6.4-9.8 | AI | 10 | 75.4 |
| 24 | Vitamin E | mg | 7.9 | 6.6-9.2 | AI | 4/5 | 10.08 |
| 25 | Folate | µg | 166.8 | 137.7-194.8 | AI | 65/80 | 2.42 |

The analysis of the compliance with the consumption guidelines indicates the deficiency of fat, iodine and vitamin D in the diet of the non-breastfed-infants. The energy and iron deficiency was also observed in every third and fourth child, respectively.

4.2.3. Nutrition of children aged 13-36 months - retrospective data on feeding practices during first 6 months of life

56.2% (n=344/612) of children aged 13-36 months were breastfed at least till the end of the 6 month of age. According to the declaration of mothers, 21.4% of infants (n=118/551) were exclusively breastfed in their first 6 months of life. The difference in the total number of children in each sample (612 vs. 551) results from the fact, that the mothers of 61 children, who were breastfed at the time of the study, were not asked about the duration of exclusive breastfeeding. It is highly probable that this very high percentage of exclusively breastfed children is overestimated. It may be assumed that the mothers of children aged 13-36 months old could not exactly remember the duration of exclusive breastfeeding. Such finding may additionally result from the fact, that exclusive breastfeeding was not defined in the question, whereas its definition was included in the questionnaire on feeding practices in infants.

55.5% of children aged 7-36 months old (n=517/932) were breastfed for at least 6 full months. These data should, however, be used cautiously, as they apply to different populations and stem from a period of at least three years (infant group born between June 2015 and February 2016, whereas the post-infancy group included children born between June 2013 and July 2015).

Figure 4 presents the calculations concerning the percentage of children aged 13-36 months old, who were partially or exclusively breastfed in their first 6 months of life.

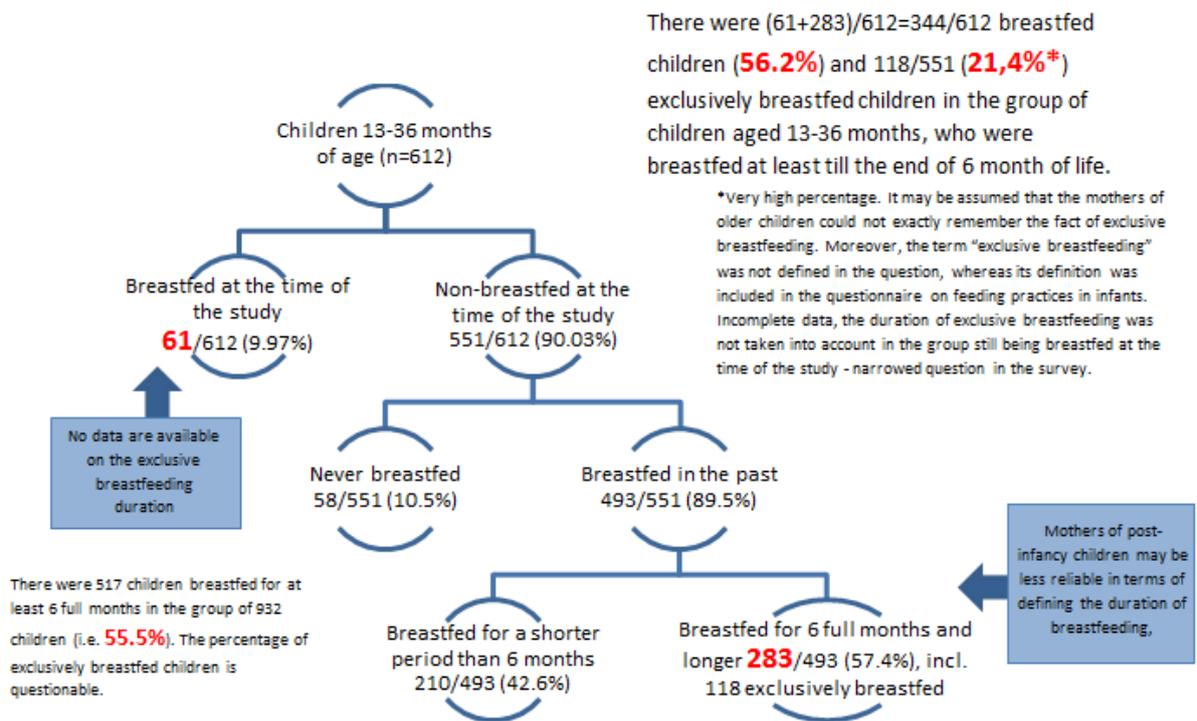


Figure 4. Breastfeeding during the first six months of life in the studied post-infancy children (retrospective data)

4.2.4. Evaluation of feeding practices in children aged 13-36 months (n=612)

During the study period (May-July 2016) the percentage of children aged 1-3 years, who were still at least partially breastfed was 10% (n=61/612). The children, who were not breastfed at all at the time of the study was therefore 90% (n=551/612). The performed analyses allowed us to assume that the breastfeeding did not significantly influence the average energy value of the diet. Therefore the feeding practices were analysed collectively for the entire group of children (n=612).

Table 38 shows data on the feeding practices in children aged 13-36 months.

Table 38. Feeding practices in post-infancy children (n=612) - feeding arrangement

| Feeding arrangement | Percentage of children aged 13-36 months consuming varied meals every day or at least 2-4 times a week* | | | | |
|---|---|-----------------------------------|-----------------------------------|-----------------------------------|---|
| | Children 13-18 months old (n=158) | Children 19-24 months old (n=148) | Children 25-30 months old (n=154) | Children 31-36 months old (n=152) | Children 13-36 months old total (n=612) |
| Breastfeeding | 23.4 | 10.8 | 4.5 | 0.7 | 10.0 |
| Recommended meals | | | | | |
| First breakfast | 98.7 | 99.3 | 99.4 | 100.0 | 99.3 |
| Second breakfast | 93.7 | 94.6 | 94.8 | 90.8 | 93.5 |
| Lunch / soup | 97.5 | 93.9 | 96.1 | 95.4 | 95.8 |
| Lunch / main course | 93.7 | 94.6 | 94.8 | 96.7 | 94.9 |
| Afternoon meal | 97.5 | 91.2 | 94.2 | 92.8 | 94.0 |
| Supper | 98.1 | 99.3 | 98.7 | 99.3 | 98.9 |
| Additional meals | | | | | |
| bedtime meal | 64.6 | 55.4 | 53.9 | 48.0 | 55.6 |
| eating/drinking at night | 55.7 | 43.9 | 35.7 | 32.2 | 42.0 |
| snacks | 82.9 | 82.43 | 88.31 | 86.84 | 85.1 |
| Feeding type | | | | | |
| family meals | 73.4 | 87.2 | 92.2 | 97.4 | 87.4 |
| meals prepared separately for the child | 47.5 | 27.7 | 18.8 | 10.5 | 26.3 |
| Meals based on foods specifically manufactured for infants and young children | 23.4-61.4 | 14.2-52.0 | 7.1-35.7 | 4.6-22.4 | 14.5-43.0 |
| meals not prepared at home | 3.8 | 4.1 | 5.2 | 0.0 | 3.3 |

The studied children aged 13-36 months consumed daily at least 5 meals, whereas every second child received a bedtime meal and drinks at night. Only approximately 15% of children did not eat snacks between main meals. A significant majority of children received family meals, and their share increased with age. However, a significant decrease in the share of foods specifically manufactured for infants and young children was observed.

Tables 39-40 present data on the consumption of different food groups in the diet of studied children aged 13-36 months.

Table 39. Average daily food ration in post-infancy children (n=612) - by age groups

| | Product group | Units | Consumption in the group of children aged 13-18 months (n=158) | | Consumption in the group of children aged 19-24 months (n=148) | | Consumption in the group of children aged 25-30 months (n=154) | | Consumption in the group of children aged 31-36 months (n=152) | |
|----|--|-------|--|--------------------|--|--------------------|--|--------------------|--|--------------------|
| | | | Median | Range 1-3 quartile |
| 1. | Cereal products and potatoes | | | | | | | | | |
| | mixed bread | g | 31.7 | 15.7-46.7 | 45.5 | 26.7-58.3 | 53.8 | 33.3-68.3 | 55.8 | 26.7-73.3 |
| | flour, noodles | g | 15.5 | 9.0-26.5 | 18.3 | 9.6-29.3 | 22.4 | 14.5-34.3 | 23.7 | 14.0-40.9 |
| | groats, rice, cereals | g | 19.0 | 9.0-32.5 | 22.2 | 9.1-34.2 | 15.6 | 7.2-29.1 | 16.5 | 7.2-28.9 |
| 1A | Potatoes | g | 54.5 | 27.0-97.0 | 73.1 | 40.4-117.9 | 74.6 | 46.3-118.2 | 88.7 | 51.9-131.9 |
| 2. | Vegetables and fruits | | | | | | | | | |
| | vegetables | g | 262.3 | 198.6-355.1 | 270.1 | 189.8-370.0 | 291.8 | 196.4-417.3 | 296.2 | 195.3-416.7 |
| | vegetables | g | 101.9 | 65.0-153.0 | 84.4 | 56.0-147.2 | 108.6 | 70.8-171.1 | 105.5 | 60.6-166.3 |
| | fruits | g | 156.9 | 98.9-226.7 | 174.6 | 100.8-241.1 | 171.7 | 98.0-286.4 | 186.7 | 94.6-265.6 |
| 3. | Milk and milk products | | | | | | | | | |
| | milk and fermented milk beverages | g | 356.6 | 181.1-506.7 | 334.5 | 205.0-490.8 | 276.9 | 174.6-399.0 | 290.1 | 140.8-434.8 |
| | including fluid milk: | g | 326.8 | 139.4-470.9 | 304.1 | 160.3-453.7 | 239.8 | 140.7-376.1 | 236.2 | 112.7-390.7 |
| | -cow's milk | g | 62.5 | 15.2-134.5 | 95.3 | 46.9-196.7 | 126.5 | 39.1-239.4 | 152.3 | 70.6-286.2 |
| | -formula | g | 187.8 | 0.0-380.0 | 53.3 | 0.0-316.7 | 0.0 | 0.0-200.0 | 0.0 | 0.0-0.0 |
| | fermented milk beverages | g | 15.4 | 0.0-50.0 | 22.9 | 0.0-54.0 | 19.1 | 0.0-57.5 | 26.7 | 0.0-51.7 |
| | cottage cheese | g | 9.5 | 0.0-36.7 | 12.2 | 3.0-31.0 | 17.3 | 5.3-50.7 | 14.3 | 0.0-46.7 |
| | rennet cheese | g | - | - | - | - | - | - | - | - |
| 4. | Meat, sliced meats, fish and eggs | | | | | | | | | |
| | meat, poultry, sliced meats | g | 53.7 | 34.0-77.6 | 70.6 | 47.5-104.6 | 75.8 | 50.1-102.1 | 77.0 | 57.5-106.3 |
| | fish | g | - | - | - | - | - | - | - | - |
| 4A | Eggs | g | 19.2 | 5.0-30.8 | 22.4 | 8.3-40.8 | 25.5 | 9.3-42.0 | 29.1 | 8.0-42.8 |
| 5. | Fats | | | | | | | | | |
| | animal: butter and cream | g | 12.6 | 7.7-18.2 | 16.9 | 10.5-22.6 | 19.2 | 13.2-29.4 | 20.2 | 14.8-31.4 |
| | animal: butter and cream | g | 6.6 | 3.3-11.8 | 8.8 | 6.0-14.7 | 11.1 | 7.2-18.3 | 12.3 | 7.4-18.1 |
| | vegetable: oils | g | 4.8 | 2.7-8.2 | 5.8 | 3.0-10.0 | 7.1 | 3.7-11.7 | 9.2 | 4.5-13.3 |
| 6. | Sugar and sweets | | | | | | | | | |
| | Sugar and sweets | g | 19.1 | 10.4-33.3 | 25.9 | 12.9-38.4 | 26.1 | 14.7-41.3 | 29.4 | 16.1-47.4 |

