Development of Children Aged 1.5-3 Years in Relation with Nourishment in a Children's Nursery in Romania

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Abstract: - In the present study we have investigated the anthropometrical indices (weight, height, thorax perimeter, cranial perimeter, body mass index) during infancy and their relation to nourishment (food intake, nutritive value of food). The study was performed on a group of 54 children (27 girls and 27 boys), aged between 1.5-3 years, in a children's nursery in Tîrgovişte, Romania. The methods consisted of a transverse epidemiological inquiry using the anthropometrical indices of infant children and a nourishment inquiry, using the list of food released from the storehouse over 10 days, twice (in October 2008 and February 2009). WHO Child Growth Standards (Geneva 2006) were also used to analyze children's development. The relation anthropometrical indices – nourishment was investigated by aid of linear regression (SPSS 13 program). The anthropometrical indices indicate a decrease to below the minimum values for thorax perimeter and body mass index (BMI) in the age group of 2.5-3 years. According to WHO Child Growth Standards (Geneva 2006), BMIs for age group 2.5-3 years are < 50 percentages for 11.1% of total investigated children and 42.18% of children included in this age group. There are not significant differences of anthropometrical indices between sexes. Nourishment of children is deficient in milk, eggs, animal fats, vegetables, and excessive in meat, cheese and vegetable fats, with normal intake of protein, deficient in carbohydrates and excessive in fats in both periods of the nourishment inquiry. In the second period of nourishment inquiry, food intake is very increased in potatoes, fruits and sugar. There is a statistically significant relation between milk and potatoes with BMI. Milk and potatoes are significant nourishment predictors of children development. Nourishment predictors of anthropometrical indices depend on groups of food, children's age and nourishment inquiry period. No predictor of cranial perimeter development is found. In conclusion, there is insubstantial association anthropometrical indices–nourishment depending on children's age, group of food and season.

Key-Words: - children aged 1-3 years, anthropometrical indices, group of food, relation, predictors

1 Introduction

Romania is a country with many changes performed lately and with numerous health aspects, poorly investigated. Many children younger than 3 years are exposed in this region, like in other study areas, to multiple risks, including poverty, malnutrition and poor health [1,2]. New researches aim to explore the predictive capacity of the measure of diet and the relation with a range of outcomes of diseases [3]. A misbalanced nourishment of children causes changes in metabolism, development and health [4]. For all that, child growth and development is considered a health indicator. Stature by weight (BMI–Body Mass Index) changes with varying economic conditions during early childhood [5]. Overweight and poor diets are becoming a greater burden for the poor than for the rich [6]. Adult height is determined by genetic potential and by net nutrition, the balance between food intake and the demands on it, including the demands of the disease, most importantly during early childhood [7].

The aim of the present study is to investigate anthropometrical indices and children's nourishment (food intake and nutritive value of food) during infancy and the relation between them, in a children's nursery in Tîrgovişte, Romania.

2 Material and methods

The study was conducted in a group of 54 children (27 girls and 27 boys), aged between 1.5-3 years, in a children's nursery in Tîrgovişte, Romania. The methods consisted of a transverse epidemiological inquiry and a nourishment inquiry.

The transverse inquiry consisted in the measurement of anthropometrical indices (weight –

weighing machine, length/height – anthrop-meter, thorax and cranial perimeter – metric ribbon) of the investigated children.

In 2006 the World Health Organization (WHO) released new standards for assessing the growth of infants and children worldwide. Weight and length of children have to be measured quarterly in the second year of life [8]. In our study the measurements were realised in spring (March) and autumn (September), in the second and third year of life.

The body mass index (BMI) is a commonly used anthropometric measure to estimate total body fat. The Body Mass Index (Quetelet Index) was counted by the formula:

$$BMI=G(Kg)/H(m)^2 \quad (1)$$

BMI – Body Mass Index; G – weight; H – height

WHO Child Growth Standards referring to length/height-for-age, weight-for-age, weight-for-length, weight-for-height and the body mass index-for-age were applied and analyzed as efficiency in some studies [9, 10]. WHO growth standards for the child are expected to have wide implications for growth and nutrition research [10]. In the present study we considered length/height-for-age, weight-for-age and body mass index-for-age.

Correlations (Pearson) were performed between investigated anthropometrical indices (Program SPSS 13).

The nourishment inquiry considered the quantities of food released from the storehouse over 10 days in October 2008 and 10 days in February 2009, and the number of consumers (children aged between 1.5-3 years). The quantity of each group of food in the 16 groups was counted per consumer and day. The energetic value and nutritive value (protein, carbohydrates and fats) of the foods received by children were counted considering the quantity of food per consumer and day.

Calories=calories% x consumable product (g)/100 (2)

The quantities of food lost during processing were considered.

Consumable product=commercial products (100 – p)/100
p- The loss coefficient (3)

The found values were compared to the needs (in tables) for this age group. Correlations and T test (Student) between offered groups of food in the first and second nourishment inquiry were applied by the aid of the program SPSS 13.

The relation anthropometrical indices – nourishment was investigated through linear regression using the statistical program SPSS 13. Initially, we considered the registered values of anthropometrical indices as dependent variables and of groups of food as independent for the entire sample.