- average consumption < 2g

Table 40. Average daily food ration in post-infancy children (n=612) compared with model food ration

| | Product group | Units | Model food ration for children 13-36 months | Consumption in the studied group of children aged 13-36 months (n=612) | | Percentage of children with insufficient intake |
|-----|-----------------------------------|-------|---|--|--------------------|---|
| | | | | Median | Range 1-3 quartile | |
| 1. | Cereal products and potatoes | | | | | |
| | mixed bread | g | 20 | 45.0 | 25.0 – 63.3 | 16.3 |
| | flour, noodles | g | 25 | 19.3 | 11.4 – 32.8 | 62.6 |
| | groats, rice, cereals | g | 30 | 17.9 | 8.1 – 32.5 | 72.2 |
| 1A. | Potatoes | g | 100 | 70.8 | 41.8 – 116.3 | 66.7 |
| 2. | Vegetables and fruits | | | | | |
| | vegetables | g | 200 | 100.8 | 62.1 – 158.0 | 87.9 |
| | fruits | g | 250 | 170.3 | 99.1 – 251.9 | 74.3 |
| 3. | Milk and milk products | | | | | |
| | milk and fermented milk beverages | g | 550 | 309.2 | 172.2 – 455.7 | 88.1 |
| | including fluid milk: | g | 450 | 270.3 | 133.0 – 426.3 | 78.3 |
| | -cow's milk | g | -- | 103.5 | 41.5 – 227.8 | -- |
| | -formula | g | -- | 0.0 | 0.0 – 270.0 | -- |
| | fermented milk beverages | g | 100 | 20.7 | 0.0 – 53.3 | 91.4 |
| | cottage cheese | g | 10-15 | 13.3 | 2.1 – 43.3 | 43.6 |
| | rennet cheese | g | 2 | 0.0 | 0.0 – 5.7 | 59.6 |
| 4. | Meat, sliced meats, fish and eggs | | | | | |
| | meat, poultry, sliced meats | g | 20 | 68.8 | 43.8 – 100.5 | 7.5 |
| | fish | g | 10 | 0.0 | 0.0 – 5.7 | 77.5 |
| 4A. | Eggs | g | 25 | 22.7 | 6.8 – 41.3 | 53.9 |
| 5. | Fats | | | | | |
| | animal: butter and cream | g | 6 | 9.7 | 6.0 – 15.9 | 25.0 |
| | vegetable: oils | g | 10 | 6.6 | 3.3 – 10.9 | 71.7 |
| 6. | Sugar and sweets | g | 20 | 25.3 | 13.3 – 40.1 | 39.9 |

Table 40 compares the average daily food ration of post-infancy children with the model food ration. It is noteworthy that the consumption of milk, dairy products, vegetables, fruits and fish was insufficient, which was reflected in the abnormal nutrient profile in their diets (Table 44).

Tables 41-44 summarises data on the average nutritional and energy value of the diets of the post-infancy children.

Table 41. Energy and nutritional value of the diet of post-infancy children (n=612) by age groups

| Macronutrients | Units | Children 13-18 months old (n=158) | | Children 19-24 months old (n=148) | | Children 25-30 months old (n=154) | | Children 31-36 months old (n=152) | |
|-----------------------------------|-------|-----------------------------------|---------------|-----------------------------------|---------------|-----------------------------------|---------------|-----------------------------------|---------------|
| | | Median | 1-3 quartile |
| Energy | kJ | 4067.1 | 3404.4-4854.7 | 4595.1 | 3963.9-5428.7 | 5050.1 | 4071.5-5939.4 | 5075.2 | 4188.7-6200.2 |
| Energy | kcal | 971.3 | 812.9-1160.7 | 1097.7 | 946.7-1295.4 | 1206.3 | 973.5-1417.3 | 1210.2 | 1000.3-1480.8 |
| Protein total | g | 34.9 | 27.2-42.5 | 40.2 | 32.2-49.5 | 44.8 | 35.2-54.3 | 45.4 | 36.0-55.8 |
| Fat | g | 30.4 | 24.4-37.6 | 36.8 | 29.7-44.6 | 39.3 | 31.1-50.3 | 40.8 | 31.8-53.0 |
| LCPUFA | mg | 33.0 | 12.8-70.3 | 41.2 | 21.5-92.7 | 38.4 | 22.3-86.7 | 35.8 | 18.0-65.2 |
| Carbohydrates total | g | 144.4 | 118.3-176.4 | 158.5 | 133.7-185.3 | 171.1 | 138.4-203.8 | 173.3 | 138.4-211.2 |
| Digestible carbohydrates | g | 135.9 | 112.0-166.4 | 149.5 | 127.7-174.9 | 162.3 | 131.2-192.8 | 162.3 | 132.3-199.7 |
| Sucrose | g | 30.9 | 20.5-45.0 | 37.0 | 25.0-52.5 | 43.5 | 30.2-60.2 | 41.3 | 30.9-63.5 |
| Lactose | g | 16.6 | 8.0-29.1 | 17.0 | 9.7-27.4 | 14.9 | 9.7-25.1 | 14.2 | 7.8-23.1 |
| Starch | g | 45.0 | 30.5-56.1 | 56.5 | 42.0-73.9 | 63.7 | 49.9-81.7 | 67.3 | 48.8-82.4 |
| Dietary fibre | g | 9.1 | 7.2-11.2 | 9.6 | 7.5-11.5 | 10.0 | 7.7-12.9 | 10.3 | 7.4-13.6 |
| Percent of energy from proteins | % | 14.1 | 12.1-15.9 | 14.4 | 12.8-16.3 | 14.8 | 13.2-17.2 | 15.2 | 13.2-16.9 |
| Percent energy from fats | % | 28.7 | 24.1-32.5 | 29.9 | 26.4-33.6 | 30.1 | 26.1-33.7 | 30.4 | 26.6-33.1 |
| Percent energy from carbohydrates | % | 57.1 | 53.1-62.6 | 55.3 | 51.0-59.3 | 54.3 | 49.8-59.6 | 55.2 | 50.7-58.8 |

Table 42. Minerals in the diet of post-infancy children (n=612) - by age groups

| Minerals | | Children 13-18 months old (n=158) | | Children 19-24 months old (n=148) | | Children 25-30 months old (n=154) | | Children 31-36 months old (n=152) | |
|------------|----|-----------------------------------|---------------|-----------------------------------|---------------|-----------------------------------|---------------|-----------------------------------|---------------|
| | | Median | 1-3 quartile |
| Sodium | mg | 1111.4 | 78.2-1510.4 | 1469.8 | 1188.8-1929.8 | 1731.8 | 1318.1-2103.8 | 1805.9 | 1388.1-2166.6 |
| Potassium | mg | 1514.0 | 1244.8-1801.3 | 1677.1 | 1397.8-2069.4 | 1854.7 | 1422.2-2243.3 | 1881.3 | 1426.6-2278.1 |
| Calcium | mg | 534.9 | 388.1-685.2 | 546.4 | 424.6-695.8 | 543.9 | 416.3-706.0 | 562.6 | 400.5-770.2 |
| Phosphorus | mg | 608.4 | 471.1-711.3 | 680.5 | 559.3-828.4 | 755.7 | 599.9-895.6 | 783.1 | 608.8-945.2 |
| Magnesium | mg | 127.8 | 104.3-155.2 | 145.8 | 117.8-179.4 | 167.9 | 136.9-198.8 | 170.7 | 132.1-207.1 |
| Iron | mg | 7.20 | 5.14-9.06 | 6.96 | 5.43-9.18 | 7.00 | 5.46-8.90 | 6.86 | 5.13-8.38 |
| Zinc | mg | 5.44 | 4.27-6.54 | 5.71 | 4.70-6.78 | 5.80 | 4.36-6.72 | 5.91 | 4.29-6.95 |
| Copper | mg | 0.53 | 0.43-0.65 | 0.58 | 0.46-0.70 | 0.66 | 0.50-0.78 | 0.65 | 0.48-0.83 |
| Manganese | mg | 1.32 | 0.93-1.75 | 1.63 | 1.16-2.00 | 1.91 | 1.38-2.33 | 1.91 | 1.33-2.66 |
| Iodine | µg | 86.9 | 64.2-110.8 | 94.3 | 69.7-116.4 | 90.1 | 64.8-114.1 | 83.9 | 64.5-107.9 |

Table 43. Vitamins in the diet of post-infancy children (n=612) - by age groups

| Vitamins | Units | Children 13-18 months old (n=158) | | Children 19-24 months old (n=148) | | Children 25-30 months old (n=154) | | Children 31-36 months old (n=152) | |
|---|-------|-----------------------------------|--------------|-----------------------------------|--------------|-----------------------------------|--------------|-----------------------------------|--------------|
| | | Median | 1-3 quartile |
| Vitamin A (retinol equivalent) | µg | 943.6 | 644.1-1275.6 | 870.1 | 634.1-1159.0 | 787.3 | 559.0-1126.6 | 714.4 | 527.3-1041.3 |
| Vitamin E (alpha-tocopherol equivalent) | mg | 5.9 | 4.3-7.9 | 5.2 | 3.9-7.7 | 5.7 | 4.2-7.1 | 5.4 | 3.7-7.2 |
| Thiamine | mg | 0.66 | 0.54-0.92 | 0.71 | 0.56-0.92 | 0.79 | 0.61-1.11 | 0.78 | 0.59-0.99 |
| Riboflavin | mg | 1.05 | 0.81-1.27 | 1.13 | 0.89-1.41 | 1.25 | 0.96-1.46 | 1.25 | 0.97-1.54 |
| Niacin | mg | 7.98 | 6.29-10.19 | 8.26 | 6.82-10.95 | 9.52 | 6.90-11.77 | 9.45 | 7.26-11.42 |
| Vitamin B6 | mg | 0.99 | 0.78-1.20 | 1.00 | 0.85-1.33 | 1.14 | 0.92-1.48 | 1.15 | 0.94-1.42 |
| vitamin B12 | µg | 1.77 | 1.34-2.34 | 2.07 | 1.56-2.83 | 2.05 | 1.53-2.87 | 2.18 | 1.62-2.83 |
| vitamin D | µg | 5.52 | 2.10-7.80 | 4.88 | 1.72-6.97 | 2.74 | 1.43-5.57 | 1.78 | 1.13-4.19 |
| Vitamin C | mg | 89.5 | 56.3-124.2 | 81.0 | 58.5-108.2 | 81.8 | 53.9-119.2 | 83.4 | 48.0-119.5 |
| Folate (diet equivalent) | µg | 161.3 | 119.8-193.7 | 156.7 | 129.6-199.6 | 162.4 | 132.4-203.1 | 166.7 | 129.9-201.4 |
| Folic acid | µg | 26.0 | 1.3-50.3 | 18.8 | 0.0-42.1 | 0.0 | 0.0-33.0 | 0.0 | 0.0-17.9 |

Table 44. Nutrient profile in the diet of post-infancy children compared to nutritional guidelines (13-36 months of age; n=612)

| Nutrients | | Children aged 13-36 months (n=612) | | Reference EAR / AI* | Percentage of children with insufficient intake |
|---|------|------------------------------------|---------------|---------------------|---|
| | | Median | 1-3 quartile | | |
| Energy | kJ | 4638.0 | 3826.1-5693.4 | -- | |
| Energy | kcal | 1105.2 | 913.6-1355.9 | 1000 | 36.6 |
| Protein total | g | 40.7 | 32.1-50.6 | 12 | 0.3 |
| Fat | g | 36.3 | 28.6-46.7 | 39 | 58.7 |
| LCPUFA | mg | 37.1 | 18.5-76.5 | 250* | 99.0 |
| Carbohydrates total | g | 161.2 | 131.2-195.1 | -- | -- |
| Digestible carbohydrates | g | 152.4 | 123.7-183.7 | 100 | 11.1 |
| Sucrose | g | 38.2 | 25.6-53.7 | -- | -- |
| Lactose | g | 15.7 | 8.6-26.6 | -- | -- |
| Starch | g | 56.4 | 42.0-75.1 | -- | -- |
| Dietary fibre | g | 9.6 | 7.4-12.4 | 10* | 56.4 |
| Percent of energy from proteins | % | 14.6 | 12.9-16.7 | -- | -- |
| Percent energy from fats | % | 29.6 | 26.1-33.2 | -- | -- |
| Percent energy from carbohydrates | % | 55.5 | 51.2-59.9 | -- | -- |
| Percent energy from sucrose | % | 13.9 | 10.0-18.0 | <10% | 25.2 |
| Minerals | | | | | |
| Sodium | mg | 1541.8 | 1122.9-1944.9 | 750* | 9.3 |
| Potassium | mg | 1711.3 | 1361.7-2110.2 | 2400* | 87.4 |
| Calcium | mg | 546.7 | 414.2-707.8 | 500 | 42.3 |
| Phosphorus | mg | 685.8 | 556.0-855.4 | 380 | 5.4 |
| Magnesium | mg | 150.2 | 119.0-187.6 | 65 | 2.0 |
| Iron | mg | 6.98 | 5.35-8.85 | 3 | 2.0 |
| Zinc | mg | 5.68 | 4.44-6.72 | 2,5 | 2.0 |
| Copper | mg | 0.60 | 0.46-0.74 | 0,25 | 1.1 |
| Manganese | mg | 1.66 | 1.16-2.20 | -- | -- |
| Iodine | µg | 88.9 | 65.1-112.5 | 65 | 27.5 |
| Vitamins | | | | | |
| Vitamin A (retinol equivalent) | µg | 829.8 | 585.4-1155,7 | 280 | 3.4 |
| Vitamin E (alpha-tocopherol equivalent) | mg | 5.6 | 4.0-7,5 | 6* | 59.2 |
| Thiamine | mg | 0.73 | 0.57-0.98 | 0.4 | 7.0 |
| Riboflavin | mg | 1.15 | 0.90-1.44 | 0.4 | 1.8 |
| Niacin | mg | 8.60 | 6.78-11.26 | 5 | 10.1 |
| Vitamin B6 | mg | 1.07 | 0.86-1.35 | 0.4 | 1.1 |
| vitamin B12 | µg | 2.00 | 1.50-2.77 | 0.7 | 3.1 |
| vitamin D | µg | 3.49 | 1.43-6.36 | 10 | 94.4 |
| Vitamin C | mg | 83.1 | 54.0-118.1 | 30 | 7.5 |
| Folate (diet equivalent) | µg | 161.1 | 127.5-201.1 | 120 | 20.8 |
| Folic acid | µg | 7.7 | 0.0-39.3 | -- | |

The analysis of the nutrient profile of the diet of children aged 13-36 months revealed the differentiated energy value and significantly higher protein consumption in comparison to population-based standards (EAR/AI). The share of sucrose-derived energy in 74.8% of children was higher in comparison to guidelines (sucrose-derived energy<10%). The diet of almost every studied child was deficient in long-chain polyunsaturated fatty acids (LC PUFA), vitamin D and potassium (99.0%, 94.4% and 87.4% respectively). Insufficient consumption of fat, vitamin E, calcium and fibre was observed in every second child, whereas energy- and iodine-deficient diet was observed in every third child. Overconsumption of sodium was noted in 90.7% of children.

4.3. Identification of environmental, nutritional factors, which influence the nutritional status of children

Tables 45-61 present the influence of environmental factors, including nutritional ones, on the nutritional status of the studied children.

4.3.1. Breastfed infants

Tables 45-49 present the relationship between the nutritional status of breastfed infants and the feeding practice, as well as familial and environmental conditions. A trend towards the association between the nutritional status of the studied children and the nutritional status of their parents and place of residence was observed (Table 45). The children of overweight mothers more frequently showed body mass deficiency. The parents of infants with excessive body mass and risk thereof more commonly lived in the rural areas. More common consumption of additional meals (bedtime meals) and snacks was observed in infants with excessive body mass and risk thereof.

Table 45. Comparison of environmental factors in breastfed infant groups, which differ in nutritional status

| Variables | Infants with body mass deficit (n=27) | | Infants with normal body mass (n=121) | | Infants with excessive body mass and risk thereof (n=29) | | Statistical test and p value | |
|--|---------------------------------------|--------|---------------------------------------|--------|--|--------|-----------------------------------|--------------------------|
| Age [months] median (range 1-3 quartile) | 6.4 (5.3-9.2) | | 7.1 (5.9-9.2) | | 9.4 (6.1-11.0) | | Anova rank Kruskal-Wallis; p=0.08 | |
| Gender [%] boys girls | 51.9 48.2 | | 49.6 50.4 | | 62.1 37.9 | | Chi ² ; p=0.5 | |
| Parent's educational background [%] | Mother | Father | Mother | Father | Mother | Father | Mother | Father |
| primary | 3.7 | 0.0 | 0.8 | 2.6 | 0.0 | 3.6 | Chi ² ; p=0.2 | Chi ² ; p=0.8 |
| vocational | 7.4 | 24.0 | 3.3 | 14.5 | 13.8 | 17.9 | | |
| secondary | 44.4 | 36.0 | 35.5 | 45.3 | 27.6 | 35.7 | | |
| higher | 44.4 | 40.0 | 60.3 | 37.6 | 58.6 | 42.9 | | |
| Place of residence [%] | | | | | | | Chi ² ; p=0.06 | |
| agglomerations | 0.0 | | 20.7 | | 13.8 | | | |
| large city | 22.2 | | 12.4 | | 17.2 | | | |
| city | 22.2 | | 8.3 | | 3.5 | | | |
| town | 25.9 | | 21.5 | | 17.2 | | | |
| rural area | 29.6 | | 37.2 | | 48.3 | | | |
| BMI [%parents] | Mother | Father | Mother | Father | Mother | Father | Mother | Father |
| underweight (BMI<18.5) | 3.7 | 0.0 | 2.5 | 0.9 | 13.8 | 0.0 | Chi ² ; p=0.06 | Chi ² ; p=0.8 |
| normal (BMI≥18.5 i <25) | 51.9 | 39.1 | 71.7 | 35.3 | 65.5 | 28.6 | | |
| overweight (BMI≥25 i <30) | 29.6 | 39.1 | 19.2 | 51.7 | 17.2 | 53.6 | | |
| obesity (BMI≥30) | 18.8 | 21.7 | 6.7 | 12.1 | 3.5 | 17.9 | | |

* p<0.05

Table 46. Timing of introduction of complementary food in breastfed infants, who differ in nutritional status (n=177)

| Introduction of complementary food | Infants with body mass deficit (n=27) | Infants with normal body mass (n=121) | Infants with excessive body mass and risk thereof (n=29) | Statistical test and p value |
|------------------------------------|---------------------------------------|---------------------------------------|--|------------------------------|
| Before 5. month of life | 59.3 | 39.7 | 37.9 | Chi ² ; p=0.3 |
| Between 5. and 6. month of life | 33.3 | 51.2 | 48.3 | |
| After 6. month of life | 0.0 | 1.7 | 3.5 | |
| No data available | 7.4 | 7.4 | 10.3 | |

* p<0.05

Table 47. Comparison of the number of breastfeeding episodes in breastfed infants, who differ in nutritional status (n=177)

| Breastfeeding | Infants with body mass deficit (n=27) | | Infants with normal body mass (n=121) | | Infants with excessive body mass and risk thereof (n=29) | | Statistical test and p value |
|--|---------------------------------------|--------------------|---------------------------------------|--------------------|--|--------------------|----------------------------------|
| | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile | |
| No. of feeding episodes per day | 5 | 4-6 | 7 | 4-8 | 6 | 5-8.5 | Kruskal-Wallis ANOVA rank; p=0.1 |
| No. of feeding episodes at night | 3 | 1-3 | 2 | 1.5-3 | 2 | 1.5-3 | Kruskal-Wallis ANOVA rank; p=0.4 |
| Duration of a single feeding episode [min] | 10.0 | 10-15 | 10 | 10-15 | 10 | 7-15 | Kruskal-Wallis ANOVA rank; p=0.2 |