Therefore we counted the differences between normal values (means) of children population and registered values of each anthropometrical index (height, weight, thorax perimeter, cranial perimeter and Body Mass Index) and differences between daily needs and daily registered values of each group of food. We considered the excess as positive value and the deficit as negative one. These difference values were applied in linear regression, considering the age groups (1.5-2 years, 2-2.5 years and 2.5-3 years) and the nourishment inquiry periods (October and February), separately.

3 Results

3.1 Sample structure

The sample structure consisted of 50% boys and 50% girls. The most frequent were the children aged between 2-2.5 years (23% girls and 31% boys), followed by 1.5-2 years and 2.5-3 years (19% girls, 4% boys and 8% girls, 15% boys, respectively) (Fig.1).

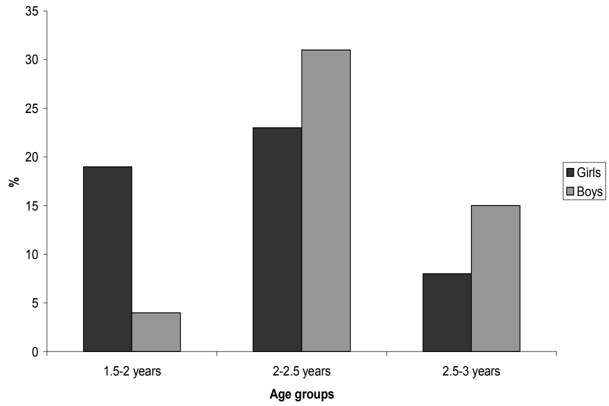

Fig. 1, Gender and age distribution of children (%)

3.2 Physical development

Means of anthropometrical indices (weight, height, thorax perimeter, cranial perimeter and Body Mass Index – BMI) followed in 3 age groups (1.5-2 years, 2-2.5 years, 2.5-3 years) intervals of normal values (maximal and minimal values) can be seen in Fig. 2.

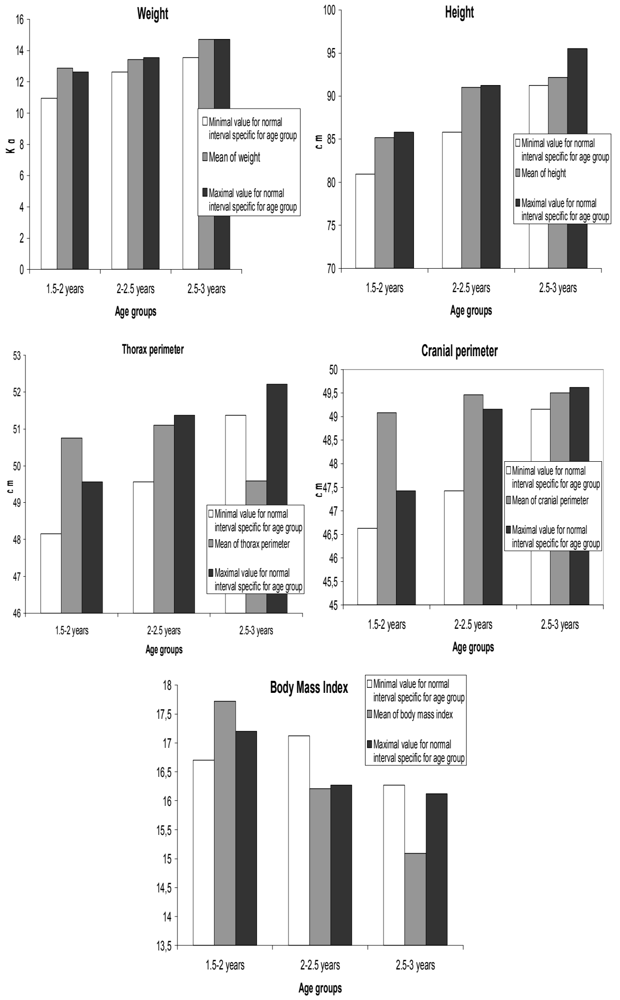

Fig. 2, Means of weight (Kg), height, thorax perimeter, cranial perimeter (cm) and BMI depending on age groups and normal values intervals

Weight increases with age, but with a decrease of the growing rhythm. If in the lowest age group the mean exceeds the maximum limit of the normal values interval, in the highest age group it is equal to this limit.

Height increases with age and it is situated in the normal interval of values for all age groups. The growth rhythm also decreases.

Thorax perimeter is over (first age group) in (second age group) and under (third age group) the interval of normal values, and decreases between second and third age groups.

Cranial perimeter is excessively increased in the first and second age group and it is in the interval of normal values in the third age group.

Body Mass Index is excessive, in normal interval and deficient in the first, second and third age group, respectively.

WHO standards (Geneva 2006) which consider weight for age, height for age and Body Mass Index for age (in percentiles - PC) offer a better perspective of children's development (Fig.3).