* p<0.05

Table 48. Comparison of feeding arrangement in breastfed infant groups, which differ in nutritional status (n=177)

| Feeding arrangement | Percentage of infants consuming varied meals every day or at least 2-4 times a week* | | | Statistical test and p value |
|--|--|---------------------------------------|--|------------------------------|
| | Infants with body mass deficit (n=27) | Infants with normal body mass (n=121) | Infants with excessive body mass and risk thereof (n=29) | |
| Recommended meals | | | | |
| Morning meal / First breakfast | 74.1 | 87.6 | 79.3 | Chi2; p=0.3 |
| Forenoon meal / Second breakfast | 74.1 | 84.3 | 82.8 | Chi2; p=0.3 |
| Early midday meal / soup | 74.1 | 74.4 | 75.9 | Chi2; p=0.7 |
| Midday meal / main course | 48.1 | 58.7 | 69.0 | Chi2; p=0.3 |
| Afternoon meal / tea time | 59.3 | 76.0 | 75.9 | Chi2; p=0.5 |
| Evening meal / supper | 6.7 | 82.6 | 79.3 | Chi2; p=0.1 |
| Additional meals | | | | |
| bedtime meal | 48.1 | 54.5 | 72.4 | Chi2; p=0.04* |
| eating/drinking at night | 66.7 | 71.1 | 82.8 | Chi2; p=0.7 |
| snacks | 29.6 | 39.7 | 62.1 | Chi2; p=0.03* |
| Feeding type | | | | |
| family meals | 25.9 | 15.7 | 27.6 | Chi2; p=0.6 |
| meals prepared separately for the child | 51.9 | 64.5 | 55.2 | Chi2; p=0.6 |
| Meals based on foods specifically manufactured for infants and young children | | | | |
| Formula | 18.5 | 24.8 | 20.7 | Chi2; p=0.8 |
| Soups / dinners | 51.9 | 50.4 | 37.9 | Chi2; p=0.9 |
| Groats / gruels | 44.4 | 56.2 | 58.6 | Chi2; p=0.1 |
| Fruits puree, desserts | 51.9 | 56.2 | 55.2 | Chi2; p=0.2 |
| Juices drinks | 37.0 | 30.6 | 20.7 | Chi2; p=0.2 |
| Tea | 37.0 | 25.6 | 31.0 | Chi2; p=0.4 |

* p<0.05

Table 49. Comparison of energy value, macronutrient supply and distribution of sources of energy in breastfed infants, who differ in nutritional status (n=177)

| Energy and nutrients | Units | Infants with body mass deficit (n=27) | | Infants with normal body mass (n=121) | | Infants with excessive body mass and risk thereof (n=29) | | p value for Kruskal-Wallis Anova rank test |
|-----------------------------------|-------|---------------------------------------|--------------------|---------------------------------------|--------------------|--|--------------------|--|
| | | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile | |
| Energy | kcal | 174.3 | 42.1-592.0 | 294 | 140.0-570.3 | 296.2 | 185.7-714.7 | 0.2 |
| Protein total | g | 5.6 | 0.9-16.1 | 8.9 | 3.5-16.9 | 12.5 | 6.3-27.3 | 0.09 |
| Fat | g | 3.7 | 0.9-15.3 | 7.7 | 2.6-16.1 | 9.5 | 5.4-19.0 | 0.1 |
| Carbohydrates total | g | 33.7 | 8.8-85.9 | 46.6 | 22.6-90.6 | 46.5 | 29.6-97.3 | 0.3 |
| Sucrose | g | 4.9 | 1.9-15.4 | 6.1 | 2.3-11.1 | 7.2 | 2.1-18.8 | 0.7 |
| Dietary fibre | g | 2.4 | 1.1-7.3 | 4.3 | 2.0-6.6 | 4.1 | 2.0-5.5 | 0.4 |
| Percent of energy from proteins | % | 10.4 | 7.5-14.3 | 11.7 | 9.2-14.4 | 12.8 | 10.5-15.2 | 0.3 |
| Percent energy from fats | % | 18.8 | 13.5-30.7 | 22.3 | 16.6-31.6 | 25.8 | 20.9-38.1 | 0.1 |
| Percent energy from carbohydrates | % | 67.2 | 55.9-73.5 | 63.7 | 55.1-72.2 | 59.6 | 48.9-67.1 | 0.06 |

* p<0.05

4.3.2. Non-breastfed infants

Tables 50-55 present the relationship between the nutritional status of non-breastfed infants and the feeding practice, as well as familial and environmental conditions. A trend towards the association between the nutritional status of the studied children and the nutritional status of their parents was observed (Table 50). The children of overweight mothers more frequently showed excessive body mass and risk thereof. The studied groups were significantly differentiated by the higher share of carbohydrate-derived energy and lower share of fat-derived energy (Table 54). It is noteworthy that a significant percentage of non-breastfed infants with body mass deficiency exhibited an insufficient dietary intake of iron, zinc and folates (Table 55).

Table 50. Comparison of environmental factors in non-breastfed infant groups, which differ in nutritional status (n=248)

| Variables | Infants with body mass deficit (n=33) | | Infants with normal body mass (n=165) | | Infants with excessive body mass and risk thereof (n=50) | | Statistical test and p value | |
|-------------------------------------|---|---------------|---------------------------------------|----------------|--|----------------|------------------------------|-------------------------------------|
| | Age [months] median (range 1-3 quartile) | 6.1 (5.3-8.8) | | 8.2 (6.2-10.5) | | 9.3 (8.1-11.2) | | Kruskal-Wallis Anova rank; p=0.003* |
| Gender [%] boys girls | 48.5 51.5 | | 47.3 52.7 | | 50.0 50.0 | | Chi ² ; p=0.9 | |
| Parent's educational background [%] | Mother | Father | Mother | Father | Mother | Father | Mother | Father |
| primary | 3.0 | 9.4 | 1.8 | 6.0 | 6.0 | 6.5 | Chi ² ; p=0.3 | Chi ² ; p=0.3 |
| vocational | 24.2 | 46.9 | 17.6 | 24.2 | 24.0 | 30.4 | | |
| secondary | 51.5 | 31.3 | 41.8 | 43.1 | 36.0 | 39.1 | | |
| higher | 21.2 | 12.5 | 38.8 | 25.8 | 34.0 | 23.9 | | |
| Place of residence [%] | | | | | | | Chi ² ; p=0.7 | |
| agglomerations | 3.0 | | 12.7 | | 6.0 | | | |
| large city | 15.2 | | 10.9 | | 12.0 | | | |
| city | 15.2 | | 9.7 | | 8.0 | | | |
| town | 24.2 | | 29.1 | | 32.0 | | | |
| countryside | 42.4 | | 37.6 | | 42.0 | | | |
| BMI [%parents] | Mother | Father | Mother | Father | Mother | Father | Mother | Father |
| underweight (BMI<18.5) | 3.0 | 0.0 | 6.1 | 1.3 | 4.0 | 0.0 | Chi ² ; p=0.08 | Chi ² ; p=0.5 |
| normal (BMI≥18.5 and <25) | 60.6 | 51.6 | 64.0 | 32.9 | 46.0 | 30.4 | | |
| overweight (BMI≥25 and <30) | 21.2 | 35.5 | 22.6 | 48.3 | 28.0 | 52.2 | | |
| obesity (BMI≥30) | 15.2 | 12.9 | 7.3 | 17.5 | 22.0 | 17.4 | | |

* p<0.05

Table 51. Timing of introduction of complementary food in non-breastfed infants, who differ in nutritional status (n=248)

| Introduction of complementary food | Infants with body mass deficit (n=33) | Infants with normal body mass (n=165) | Infants with excessive body mass and risk thereof (n=50) | Statistical test and p value |
|------------------------------------|---------------------------------------|---------------------------------------|--|------------------------------|
| Before 5. month of life | 87.9 | 79.4 | 70.0 | Chi ² ; p=0.2 |
| Between 5. and 6. month of life | 9.1 | 19.4 | 28.0 | |
| After 6. month of life | 0.0 | 0.6 | 2.0 | |
| No data available | 3.0 | 0.6 | 0.0 | |

* p<0.05

Table 52. Comparison of feeding arrangement in non-breastfed infant groups, which differ in nutritional status (n=248)

| Feeding arrangement | Percentage of infants consuming varied meals every day or at least 2-4 times a week* | | | Statistical test and p value |
|--|--|---------------------------------------|--|------------------------------|
| | Infants with body mass deficit (n=33) | Infants with normal body mass (n=165) | Infants with excessive body mass and risk thereof (n=50) | |
| Recommended meals | | | | |
| Morning meal / First breakfast | 93.9 | 95.8 | 96.0 | Chi2; p=0.9 |
| Forenoon meal / Second breakfast | 90.9 | 92.7 | 90.0 | Chi2; p=0.5 |
| Early midday meal / soup | 75.8 | 87.3 | 82.0 | Chi2; p=0.02* |
| Midday meal / main course | 63.6 | 78.2 | 76.0 | Chi2; p=0.5 |
| Afternoon meal / tea time | 93.9 | 89.7 | 92.0 | Chi2; p=0.7 |
| Evening meal / supper | 93.9 | 95.2 | 96.0 | Chi2; p=0.4 |
| Additional meals | | | | |
| bedtime meal | 51.5 | 54.5 | 54.0 | Chi2; p=0.9 |
| eating/drinking at night | 60.6 | 61.8 | 56.0 | Chi2; p=0.5 |
| snacks | 45.5 | 63.6 | 70.0 | Chi2; p=0.07 |
| Feeding type | | | | |
| family meals | 33.3 | 35.2 | 40.0 | Chi2; p=0.2 |
| meals prepared separately for the child | 57.6 | 70.3 | 62.0 | Chi2; p=0.6 |
| Meals based on foods specifically manufactured for infants and young children | | | | |
| Formula | 87.9 | 92.1 | 92.0 | Chi2; p=0.4 |
| Soups / dinners | 57.6 | 59.4 | 54.0 | Chi2; p=0.9 |
| Groats / gruels | 57.6 | 73.9 | 70.0 | Chi2; p=0.1 |
| Fruits puree, desserts | 54.5 | 59.4 | 62.0 | Chi2; p=0.9 |
| Juices drinks | 48.5 | 50.9 | 44.0 | Chi2; p=0.1 |
| Tea | 42.4 | 45.5 | 42.0 | Chi2; p=0.8 |

* p<0.05

Table 53. Comparison of average daily food ration in non-breastfed infants, who differ in nutritional status (n=248)