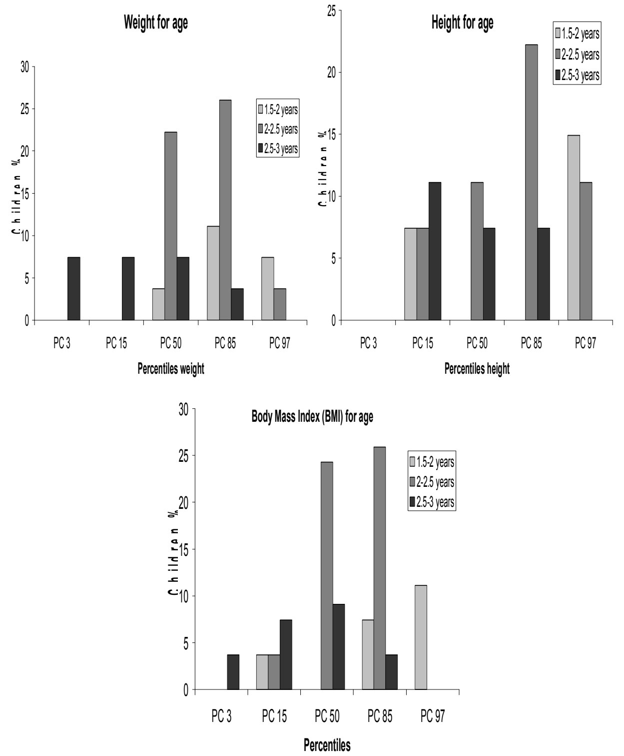

Fig 3, Children frequency (%) depending on age-groups distribution in percentages of weight for age, height for age and Body Mass Index for age (WHO standards 2006)

Weight increases with age but the growth rhythm decreases (children aged 1.5-2 years: 0% children <50PC, 18.5% children >50 PC and children aged 2.5-3 years: 14.8% children <50PC, 3.7% children >50 PC).

When we consider percentages of children in the same age group we have a multiple of 4.5 (age group 1.5-2 years), 1.92 (age group 2-2.5 years) and 3.86 (age group 2.5-3 years). Thus, the weight evolves as follows: for children aged 1.5-2 years (0% children <50PC, 83.25% children >50 PC) and children aged 2.5-3 years (57.12% children <50PC, 14.28% children >50 PC).

The greatest percentage of children with weight = 50 PC was registered at the age group 2-2.5 years (22.2% children of investigated sample and 42.62% of children of the same age).

Height increases with age and the growth rhythm also decreases (children aged 1.5-2 years: 7.4%=15 PC, 14.9% =97 PC and children aged 2.5-3 years: 11.1%=15 PC, 7.4%=85 PC). Considering percentages in the same age group, height evolves as follows: children aged 1.5-2 years (33.3%=15 PC, 67.05%=97 PC) and children aged 2.5-3 years (42.84%=15 PC, 28.56%=85 PC). The greatest percentage of children with height =50 PC was registered in the age group 2.5-3 years (7.4% children of the investigated sample and 28.56% of children of the same age), followed by 2-2.5 years (11.1% children of the investigated sample and 21.32% of children of the same age).

BMI decreases with age (children aged 1.5-2 years: 3.7% children <50 PC, 18.5% >50 PC and children aged 2.5-3 years: 11.1 %< 50 PC, 3.7%>50 PC) (Fig.3). Considering percentages in the same age group, BMI has the same evolution: children aged 1.5-2 years (14.28% children<50 PC, 83.25%>50%) and children aged 2.5-3 years (42.84%<50 PC, 14.28%>50PC).

The greatest percentage of children with BMI = 50 PC was registered in the age group 2-2.5 years (24.3% children of the investigated sample and 46.65% of children of the same age).

The obtained results of anthropometrical indices related to WHO Standards (Geneva 2006) indicate a similar evolution with the results of the means of anthropometrical indices regarding children’s development with age.

There is an inverse correlation BMI – age (r=-0.502, p<0.001) and BMI – height (r=-0,447, p=0.001) in investigated children.

Considering WHO standards there are no important differences of anthropometrical indices between boys and girls; boys have greater values for weight and BMI, and height is similar for both sexes (Fig. 4).

Thus, for weight, boys are registered in the PC97 (11.1% of the investigated children and 22.2% of the total number of investigated boys), and girls are more frequent than boys in the PC85 with 11.1%. Therefore we found the percentage difference between girls and boys at the PC85 as percentage of boys in the PC97 with higher values of weight.

For BMI, we observed greater values of BMI for boys than for girls = and >50 PC (42% and 39.5% respectively) and greater values of BMI for girls than for boys >50 PC (25% and 23%, respectively).

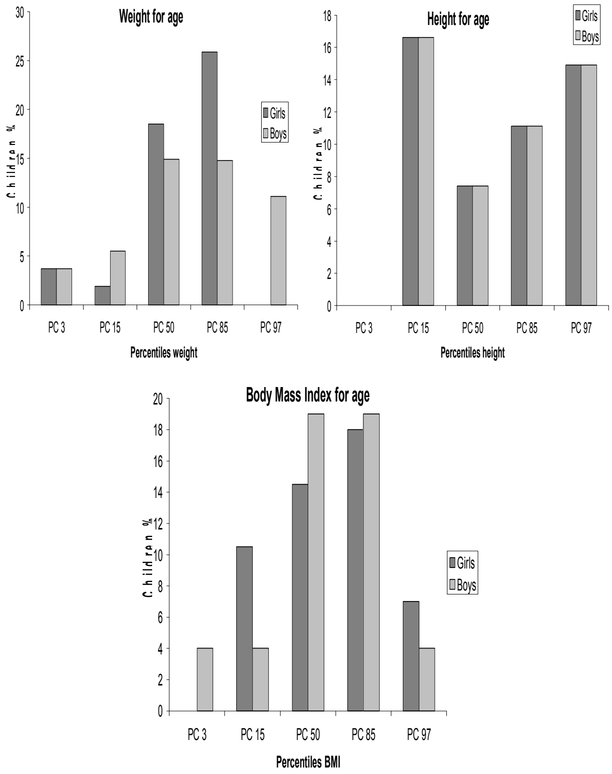

Fig 4, Children’s frequency (%) depending on sex distribution in percentages of weight for age, height for age and Body Mass Index for age (WHO standards 2006)

3.3 Nourishment inquiry

3.3.1 Food intake

Food intake (mean per consumer and day) considered by 16 groups of food and investigated in both nourishment inquiry periods (October 2008 and February 2009) in comparison with needs was misbalanced (Fig.5).

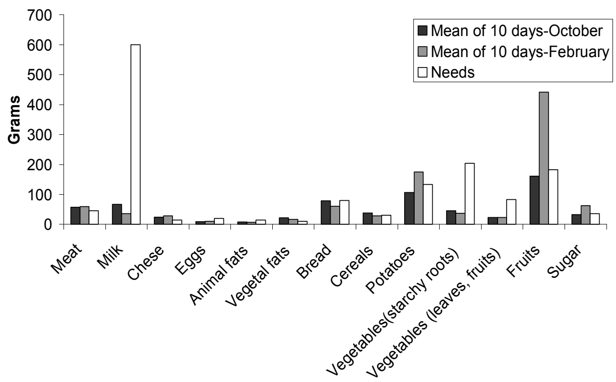

Fig.5, Groups of food distribution (means - grams/consumer and day) in October and February in comparison with needs for age group 1-3 years

Thus, considering each group of food, children's nourishment was deficient in milk, eggs, animal fats, vegetables-starchy roots and vegetables (leaves, fruits) during both periods of the nourishment inquiry (Fig.6).

The most deficient groups of food were milk and root vegetables. The daily mean of milk offered to children for nourishment was very low in comparison with the necessary one (600 ml/day) during the first and second periods of the nourishment inquiry (36 and 67ml/day, respectively). Roots vegetables were also very low in the first and second period of the nourishment inquiry (45 and 36 grams/day, respectively) in comparison with needs (204 grams/day).

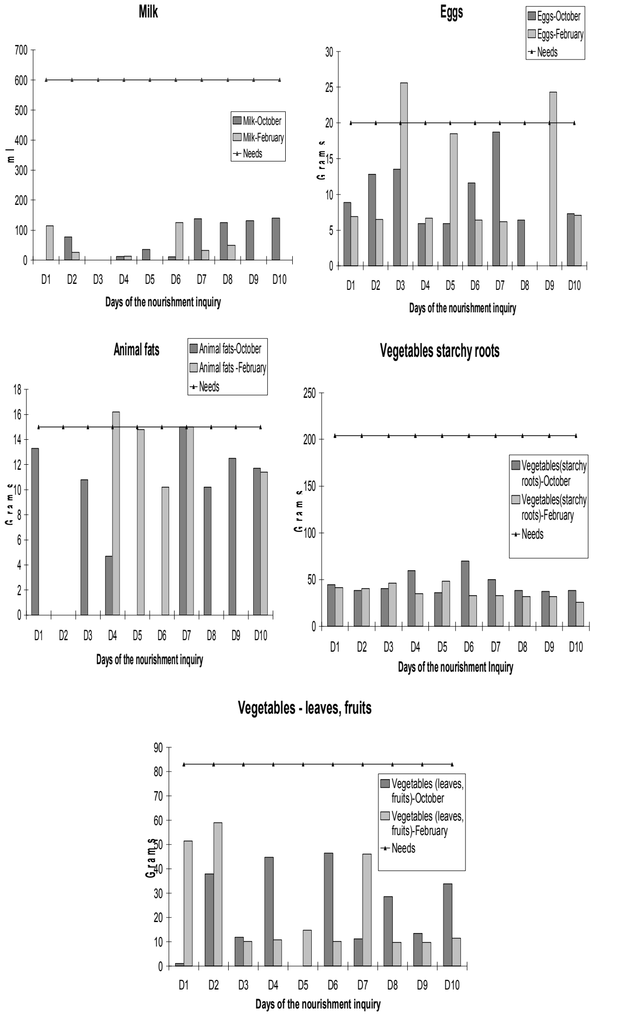

Fig. 6, Daily intake of milk (ml/consumer and day), eggs, animal fats, vegetable roots, vegetable leaves and fruits (grams/consumer and day) in both periods of the nourishment inquiry in comparison with needs

Children's nourishment was also misbalanced, being excessive for meat, cheese and vegetable fats during both periods of the inquiry (Fig. 7). Vegetal fats were the most excessive food offered to the investigated children: 16 and 21 grams/day during the first and second periods of the nourishment inquiry, in comparison with the necessary quantity (10grams/day).