| | Product group | Units | Infants with body mass deficit (n=33) | | Infants with normal body mass (n=165) | | Infants with excessive body mass and risk thereof (n=50) | | p value for Kruskal-Wallis Anova rank test |
|---------------|-------------------------------------|-------|---------------------------------------|--------------------|---------------------------------------|--------------------|--|--------------------|--|
| | | | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile | |
| 1. | Cereal products and potatoes | | | | | | | | |
| | mixed bread | g | 0.0 | 0.0-3.3 | 0.7 | 0.0-11.7 | 5.8 | 0.0-20.0 | 0.02* |
| | flour, noodles | g | 3.5 | 0.1-10.1 | 5.2 | 1.5-9.9 | 5.6 | 1.8-10.6 | 0.4 |
| | groats, rice, cereals | g | 8.3 | 0.4-22.6 | 18.0 | 5.8-31.6 | 15.8 | 7.1-30.5 | 0.1 |
| 1A | Potatoes | g | 20.3 | 5.3-57.7 | 20.3 | 5.8-43.3 | 25.8 | 18.4-64.4 | 0.1 |
| 2. | Vegetables and fruits | | | | | | | | |
| | vegetables | g | 70.8 | 22.7-109.1 | 84.4 | 57.2-121.7 | 68.7 | 49.4-102.7 | 0.05 |
| | fruits | g | 77.8 | 14.5-111.6 | 101.9 | 55.7-158.2 | 97.4 | 59.8-145.8 | 0.04* |
| 3. | Milk and milk products | | | | | | | | |
| | milk and fermented milk beverages | g | 580.0 | 470.0-713.1 | 593.3 | 466.7-695.7 | 556.6 | 446.7-720.0 | 0.6 |
| | including fluid milk: | g | 580.0 | 470.0-700.2 | 580.8 | 466.7-695.0 | 548.9 | 428.9-720.0 | 0.5 |
| | -cow's milk | g | 22.7 | 0.0-60.0 | 30.4 | 0.0-85.4 | 27.7 | 0.0-79.2 | 0.5 |
| | -formula | g | 543.3 | 400.0-693.3 | 540.0 | 373.3-660.0 | 504.0 | 388.3-680.0 | 0.6 |
| | fermented milk beverages | g | 0.0 | 0.0-10.8 | 0.0 | 0.0-15.0 | 0.0 | 0.0-30.0 | 0.3 |
| | cottage cheese | g | 0.0 | 0.0-7.0 | 0.0 | 0.0-6.5 | 0.0 | 0.0-5.7 | 0.9 |
| rennet cheese | g | 0.0 | 0.0-0.0 | 0.0 | 0.0-0.0 | 0.0 | 0.0-0.0 | 0.9 | |
| 4. | Meat, sliced meats, fishes and eggs | | | | | | | | |
| | meat, poultry, sliced meats | g | 7.3 | 0.0-18.9 | 12.0 | 5.7-37.8 | 15.7 | 8.0-45.1 | 0.08 |
| | fish | g | 0.0 | 0.0-0.0 | 0.0 | 0.0-1.7 | 0.0 | 0.0-0.0 | 0.1 |
| 4A | Eggs | g | 0.5 | 0.0-9.3 | 1.6 | 0.0-12.1 | 5.0 | 0.0-18.5 | 0.1 |
| 5. | Fats | | | | | | | | |
| | animal: butter and cream | g | 0.0 | 0.0-1.1 | 0.4 | 0.0-3.3 | 0.8 | 0.0-2.7 | 0.04* |
| | vegetable: oils | g | 2.5 | 0.3-4.3 | 2.8 | 1.2-5.4 | 3.0 | 1.3-5.6 | 0.2 |
| 6. | Sugar and sweets | g | 4.9 | 0.7-13.6 | 7.3 | 2.2-16.6 | 8.7 | 4.3-15.0 | 0.3 |

* p<0.05

Table 54. Comparison of energy value, macronutrient supply and distribution of sources of energy in non-breastfed infants, who differ in nutritional status (248)

| Energy and nutrients | Units | Infants with body mass deficit (n=33) | | Infants with normal body mass (n=165) | | Infants with excessive body mass and risk thereof (n=50) | | p value for Kruskal-Wallis Anova rank test |
|--------------------------------------|-------|---------------------------------------|--------------------|---------------------------------------|--------------------|--|--------------------|--|
| | | Median | Range 1-3 quartile | Median | Range 1-3 quartile | Median | Range 1-3 quartile | |
| Energy | kcal | 669.7 | 543.1-871.3 | 744.3 | 625.8-914.9 | 792.3 | 667.4-895.5 | 0.3 |
| Protein total | g | 18.4 | 11.7-27.2 | 21.1 | 15.8-26.9 | 21.8 | 16.4-26.1 | 0.3 |
| Fat | g | 26.7 | 22.9-31.8 | 26.9 | 23.0-31.4 | 26.0 | 22.4-30.3 | 0.8 |
| Carbohydrates total | g | 100.3 | 68.7-127.3 | 111.8 | 88.3-139.5 | 121.2 | 99.6-135.1 | 0.08 |
| Sucrose | g | 6.2 | 3.8-18.2 | 12.9 | 6.7-21.8 | 12.1 | 8.4-26.1 | 0.06 |
| Dietary fibre | g | 5.9 | 3.3-8.8 | 7.8 | 5.7-9.1 | 7.0 | 6.1-8.6 | 0.2 |
| Percent of energy from proteins | % | 9.8 | 8.7-11.9 | 10.6 | 9.4-12.5 | 10.9 | 9.2-12.3 | 0.3 |
| Percent of energy from fats | % | 34.0 | 30.3-40.4 | 32.3 | 27.6-37.5 | 30.0 | 28.5-32.5 | 0.02* |
| Percent of energy from carbohydrates | % | 54.2 | 49.7-58.0 | 56.2 | 51.2-60.9 | 58.3 | 54.7-61.3 | 0.03* |

* p<0.05

Table 55. Comparison of compliance with guidelines in non-breastfed infants, who differ in nutritional status (n=248)

| Nutrient | Units | Reference | Reference value 0-6 m.o.l/7-12 m.o.l. | Percentage of children with insufficient intake | | | p value chi ² test |
|--------------------------|-------|-----------|---------------------------------------|---|---------------------------------------|--|-------------------------------|
| | | | | Infants with body mass deficit (n=33) | Infants with normal body mass (n=165) | Infants with excessive body mass and risk thereof (n=50) | |
| Energy | kcal | EAR | 600/700 | 42.4 | 32.1 | 30.0 | 0.4 |
| Protein | g | AI | 10/14 | 18.2 | 9.7 | 8.0 | 0.3 |
| Fat | g | EAR | 37/43 | 93.9 | 94.6 | 94.0 | 0.9 |
| Digestible carbohydrates | g | AI | 60/95 | 27.3 | 21.2 | 16.0 | 0.5 |
| Calcium | mg | AI | 200/260 | 3.0 | 1.8 | 0.0 | 0.5 |
| Magnesium | mg | AI | 30/70 | 12.1 | 13.3 | 16.0 | 0.9 |
| Iron | mg | AI/EAR | 0.3/7 | 69.7 | 47.9 | 36.0 | 0.01* |
| Zinc | mg | AI/EAR | 2/2.5 | 48.5 | 23.6 | 12.0 | 0.0007* |
| Iodine | mcg | AI | 110/130 | 81.8 | 82.4 | 82.0 | 0.9 |
| Sodium | mg | AI | 120/370 | 15.2 | 29.1 | 28.0 | 0.3 |
| Potassium | mg | AI | 400/700 | 9.1 | 5.5 | 8.0 | 0.6 |
| Vitamin A | mcg | AI | 400/500 | 6.1 | 2.4 | 6.0 | 0.4 |
| Thiamine (B1) | mg | AI | 0.2/0.3 | 3.0 | 1.2 | 2.0 | 0.7 |
| Riboflavin (B2) | mg | AI | 0.3/0.4 | 0.0 | 1.8 | 0.0 | 0.5 |
| Niacin | mg | AI | 2/4 | 3.0 | 9.1 | 2.0 | 0.1 |
| Vitamin B6 | mg | AI | 0.1/0.3 | 0.0 | 1.2 | 0.0 | 0.6 |
| Vitamin B12 | mg | AI | 0.4/0.5 | 0.0 | 1.2 | 0.0 | 0.6 |
| Vitamin C | mg | AI | 40/50 | 6.1 | 5.5 | 6.0 | 0.9 |
| Vitamin D | mcg | AI | 10 | 78.8 | 75.8 | 72.0 | 0.8 |
| Vitamin E | mg | AI | 4/5 | 6.1 | 11.5 | 6.0 | 0.4 |
| Folate | mcg | AI | 65/80 | 9.1 | 1.8 | 0.0 | 0.02* |

* p<0.05

4.3.3. Post-infancy period.

Tables 56-61 summarise the influence of environmental factors, including nutritional, on the nutritional status of studied children aged 1-3 years.

The analyses revealed that mothers' overweight and obesity was one of the factors associated with excessive body mass (overweight, obesity) and risk thereof in children aged 13-36 months. The children of overweight mothers (defined as increased ABI) more frequently showed overweight and obesity (Table 56). Excessive consumption of meals containing meat, poultry, sliced meats and fats was identified as nutritional factors associated with a risk of excessive body mass, as well as overweight and obesity in children aged 13-36 months.

The obtained results indicate a trend towards the relationship between body mass deficiency in children aged 13-36 months and consumption of products containing monosaccharides and disaccharides, mainly breakfast cereals with added sugar (Tables 58 and 60). The observed trends need confirmation in further studies.

Table 56. Comparison of environmental factors in children aged 13-36 months, who differ in nutritional status (n=612)

| Variables | Children aged 13-36 months with body mass deficit (n=25) | | Children aged 13-36 months with normal body mass (n=415) | | Children aged 13-36 months with risk of excessive body mass (n=113) | | Children aged 13-36 months with excessive body mass (n=59) | | Statistical test and p value | |
|--|--|---------------------|--|---------------------|---|---------------------|--|---------------------|-------------------------------|--|
| | Age [months] Median (range 1-3 quartile) | 25.8 (19.0-32.9) | | 24.2 (17.8-30.2) | | 24.0 (16.5-29.3) | | 22.1 (18.0-29.8) | | Kruskal-Wallis Anova rank; p=0.7 |
| Gender [%] boys girls | 48.0 52.0 | | 48.9 51.1 | | 50.4 49.6 | | 57.6 42.4 | | Chi ² ; p=0.7 | |
| Parent's educational background [%] | Mother | Father | Mother | Father | Mother | Father | Mother | Father | Mother | Father |
| primary | 4.0 | 0.0 | 4.6 | 3.9 | 5.4 | 3.9 | 5.1 | 7.7 | Chi ² ; p=0.7 | Chi ² ; p=0.4 |
| vocational | 24.0 | 21.7 | 12.1 | 24.0 | 9.8 | 23.1 | 17.0 | 28.9 | | |
| secondary | 36.0 | 60.9 | 34.5 | 39.7 | 35.7 | 41.4 | 37.3 | 28.9 | | |
| higher | 36.0 | 17.4 | 48.8 | 32.4 | 49.1 | 31.7 | 40.7 | 34.6 | | |
| Place of residence [%] agglomerations | 32.0 | | 12.1 | | 12.4 | | 5.1 | | Chi ² ; p=0.1 | |
| large city | 12.0 | | 13.0 | | 12.4 | | 15.3 | | | |
| city | 8.0 | | 10.1 | | 4.4 | | 8.5 | | | |
| town | 12.0 | | 26.0 | | 27.4 | | 22.0 | | | |
| rural area | 36.0 | | 38.8 | | 43.4 | | 49.2 | | | |
| BMI [% parents] | Mother | Father | Mother | Father | Mother | Father | Mother | Father | Mother | Father |
| underweight (BMI<18.5) | 0.0 | 0.0 | 5.7 | 0.3 | 3.6 | 0.0 | 1.7 | 0.0 | Chi ² ; p=0.03* | Chi ² ; p=0.8 |
| normal (BMI≥18.5 and <25) | 85.7 | 38.9 | 63.4 | 34.8 | 65.8 | 25.5 | 50.9 | 28.9 | | |
| overweight (BMI≥25 and <30) | 14.3 | 55.6 | 23.0 | 50.8 | 20.7 | 59.8 | 27.1 | 53.9 | | |
| obesity (BMI≥30) | 0.0 | 5.6 | 7.9 | 14.1 | 9.9 | 14.7 | 20.3 | 17.3 | | |