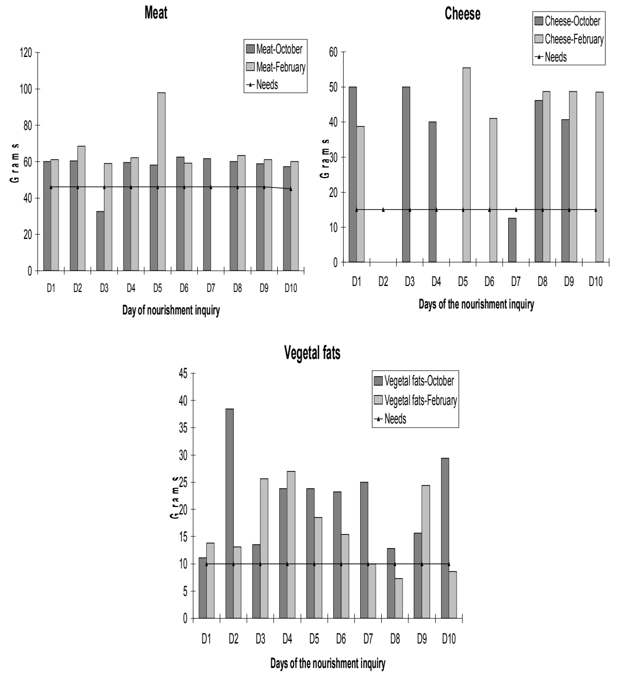

Fig. 7, Daily intake of meat, cheese, vegetal fats (grams/consumer and day) during both periods of the nourishment inquiry in comparison with needs

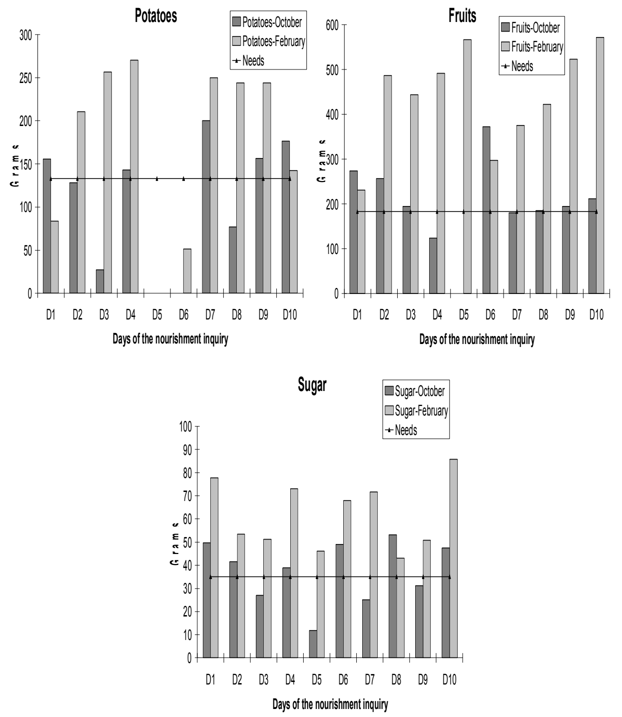

Fig. 8, Distribution of daily intake of potatoes, fruits and sugar (grams/consumer and day) in both periods of the nourishment inquiry in comparison with needs

In the second period of the nourishment inquiry food intake was very increased in potatoes, fruits and sugar (Fig. 8). Thus, fruits were most excessive with a quantity of food offered at investigated children 440 grams/day in comparison with needs 183 grams/day. Potatoes were on the second place with a quantity of 175 grams/day offered to children in comparison with needs (133 grams/day). Sugar was offered in a quantity of 62 grams/day in comparison with needs (35 grams/day).

3.3.2 Nutritive value

Daily means of energy intake (calories) were higher than children's needs for the age 1-3 years in both periods of the nourishment inquiry, the greatest mean being registered in October (1384.45 calories) (Fig.9).

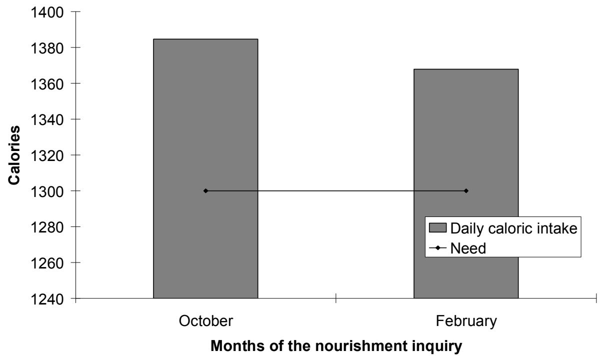

Fig. 9, Daily means of energy intake (calories) during both periods of alimentary inquiry

Means of daily nutritive factors (proteins, carbohydrates and fats) compared with needs during the both periods of the nourishment inquiry can be seen in Fig. 10. The nutritive factors intake was normal-excessive for proteins, deficient for carbohydrates and excessive for fats.