* p<0.05

Table 57. Comparison of feeding arrangement in children aged 13-36 months, who differ in nutritional status (n=612)

| Feeding arrangement | Percentage of children consuming varied meals every day or at least 2-4 times a week* | | | | Statistical test and p value |
|--|---|--|---|--|------------------------------|
| | Children aged 13-36 months with body mass deficit (n=25) | Children aged 13-36 months with normal body mass (n=415) | Children aged 13-36 months with risk of excessive body mass (n=113) | Children aged 13-36 months with excessive body mass (n=59) | |
| Recommended meals | | | | | |
| First breakfast | 96.0 | 99.5 | 99.1 | 100.0 | Chi2; p=0.2 |
| Second breakfast | 92.0 | 93.5 | 95.6 | 89.8 | Chi2; p=0.08 |
| Midday meal / soup | 96.0 | 95.7 | 95.6 | 96.6 | Chi2; p=0.6 |
| Midday meal / main course | 100.0 | 95.7 | 92.0 | 93.2 | Chi2; p=0.5 |
| Tea time | 92.0 | 93.7 | 93.8 | 96.6 | Chi2; p=0.5 |
| Supper | 100.0 | 98.8 | 98.2 | 100.0 | Chi2; p=0.5 |
| Additional meals | | | | | |
| bedtime meal | 60.0 | 55.4 | 54.9 | 55.9 | Chi2; p=0.3 |
| eating/drinking at night | 44.0 | 41.4 | 46.0 | 37.3 | Chi2; p=0.3 |
| snacks | 80.0 | 85.1 | 87.6 | 83.1 | Chi2; p=0.7 |
| Feeding type | | | | | |
| family meals | 96.0 | 86.7 | 86.7 | 89.8 | Chi2; p=0.9 |
| meals prepared separately for the child | 24.0 | 27.7 | 23.0 | 23.7 | Chi2; p=0.3 |
| Meals based on foods specifically manufactured for infants and young children | | | | | |
| Formula | 32.0 | 44.8 | 40.7 | 39.0 | Chi2; p=0.4 |
| Soups / dinners | 24.0 | 13.7 | 15.9 | 13.6 | Chi2; p=0.5 |
| Groats / gruels | 28.0 | 38.6 | 39.8 | 30.5 | Chi2; p=0.9 |
| Fruits puree, desserts | 20.0 | 21.7 | 23.9 | 18.6 | Chi2; p=0.5 |
| Juices drinks | 40.0 | 25.3 | 33.6 | 23.7 | Chi2; p=0.2 |
| Tea | 28.0 | 14.7 | 22.1 | 15.3 | Chi2; p=0.4 |

* p<0.05

Table 58. Comparison of average daily food rations in children aged 13-36 months, who differ in nutritional status (n=612)

| | Product group | Units | Children aged 13-36 months with body mass deficit (n=25) | | Children aged 13-36 months with normal body mass (n=415) | | Children aged 13-36 months with risk of excessive body mass (n=113) | | Children aged 13-36 months with excessive body mass (n=59) | | p value for Kruskal-Wallis Anova rank test |
|----|-----------------------------------|-------|--|--------------------|--|--------------------|---|--------------------|--|--------------------|--|
| | | | Me | Range 1-3 quartile | Me | Range 1-3 quartile | Me | Range 1-3 quartile | Me | Range 1-3 quartile | |
| 1. | Cereal products and potatoes | | | | | | | | | | |
| | mixed bread | g | 40.8 | 20.0-58.3 | 45.0 | 25.0-63.3 | 43.3 | 25.0-65.0 | 50.0 | 28.3-65.7 | 0.6 |
| | flour, noodles | g | 18.4 | 13.0-35.0 | 19.2 | 10.8-33.2 | 19.7 | 12.5-33.7 | 19.8 | 10.7-27.5 | 0.9 |
| | groats, rice, cereals | g | 26.9 | 11.7-35.2 | 17.7 | 7.3-32.0 | 20.0 | 10.0-33.5 | 11.1 | 4.7-29.6 | 0.07 |
| 1A | Potatoes | g | 59.4 | 27.8-109.7 | 70.0 | 42.8-113.1 | 71.8 | 37.4-118.7 | 82.5 | 53.1-153.5 | 0.1 |
| 2. | Vegetables and fruits | | | | | | | | | | |
| | vegetables | g | 104.1 | 64.3-134.4 | 96.9 | 58.1-156.9 | 112.1 | 70.8-173.8 | 108.6 | 64.6-146.4 | 0.3 |
| | fruits | g | 183.1 | 82.2-253.0 | 173.4 | 100.0-259.2 | 161.8 | 98.9-238.1 | 151.7 | 93.3-216.7 | 0.6 |
| 3. | Milk and milk products | | | | | | | | | | |
| | milk and fermented milk beverages | g | 305.0 | 205.4-519.4 | 296.5 | 164.6-436.5 | 333.8 | 201.3-471.9 | 377.2 | 153.9-494.0 | 0.08 |
| | including fluid milk: | g | 266.2 | 181.1-427.5 | 256.6 | 126.4-408.1 | 283.8 | 153.9-435.3 | 331.3 | 133.7-469.7 | 0.2 |
| | -cow's milk | g | 171.5 | 96.1-237.9 | 95.6 | 40.3-208.8 | 119.7 | 42.3-237.3 | 120.6 | 34.9-331.3 | 0.3 |
| | -formula | g | 0.0 | 0.0-283.3 | 0.0 | 0.0-266.7 | 0.0 | 0.0-280.0 | 0.0 | 0.0-303.3 | 0.5 |
| | fermented milk beverages | g | 28.3 | 3.3-51.7 | 19.7 | 0.0-50.0 | 22.5 | 0.0-60.3 | 25.0 | 0.0-51.7 | 0.7 |
| | cottage cheese | g | 12.2 | 0.0-29.3 | 13.3 | 2.4-43.3 | 15.0 | 1.7-45.7 | 8.7 | 1.2-50.0 | 0.8 |
| | rennet cheese | g | 0.0 | 0.0-5.0 | 0.0 | 0.0-5.7 | 0.0 | 0.0-5.7 | 0.0 | 0.0-5.7 | 0.9 |
| 4. | Meat, sliced meats, fish and eggs | | | | | | | | | | |
| | meat, poultry, sliced meats | g | 56.9 | 46.9-77.0 | 64.7 | 39.0-97.6 | 83.1 | 57.0-107.3 | 82.9 | 54.4-116.7 | 0.0001* |
| | fish | g | 0.0 | 0.0-13.3 | 0.0 | 0.0-5.7 | 0.0 | 0.0-7.5 | 0.0 | 0.0-4.7 | 0.9 |
| 4A | Eggs | g | 26.1 | 5.3-38.4 | 22.4 | 6.3-41.4 | 22.8 | 9.2-40.0 | 24.7 | 8.8-41.3 | 0.9 |
| 5. | Fats | | | | | | | | | | |
| | animal: butter and cream | g | 10.3 | 6.0-14.0 | 9.5 | 6.0-15.7 | 10.0 | 5.7-14.6 | 11.1 | 6.0-18.8 | 0.7 |
| | vegetable: oils | g | 6.1 | 3.2-9.5 | 6.5 | 3.4-10.6 | 7.1 | 3.0-11.4 | 7.0 | 3.2-12.5 | 0.9 |
| 6. | Sugar and sweets | g | 29.4 | 15.6-41.2 | 25.2 | 13.1-40.8 | 26.2 | 13.8-39.0 | 23.2 | 13.8-35.6 | 0.9 |

Me - Median

* p<0.05

Table 59. Comparison of compliance with model food rations in children aged 13-36 months, who differ in nutritional status (n=612)

| | Product group | Units | Model food ration for children 13-36 months | Percentage of children with insufficient intake | | | | p value for chi ² test |
|-----|-------------------------------------|-------|---|--|--|---|--|-----------------------------------|
| | | | | Children aged 13-36 months with body mass deficit (n=25) | Children aged 13-36 months with normal body mass (n=415) | Children aged 13-36 months with risk of excessive body mass (n=113) | Children aged 13-36 months with excessive body mass (n=59) | |
| 1. | Cereal products and potatoes | | | | | | | |
| | mixed bread | гг | 20 | 24.0 | 16.1 | 1.,7 | 11.9 | 0.6 |
| | flour, noodles | гг | 25 | 60.0 | 62.2 | 61.1 | 69.5 | 0.7 |
| | groats, rice, cereals | гг | 30 | 60.0 | 73.3 | 69.0 | 76.3 | 0.4 |
| 1A. | Potatoes | гг | 100 | 72.0 | 68.0 | 66.4 | 55.9 | 0.3 |
| 2. | Vegetables and fruits | | | | | | | |
| | vegetables | гг | 450 | 84.0 | 82.2 | 80.5 | 89.8 | 0.5 |
| | fruits | гг | 200 | 92.0 | 87.7 | 85.8 | 91.5 | 0.7 |
| | fruits | гг | 250 | 68.0 | 72.8 | 77.0 | 83.1 | 0.3 |
| 3. | Milk and milk products | | | | | | | |
| | milk and fermented milk beverages | гг | 550 | 80.0 | 89.6 | 86.7 | 83.1 | 0.2 |
| | including fluid milk: | гг | 450 | 76.0 | 80.0 | 78.8 | 66.1 | 0.1 |
| | -cow's milk | гг | 100 | 92.0 | 93.0 | 86.7 | 88.1 | 0.2 |
| | -formula | гг | 10-15 | 44.0 | 42.9 | 41.6 | 52.5 | 0.5 |
| | fermented milk beverages | гг | 2 | 68.0 | 59.3 | 58.4 | 61.0 | 0.8 |
| 4. | cottage cheese | | | | | | | |
| | rennet cheese | гг | 20 | 4.0 | 8.7 | 7.1 | 1.7 | 0.2 |
| | Meat, sliced meats, fishes and eggs | гг | 10 | 72.0 | 78.1 | 75.2 | 79.7 | 0.8 |
| 4A. | meat, poultry, sliced meats | гг | 25 | 48.0 | 55.2 | 52.2 | 50.8 | 0.8 |
| 5. | fish | | | | | | | |
| | Eggs | гг | 6 | 24.0 | 24.6 | 27.4 | 23.7 | 0.9 |
| | Fats | гг | 10 | 80.0 | 72.5 | 71.7 | 62.7 | 0.3 |
| 6. | animal: butter and cream | гг | 20 | 40.0 | 40.2 | 37.2 | 42.4 | 0.9 |

* p<0.05

Table 60. Comparison of energy value, macronutrient supply and distribution of sources of energy in children aged 13-36 months, who differ in nutritional status (n=612)

| Energy and nutrients | Units | Children aged 13-36 months with body mass deficit (n=25) | | Children aged 13-36 months with normal body mass (n=415) | | Children aged 13-36 months with risk of excessive body mass (n=113) | | Children aged 13-36 months with excessive body mass (n=59) | | p value for Kruskal-Wallis Anova rank test |
|--------------------------------------|-------|--|--------------------|--|--------------------|---|--------------------|--|--------------------|--|
| | | Me | Range 1-3 quartile | Me | Range 1-3 quartile | Me | Range 1-3 quartile | Me | Range 1-3 quartile | |
| Energy | kcal | 1050.9 | 943.8-1260.1 | 1085.7 | 897,8-1332,4 | 1168.5 | 966.2-1414.3 | 1154.3 | 951.2-1428.7 | 0.1 |
| Protein total | g | 38.6 | 30.2-51.0 | 39.5 | 31,3-49,3 | 42.9 | 35.1-51.6 | 43.5 | 31.6-60.5 | 0.054 |
| Fat | g | 35.0 | 27.4-49.6 | 35.6 | 27,6-46,0 | 37.4 | 30.8-49.0 | 42.0 | 31.3-52.2 | 0.03* |
| Carbohydrates total | g | 153.0 | 142.1-179.3 | 159.6 | 130,0-192,8 | 174.7 | 131.7-199.5 | 163.9 | 130.6-193.4 | 0.4 |
| Sucrose | g | 42.4 | 25.9-54.5 | 38.2 | 25,2-53,7 | 39.0 | 26.3-54.7 | 38.4 | 24.9-51.5 | 0.9 |
| Dietary fibre | g | 9.7 | 6.8-12.1 | 9.6 | 7,2-12,4 | 9.9 | 7.7-12.7 | 9.3 | 7.4-12.0 | 0.7 |
| Percent of energy from proteins | % | 14.2 | 12.9-16.3 | 14.4 | 12,7-16,8 | 14.7 | 13.2-16.1 | 15.2 | 13.4-17.2 | 0.4 |
| Percent of energy from fats | % | 27.8 | 26.3-31.4 | 29.3 | 25,5-33,1 | 29.9 | 26.2-33.3 | 30.8 | 28.1-34.2 | 0.09 |
| Percent of energy from carbohydrates | % | 56.8 | 54.4-59.9 | 55.9 | 51,3-60,4 | 54.7 | 51.1-59.5 | 54.3 | 49.6-57.3 | 0.06 |

Me - Median

* p<0.05

Table 61. Comparison of compliance with guidelines in children aged 13-36 months, who differ in nutritional status (n=612)

| Nutrients | | Reference EAR / AI* | Percentage of children with insufficient intake | | | | p value for chi ² test |
|---|------|---------------------------|---|--|---|--|--------------------------------------|
| | | | Children aged 13-36 months with body mass deficit (n=25) | Children aged 13-36 months with normal body mass (n=415) | Children aged 13-36 months with risk of excessive body mass (n=113) | Children aged 13-36 months with excessive body mass (n=59) | |
| Energy | kcal | 1000 | 40.0 | 37.6 | 30.1 | 32.2 | 0.4 |
| Protein total | g | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 |
| Fat | g | 39 | 64.0 | 59.0 | 54.0 | 45.8 | 0.2 |
| Digestible carbohydrates | g | 100 | 4.0 | 10.6 | 11.5 | 8.5 | 0.7 |
| Dietary fibre | g | 10* | 56.0 | 54.0 | 51.3 | 57.6 | 0.9 |
| Percent energy from sucrose | % | <10% | 24.0 | 24.6 | 25.7 | 28.8 | 0.9 |
| Minerals | | | | | | | |
| Sodium | mg | 750* | 12.0 | 9.2 | 4.4 | 8.5 | 0.4 |
| Potassium | mg | 2400* | 88.0 | 87.5 | 88.5 | 79.7 | 0.4 |
| Calcium | mg | 500 | 28.0 | 41.7 | 41.6 | 33.9 | 0.4 |
| Magnesium | mg | 65 | 4.0 | 1.9 | 0.9 | 3.4 | 0.6 |
| Iron | mg | 3 | 0.0 | 2.4 | 0.9 | 0.0 | 0.4 |
| Zinc | mg | 2.5 | 0.0 | 2.4 | 1.8 | 0.0 | 0.5 |
| Copper | mg | 0.25 | 4.0 | 1.2 | 0.0 | 0.0 | 0.2 |
| Iodine | µg | 65 | 20.0 | 27.0 | 18.6 | 22.0 | 0.3 |
| Vitamins | | | | | | | |
| Vitamin A (retinol equivalent) | µg | 280 | 0.0 | 2.7 | 1.8 | 1.7 | 0.8 |
| Vitamin E (alpha-tocopherol equivalent) | mg | 6* | 56.0 | 56.4 | 58.4 | 49.2 | 0.7 |
| Thiamine | mg | 0.4 | 4.0 | 7.7 | 4.4 | 3.4 | 0.4 |
| Riboflavin | mg | 0.4 | 0.0 | 2.2 | 0.0 | 0.0 | 0.2 |
| Niacin | mg | 5 | 16.0 | 9.2 | 7.1 | 5.1 | 0.4 |
| Vitamin B6 | mg | 0.4 | 4.0 | 1.2 | 0.9 | 0.0 | 0.5 |
| vitamin B12 | µg | 0.7 | 4.0 | 2.9 | 1.8 | 0.0 | 0.5 |
| vitamin D | µg | 10 | 92.0 | 94.7 | 92.9 | 93.2 | 0.8 |
| Vitamin C | mg | 30 | 4.0 | 6.3 | 3.5 | 3.4 | 0.6 |
| Folate (diet equivalent) | µg | 120 | 16.0 | 20.7 | 17.7 | 13.6 | 0.5 |

* p<0.05

IV. Summary and conclusions

The population study on children aged 5-36 months, which was performed in 2016 revealed that:

- The feeding practice in children aged 0-1 year (5-12 months) differed from the nutritional guidelines. 54.1% of the studied children were breastfed (5,9% exclusively) during first six months of life, 61.1% of children received various complementary products before the age of 5 months, 30.2% of infants received such products between 17 and 26 week of age. During the second six-month period both breastfed and non-breastfed infants received mainly meals that were prepared separately for them and meals based on foods specifically manufactured for infants and young children. A significantly higher percentage of non-breastfed infants received family meals (61.4% vs. 40.4%). The nutrient profile of an average food ration in the studied children differed from the guidelines, especially in terms of fat, iodine, vitamin D and iron.
- The feeding practice in children aged 13-36 months differed from the current nutritional guidelines as well, yet raised no objections in 67.2% of children. Average food ration was significantly different from the model one. It was clearly visible in terms of the consumption of vegetables and fruits, milk and fermented milk beverages. The only products, which consumption was near guidelines were cereal products, meat, sliced meats and poultry. The deficiency of long-chain polyunsaturated fatty acids, potassium, vitamin E, vitamin D and consumption of excessive amounts of sodium in the profile of the diets of studied children are noteworthy. The excessive consumption of sucrose was observed in every fourth child.
- The recommendations for infant and small children nutrition require verification. Further educational actions for parents, physicians, nutrition specialists and dieticians are needed.

Conclusions:

1. Breastfeeding should be actively promoted, as only a small percentage of children is exclusively breastfed during first six months of life.(5.9%)
2. The nutrition of children aged 5-36 months frequently differed from the recommended models of safe nutrition. Therefore, feeding practices should be monitored and corrected at every medical and nutritional visit.
3. In the group of children aged 5-36 months, the percentage of infants (32.4%) and post-infancy children (32.2%) with abnormal body mass, evaluated using the normalised weight-for-height z-score, indicates that the nutrition of infants and small children should be modified through better selection of dietary products.
4. Parents' awareness of adequate weaning and introduction of food products showing beneficial nutrient profile is strictly dependant on the effective nutritional education.
5. There is a relationship between environmental conditions and the nutritional status, as well as feeding practices in children aged 5-36 months.

V. Comparison of feeding practices in children aged 5-36 months - population studies performed in 2011/2012 and 2016.

1. Infants

In 2012, the Children's Memorial Health Institute carried out a study entitled „Evaluation of feeding practices and nutritional status of infants aged 6 and 12 months in Poland”, which was supported by Nutricia Foundation, SKG/KRC Millward Brown and Lux Med. The aim of this study was to evaluate feeding practices and nutritional status in infant population aged 6 and 12 months in Poland on representative randomly selected sample. It also aimed at establishing relationship between feeding practices and nutritional status.

The evaluation of feeding practice in infants included the assessment of feeding quality and nutritional habits, as well as the comparison with the infant feeding pattern (updated in 2008) using a specially developed questionnaire, feeding practice evaluation and quantitative diet evaluation using the diary of 24-hour record of consumption. The nutritional status of the infants was evaluated by means of anthropometric indices and selected biochemical parameters (complete blood count, vitamin 25(OH)D, TSH, ferritin). The study was approved by the Bioethical Committee of the Children's Memorial Health Institute.

Due to different methodology of the 2016 study “Comprehensive evaluation of feeding practices in children aged 5-36 months - nationwide Polish study 2016” only selected results were compared (Table 62)

Table 62. Summary of selected results of the studies performed in infant populations in 2012 and 2016

| Variables | Infants [n=317] <i>Study by Children's Memorial Health Institute 2012</i> | Infants [n=447] <i>Study by The Institute of Mother and Child 2016</i> |
|---|---|---|
| Adequate nutritional knowledge, as declared by mothers | 85% | 67% of mothers declare they know the Idea of 1000 First Days |
| Mothers' compliance with nutritional guidelines | 7% | 24% of mothers declare they know nutritional recommendations/pattern |
| Adding salt to foods specifically manufactured for infants and young children | every third parent | 8% add salt to every meal prepared for the child |
| Breastfeeding (partial or exclusive) for at least 6 months | 41% of children, who completed 6 months of life (data at the day of the study) | 54,1% (aggregated data) |
| Number of feeding episodes per day | 7.1 ± 3.2 [$\bar{x} \pm SD$] | 6 (5-8) [median; range 1-3 quartile] |
| Duration of a single feeding episode (min) | 13 ± 7 [$\bar{x} \pm SD$] | 10 (10-15) [median range 1-3 quartile] |
| 10 or more meals per day | 20% | ok. 11% |
| Too early introduction of inadequate meals – infants 12 months old | 60% <i>(family meals in approx. 50% of infants and consumption of cow's milk-derived products in approx. 10% of infants)</i> | Too early weaning (before 5 month of age) in 61.1% of infants Cow's milk was introduced in 27% of infants aged 10-12 months, whereas 27% of infants received family meals every day. |

2. Post-infancy children

In 2010 a study entitled “Comprehensive evaluation of feeding practices in children aged 13-36 months in Poland - nationwide study” was carried out on a randomly selected representative sample of children aged 13-36 months. The inclusion criteria was age (13-36 months), whereas the exclusion criteria included diseases, which require nutrition other than enteral. The study project was approved by the Bioethical Committee of the Institute of Mother and Child in Warsaw.

The aim of this study was to comprehensively evaluate the feeding practices in children aged 5 to 36 months in Poland and to establish a relationship with nutritional status and check whether they comply with the nutritional guidelines

The following detailed aims were specified:

- To evaluate the nutritional status of children in relation to the WHO standards based on selected features and anthropometric indices
- To evaluate feeding practices in post-infancy children in relation to present nutritional recommendations (2008)
- To analyse the nutritional behaviour of the studied children
- To analyse the influence of familial and environmental conditions on the feeding practices

Tables 63-65 compare the results obtained in 2010 and 2016. The obtained data indicate that the nutritional practices in children significantly changed in the following aspects:

- Feeding arrangement - small children (group analysed in 2016) more frequently received bedtime meals and family meals
- Product selection - lower consumption of milk and milk beverages, potatoes, sugar and sweets was observed, whereas the consumption of fruits, cheese, eggs and milk fat (butter, cream) was higher.
- Nutrient profile - consumption of calcium, sodium, vitamin A and niacin was significantly reduced.
- Energy value - significant reduction.