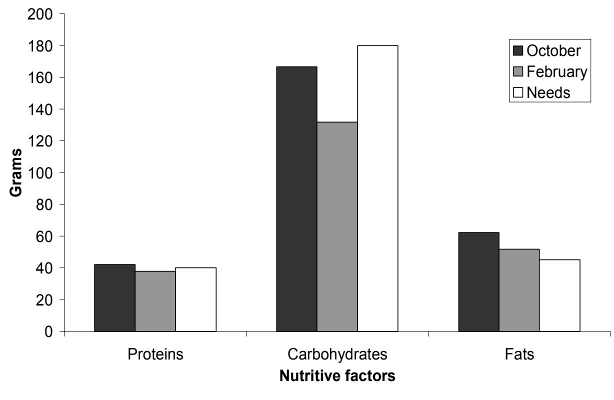

Fig. 10, Daily means of proteins, carbohydrates and fats (g) during both periods of the inquiry

The protein intake was ensured, especially by meat, cheese, bread, cereals and potatoes, in both periods of the nourishment inquiry. The carbohydrates intake was ensured by bread, cereals, potatoes, fruits and sugar products. Fats intake was ensured by meat, milk, cheese, animal and vegetal fats (very excessive in October), potatoes and sugar products (especially sweets with high concentration of fats – chocolate) (Fig. 11).

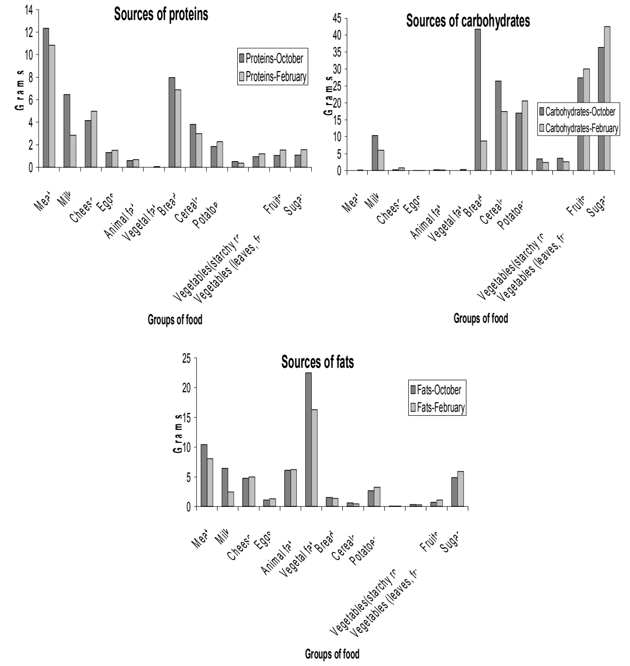

Fig. 11, Daily intake of proteins, carbohydrates and fats (g) by groups of food during both periods of the nourishment inquiry

A decreased intake of bread during the second period of alimentary inquiry can be a cause of the decreased level of carbohydrates registered in February. This deficient intake of bread was not compensated by the high intake of potatoes, fruits and sugar products observed during the same month.

The excessive energy intake can be explained by this excessive intake of fats in both periods of the nourishment inquiry. Vegetable oil and animal fats (meat, cheese and animal fats) seem to be the main source of excessive energy intake.

We observed the following correlations between quantities of food offered to children during the first period of the nourishment inquiry: fruit correlates directly with sugar products (r=0.715, p=0.02) and cheese correlates inversely with vegetal fats (r=-0.824, P=0.003).

In the second period of the nourishment inquiry, there were direct correlations: vegetables (roots) - cereals (r=0.770, p=0.009), meat – cereals (r=0.704, p=0.023) and eggs - vegetable fats (r=0.711, p=0.021) and an inverse correlation milk - fruits (r= -0.904, p<0.001).

Between the first and second nourishment inquiry periods there is a statistically significant difference in the following groups of food: bread (t=3.525, Sig. 0.006), potatoes (t=- 2.381, Sig. 0.041), fruits (t= - 4.015, Sig. 0.003) and sugar (t= - 4.870, Sig. = 0.001). Bread was offered in greater quantities in the first period of the nourishment inquiry and potatoes, fruits and sugar were offered in greater quantities during the second period.

3.4 Relation development - nourishment

Considering the entire sample, for the majority of registered anthropometrical indices we did not find a relation with investigated groups of foods.

There is a statistically significant relation between milk, fruits and potatoes with BMI. There are inverse relations milk, fruits – BMI, and direct relations potatoes – BMI (Table 1).

Table 1, Results of linear regression (B-regression coefficient) for BMI and fruits, milk, potatoes

Model 1	B	Std. Error	t	Sig.
Constant	18.203	1.034	17.609	<0.001
Fruits	-0.01	0.002	-4.809	<0.001
Milk	-0.018	0.005	-3.533	0.003
Potatoes	0.007	0.003	2.178	0.046

a Dependent Variable: BMI

Potatoes related powerfully with weight, also (B=0.002, Std. Error=0.003, t=2.522 and P=0.021).

Considering age groups and nourishment inquiry periods (different seasons), the relation of differences (normal values – registered values) between anthropometrical indices and groups of food revealed the following significant predictors of children's development.

3.4.1 Predictors of weight

In children aged 2.5-3 years, milk (B=-0.017, t=-3,920, Sig. 0.03, Model Sig. =0.009a), vegetable roots (B=-0.257, t=-6,858, Sig. 0.006, Model Sig. =0.009a) and vegetables leaves (B=-0.035, t=-3,249, Sig. 0.048, Model Sig. =0.009a) were predictors for weight in the second period of the nourishment inquiry.

In children aged 2-2.5, vegetable roots ((B=0.064, t=3.222, Sig. 0.015, Model Sig. =0.032a) and animal fats (B=0.075, t=2,036, Sig. 0.081, Model Sig. =0.032a) were predictors for weight, in the first period of the nourishment inquiry.

Milk (B=0.022, t=4.458, Sig. 0.021, Model Sig. =0.13a), cereals (B=-0.057, t=-3.216, Sig. 0.049, Model Sig. =0.13a), fruits (B=-0.005, t=-2.718, Sig. 0.035, Model Sig. =0.024a) and sugar (B=0.034, t=2.670, Sig. 0.037, Model Sig. =0.024a) were predictors for weight in the second nourishment inquiry period.

3.4.2 Predictors of height

In children aged 2.5-3 years, animal fats (B=0.410, t= 3.178, Sig. 0.034, Model Sig. =0.056a), potatoes (B=0.031, t= 3.519, Sig. 0.013, Model Sig. =0.055a) were predictors for height development in the first nourishment inquiry period and root vegetables (B=-0.297, t=-2.260, Sig. 0.013, Model Sig. =0.054a) were predictors in the second nourishment inquiry period.

In children aged 2-2.5 years, potatoes (B=-0.018, t=-4.264, Sig. 0.005, Model Sig. =0.001a) and sugar (B=0.147, t=5.222, Sig. 0.002, Model Sig. =0.001a) were predictors for height in the second nourishment inquiry period.

3.4.3 Predictors of the thorax perimeter

In children aged 2.5-3 years, milk (B=-0.016, t=5.061, Sig. 0.015, Model Sig. =0.010a), animal fats (B=-0.128, t=-3.365, Sig. 0.044, Model Sig. =0.010a) and vegetable leaves (B=-0.044, t=-3.621, Sig. 0.036, Model Sig. =0.010a), potatoes (B=-0.013, t=-2.647, Sig. 0.029, Model Sig. =0.029a) were predictors for weight in the first period of the nourishment inquiry.

Milk (B=0.020, t=2.928, Sig. 0.043, Model Sig. =0.036a), vegetable roots (B=0.220, t=4.767, Sig. 0.009, Model Sig. =0.036a), vegetable leaves (B=0.047, t=2.520, Sig. 0.065, Model Sig. =0.036a) and potatoes (B=-0.012, t=-2.564, Sig. 0.033, Model Sig. =0.033a) were predictors for thorax perimeter in the second period of the nourishment inquiry.

In children aged 2-2.5 years, the fruits group (B=-0.007, t=-3.430, Sig. 0.009, Model Sig. =0.009a) was predictor for thorax perimeter, in the second nourishment inquiry period.

There was no predictor for **cranial perimeter** development at all three age groups in the both nourishment inquiry periods.

3.4.4 Predictors of BMI

In the age group 2.5-3 years there was no significant predictor for consumed food for BMI evolution, in both nourishment inquiry periods.

In the age group 2-2.5 years, potatoes represented a significant predictor for BMI (B=0.006, t=3.403, Sig. =0.014, Model Sig. =0.052a), in the second period of nourishment inquiry.

In the age group 1.5-2 years, milk (B=0.009, t=2.824, Sig. =0.048, Model Sig. =0.007a), animal fats (B=0.153, t=5.064, Sig. =0.007, Model Sig. =0.007a) and potatoes (B=0.013, t=3.798, Sig. =0.009, Model Sig. =0.037a) were significant predictors of BMI evolution in the first period of nourishment inquiry.

Milk (B=-0.011, t=-3.217, Sig. =0.024, Model Sig.=0.004a), animal fats ((B=-0.081, t=-3.410, Sig. =0.019, Model Sig.=0.004a), root vegetables (B=-0.193, t=-7.127, Sig. =0.001, Model Sig. =0.004a) and vegetables leaves (B=-0.036, t=-3.290, Sig. =0.022, Model Sig. =0.004a) were predictors of BMI in the second period of nourishment inquiry.

We considered in this analysis age groups, groups of food and seasons (autumn and winter). We could not exclude as confounding, genetic, internal, physical environmental [11] and socio-economic environmental factors. The small number of investigated children is a limitation of study.

4 Discussion and limitations

In some studies there are differences between genders referring to anthropometric indices (boys were found to be taller than girls in all ages and heavier only for the age period from 1 to 3 years) and nourishment needs (boys older than 2 years of age were found to have a higher energy intake, proteins, fats, carbohydrates compared to girls) [12]. In our study there are no important differences of anthropometrical indices between girls and boys (boys are a little heavier, but not significantly) and the received diet was similar for both sexes. BMI is one with the smallest differences between genders and the most linear shape with age [13].