Table 63. Comparison of feeding practices/feeding arrangement in post-infancy children - studies performed in 2010 and 2016

| Feeding arrangement | Percentage of children aged 13-36 months consuming varied meals every day or at least 2-4 times a week* | |
|---|---|--------------------|
| | Study 2010 (n=400) | Study 2016 (n=612) |
| Breastfeeding | 7.3 | 10.0 |
| Recommended meals | | |
| First breakfast | 99.5 | 99.3 |
| Second breakfast | 93.0 | 93.5 |
| Midday meal / soup | 95.3 | 95.8 |
| Midday meal / main course | 94.3 | 94.9 |
| Tea time | 93.8 | 94.0 |
| Supper | 99.0 | 98.9 |
| Additional meals | | |
| bedtime meal | 34.5 | 55.6 |
| eating/drinking at night | 38.3 | 42.0 |
| snacks | 88.5 | 85.1 |
| Feeding type | | |
| family meals | 83.5 | 87.4 |
| meals prepared separately for the child | 35.3 | 26.3 |
| Meals based on foods specifically manufactured for infants and young children | 21.3-70.5 | 14.5-43.0 |
| meals not prepared at home | 2.3 | 3.3 |

Table 64. Comparison of average daily food ration in post-infancy children and model food ration - studies performed in 2010 and 2016

| | Product group | Units | Model food ration for children 13-36 months (2013) | Study 2010 (n=400) | | Study 2016 (n=612) | | Percentage of children with insufficient intake - 2010 | Percentage of children with insufficient intake - 2016 |
|-----|-------------------------------------|-------|--|--------------------|--------------------|--------------------|--------------------|--|--|
| | | | | Median | Range 1-3 quartile | Median | Range 1-3 quartile | | |
| 1. | Cereal products and potatoes | | | | | | | | |
| | mixed bread | g | 20 | 43.2 | 25.0-64.2 | 45.0 | 25.0 – 63.3 | 18.8 | 16.3 |
| | flour, noodles | g | 25 | 19.4 | 11.5-30.0 | 19.3 | 11.4 – 32.8 | 62.3 | 62.6 |
| | groats, rice, cereals | g | 30 | 17.8 | 8.5-32.6 | 17.9 | 8.1 – 32.5 | 71.5 | 72.2 |
| 1A. | Potatoes | g | 100 | 95.6 | 58.1-146.0 | 70.8 | 41.8 – 116.3 | 52.0 | 66.7* |
| 2. | Vegetables and fruits | | | | | | | | |
| | vegetables | g | 450 | 259.0 | 182.2-357.3 | 277.6 | 195.3 – 384.2 | 88.8 | 82.7* |
| | vegetables | g | 200 | 103.7 | 67.2-146.0 | 100.8 | 62.1 – 158.0 | 90.5 | 87.9 |
| | fruits | g | 250 | 151.7 | 94.1-217.2 | 170.3 | 99.1 – 251.9 | 84.3 | 74.3* |
| 3. | Milk and milk products | | | | | | | | |
| | milk and fermented milk beverages | g | 550 | 387.7 | 260.9-521.1 | 309.2 | 172.2 – 455.7 | 78.8 | 88.1* |
| | including fluid milk: | g | 10-15 | 10.0 | 3.2-21.6 | 13.3 | 2.1 – 43.3 | 50.0 | 43.6* |
| | -cow's milk | g | 2 | 3.3 | 0.0-7.1 | 0.0 | 0.0 – 5.7 | 47.3 | 59.6* |
| 4. | -formula | | | | | | | | |
| | fermented milk beverages | g | 20 | 61.5 | 36.4-86.8 | 68.8 | 43.8 – 100.5 | 8.5 | 7.5 |
| | cottage cheese | g | 10 | 0.0 | 0.0-10.9 | 0.0 | 0.0 – 5.7 | 73.8 | 77.5 |
| 4A. | rennet cheese | g | 25 | 19.5 | 5.7-30.3 | 22.7 | 6.8 – 41.3 | 69.3 | 53.9* |
| 5. | Meat, sliced meats, fishes and eggs | | | | | | | | |
| | meat, poultry, sliced meats | g | 16 | 15.0 | 9.8-20.1 | 17.2 | 10.8 – 25.6 | 55.5 | 44.6* |
| | meat, poultry, sliced meats | g | 6 | 7.4 | 4.2-11.1 | 9.7 | 6.0 – 15.9 | 39.8 | 25.0* |
| | fish | g | 10 | 6.1 | 3.4-10.1 | 6.6 | 3.3 – 10.9 | 74.5 | 71.7 |
| 6. | Eggs | g | 20 | 28.2 | 17.6-40.6 | 25.3 | 13.3 – 40.1 | 30.0 | 39.9* |

* statistically significant change in relation to the compliance with model food ration observed in 2010 - tests for significance of structure indices; p<0,05

Table 65. Comparison of nutrient profile in the diet of post-infancy children and nutritional guidelines - studies performed in 2010 and 2016

| Nutrients | Units | Study 2010 (n=400) | | Study 2016 (n=612) | | Reference EAR / AI* (2012) | Percentage of children with insufficient intake – 2010 | Percentage of children with insufficient intake – 2016 |
|---|-------|--------------------|---------------|--------------------|---------------|----------------------------|--|--|
| | | Median | 1-3 quartile | Median | 1-3 quartile | | | |
| Energy | kJ | 5042.4 | 4136.7-5872.6 | 4638.0 | 3826.1-5693.4 | -- | -- | -- |
| Energy | kcal | 1202.5 | 987.3-1400.8 | 1105.2 | 913.6-1355.9 | 1000 | 26.8 | 36.6* |
| Protein total | g | 41.7 | 33.9-4.4 | 40.7 | 32.1-50.6 | 12 | 0.3 | 0.3 |
| Fat | g | 38.2 | 30.4-46.7 | 36.3 | 28.6-46.7 | 39 | 57.5 | 58.7 |
| Carbohydrates total | g | 176.0 | 144.8-213.5 | 161.2 | 131.2-195.1 | -- | -- | -- |
| Digestible carbohydrates | g | -- | -- | 152.4 | 123.7-183.7 | 100 | 5.0 | 11.1* |
| Sucrose | g | 39.4 | 27.2-57.1 | 38.2 | 25.6-53.7 | -- | -- | -- |
| Lactose | g | 18.1 | 10.8-27.6 | 15.7 | 8.6-26.6 | -- | -- | -- |
| Starch | g | 57.0 | 41.8-77.3 | 56.4 | 42.0-75.1 | -- | -- | -- |
| Dietary fibre | g | 9.8 | 7.6-12.8 | 9.6 | 7.4-12.4 | 10* | 52.0 | 56.4 |
| Percent of energy from proteins | % | 13.9 | 12.6-15.5 | 14.6 | 12.9-16.7 | -- | -- | -- |
| Percent energy from fats | % | 28.9 | 25.0-32.4 | 29.6 | 26.1-33.2 | -- | -- | -- |
| Percent energy from carbohydrates | % | 57.0 | 53.2-61.5 | 55.5 | 51.2-59.9 | -- | -- | -- |
| Percent energy from sucrose | % | 13.9 | 10.4-17.5 | 13.9 | 10.0-18.0 | <10% | 21.5 | 25.2 |
| Minerals | | | | | | | | |
| Sodium | mg | 1631.4 | 1235.0-2002.4 | 1541.8 | 1122.9-1944.9 | 750* | 4.3 | 9.3* |
| Potassium | mg | 1823.6 | 1500.9-2292.2 | 1711.3 | 1361.7-2110.2 | 2400* | 84.5 | 87.4 |
| Calcium | mg | 645.7 | 503.7-779.5 | 546.7 | 414.2-707.8 | 500 | 23.4 | 42.3* |
| Phosphorus | mg | 723.7 | 582.4-865.9 | 685.8 | 556.0-855.4 | 380 | 3.8 | 5.4 |
| Magnesium | mg | 154.2 | 123.6-188.4 | 150.2 | 119.0-187.6 | 65 | 1.0 | 2.0 |
| Iron | mg | 8.2 | 6.5-10.2 | 6.98 | 5.35-8.85 | 3 | 2.0 | 2.0 |
| Zinc | mg | 5.8 | 4.9-7.3 | 5.68 | 4.44-6.72 | 2.5 | 0.5 | 2.0 |
| Copper | mg | 0.6 | 0.5-0.8 | 0.60 | 0.46-0.74 | 0,25 | 1.0 | 1.1 |
| Manganese | mg | 1.7 | 1.2-2.3 | 1.66 | 1.16-2.20 | -- | -- | -- |
| Iodine | µg | 85.1 | 62.3-112.8 | 88.9 | 65.1-112.5 | 65 | 26.0 | 27.5 |
| Vitamins | | | | | | | | |
| Vitamin A (retinol equivalent) | µg | 937.0 | 683.4-1308.7 | 829.8 | 585.4-1155.7 | 280 | 0.0 | 3.4* |
| Vitamin E (alpha-tocopherol equivalent) | mg | 5.4 | 4.1-7.0 | 5.6 | 4.0-7.5 | 6* | 63.8 | 59.2 |
| Thiamine | mg | 0.8 | 0.6-1.0 | 0.73 | 0.57-0.98 | 0.4 | 8.5 | 7.0 |
| Riboflavin | mg | 1.1 | 0.9-1.4 | 1.15 | 0.90-1.44 | 0.4 | 2.5 | 1.8 |
| Niacin | mg | 11.1 | 8.6-14.0 | 8.60 | 6.78-11.26 | 5 | 3.0 | 10.1* |
| Vitamin B6 | mg | 1.2 | 1.0-1.6 | 1.07 | 0.86-1.35 | 0.4 | 0.8 | 1.1 |
| Vitamin B12 | µg | 2.1 | 1.6-2.7 | 2.00 | 1.50-2.77 | 0.7 | 2.3 | 3.1 |
| Vitamin D | µg | 4.7 | 1.7-7.6 | 3.49 | 1.43-6.36 | 10 | 92.3 | 94.4 |
| Vitamin C | mg | 85.3 | 63.1-118.2 | 83.1 | 54.0-118.1 | 30 | 6.5 | 7.5 |

* statistically significant change in relation to the compliance with model food ration observed in 2010 - tests for significance of structure indices; p<0,05

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List of appendices to the research project

Appendix I – Respondent Information and Informed Consent Form

Appendix II – Questionnaire (Part A, B, C) + Forms to record the menus (Part D)

Appendix III – Instruction for anthropometric measurements

Appendix IV – Instruction of performing survey interview and method of completing nutritional diary for interviewers

Appendix V – Anthropometric measurements chart

Appendix VI – Statement of Bioethical Committee of the Institute of Mother and Child