Trajectories with age differ importantly according to the index considered (height, weight or BMI) [13]. In our study, height and weight increase with age, but decrease the growing rhythm. An interesting result of the present study is the peculiar evolution of means of thorax perimeter and BMI, which decrease below the normal interval of values in the age group 2.5-3 years, unlike in the other study realized in the same area, where these indices increase.

When we considered WHO Standards [Geneva, 2006), we observed a percentage increase in the children aged 2.5-3 years with BMI at low percentages (PC15 and PC3) and a percentage increase in the children aged 1.5-2 years with BMI at high percentages (PC85 and PC97). The similarity of results related to WHO standards with results related to the national standards (children's population means) sustained each other. This similarity was valuable for weight and stature, too. Due to its practicability, BMI remains the most suitable index [14] and thin children are less exposed to adverse risk factors and to becoming obese adults [15]. BMI decreases with age in the investigated children, contrary to the tendency of increase and the trend of overweight mentioned in literature [16].

While the genetic predisposition is a major determinant of height, weight, thorax and cranial perimeter, the early life environment (nutrition, illness, socio-economic status) also has an important impact [17]. Infant children's nourishment could have a great impact on children's development as it is mentioned in literature [11].

Nourishment inquiry indicates a misbalanced diet deficient in basic foods such as of milk, eggs, animal fats and vegetables. Milk and root vegetables are the most deficient food in children's nutrition. Milk is very necessary for children until 2 years of age. Vegetables consumption is encouraged in educational institutions and families as it is mentioned in literature [18]. Excessive intake of meat, cheese, vegetable fats determined an energetic excessive diet, at the risk of overweight observed in other studies [19]. The greatest increase of intake was registered for vegetal fats in both periods of the nourishment inquiry. If in literature a strongest negative association was found between meet and grain products intake [20], in the present study there is a strong positive association meat-cereals intake. Vegetal fats are frequently recommended in literature, because vegetable oil, soft margarines and dressings are often important sources of fatty acids in people's diet [21]. In the performed study vegetal fats correlate inversely with cheese and directly with eggs.

Increased intake of fruits is encouraged in literature, special interventions being recommended to stimulate consumption [22]. Potatoes consumption was stimulated with the purpose to cover the bread deficiency in the second period of the nourishment inquiry.

Nutritive factors intake present a peculiar aspect: high intake of protein and fats (especially polyunsaturated) and decreased carbohydrate intake. There are many studies which indicate this combination of nutritive factors with therapeutic purpose in adults: weight loss [23, 24], decreased glycemic level in diabetes [25] and life quality increase [26]. This perspective offered by literature sustains a possible preventive effect of low carbohydrates found in the infants' diet.

Excessive intake of fruits and potatoes during the second periods of nourishment inquiry seems to have a relation with children's development. There is an inverse relation fruits-BMI and a direct one potatoes-BMI in investigated children at the sample level.

On the other hand, deficient intake of milk relates inversely with BMI.

When we considered age groups and season, the main nourishment predictors of children development remain milk and potatoes, which relates with BMI.

The association milk-BMI is consistent in age group 1.5-2 years and potatoes-BMI in age groups 1.5-2 years, 2-2.5 years. The decreased BMI found in our study could be an effect of the misbalanced diet, and covering a food deficiency with other food excess is not effective. The association potatoes-weight found for the entire sample was not confirmed by analysis on age and nourishment periods. The association of groups of food with height, weight, thorax perimeter indicates milk and potatoes as main predictors which vary widely with age and period of nourishment inquiry.

A very deficient group of food (root vegetables) relates with BMI, weight, height, thorax perimeter with wide variation depending on age groups and nourishment period. A similar result was found for animal fats (another deficient food) especially during the first nourishment inquiry period. Using both linear regression with registered values for food and anthropometrical indices and linear regression of differences, one predictor was not confirmed (fruits – very excessive in the second period of the nourishment inquiry) and two predictors were found out (vegetables roots and animal fats).

Milk and potatoes resulted as significant predictors of children's development (BMI) after both regression analyses applied. No nourishment predictor was found for cranial perimeter development. For all that, these predictors present large variation depending on anthropometrical indices, age and nourishment period (season).

Conclusions

There is a good development of children with a good evolution of anthropometrical indices (weight, height, cranial perimeter) except thorax perimeter and Body Mass Index (BMI). Anthropometrical indices related to different standards (National standards considering means on the children population and WHO Standards 2006) indicate a similar evolution of children's development.

There is a misbalanced diet, deficient in milk, eggs, animal fats, vegetable and excessive in meat, cheese and vegetal fats. Children's nutrition is different between the first and second nourishment inquiry, the lately with excessive intake of potatoes, fruits and sugar products.

Despite the misbalanced diet (rich in energy, protein and fats and poor in carbohydrates) children's development has a good evolution except for thorax perimeter and BMI. This effect is better seen in children aged 2.5-3 years.

There is an insubstantial association children development–nourishment depending on type of anthropometrical indices, groups of food, age and season. Significant nourishment predictors of BMI resulting from this study are milk and potatoes, with wide variation, depending on age group and season. No nourishment predictor was found for cranial perimeter.

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