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THE ROLE OF NUTRITION IN THE FORMATION OF HUMAN CAPITAl

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Abstract

At present, in all developed countries of the world, great attention is paid to the formation of human capital as an important component of the development of modern society. The formation of human capital begins with childhood. The physical health of a person in the early stages of life has a great influence on the quality of human capital. Proper nutrition is important in maintaining and improving health. This is especially important in the early stages of a person's life. Only with food the child can receive nutrients, macronutrients and micronutrients necessary for growth and development. After birth, the child cannot eat the usual food all adults are used to. The baby requires a special diet that is able to fulfill his needs for energy substances and other useful vitamins and enzymes. In the beginning the child's diet is supplemented with the foods that are easily digested. Such foods are fruits and vegetables. They contain a lot of nutrients, such as carbohydrates, minerals and vitamins. This allows to maintain the optimal daily average amount of nutrients in the child's body. The most common complementary foods are vegetable and fruit purees. Nowadays there are many vegetable and fruit purees for baby in Russia from Poland, Italy and Russia . The results of the experiments demonstrates that domestic products are able to compete with imported products, which is important when import substitution is needed.

Keywords: Baby food, health-saving technologies, human capital, micronutrient**s,** physical health, vegetable puree.

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1. Introduction

Nowadays, the great attention is paid to the formation of human capital in many countries of the world. Human capital is an important component of the development of modern society (Razinkina, Pankova, Trostinskaya, Pozdeeva, Evseeva, & Tanova, 2018). The formation of human capital begins with childhood (Alexankov, Trostinskaya, & Pokrovskaia, 2018). The physical health of a person in the early stages of life has a great influence on the quality of human capital. Proper nutrition is important in maintaining and improving health. This is especially important in the early stages of a person's life. Only with food the child can receive nutrients, macronutrients and micronutrients necessary for growth and development (Starostenko & Belokurova, 2014).

Small child cannot eat the usual food all adults are used to. The baby requires a special diet that is able to fulfill his needs for energy substances and other useful vitamins and enzymes. In the beginning the child's diet is supplemented with the foods that are easily digested. Such foods are fruits and vegetables. They contain a lot of nutrients, such as carbohydrates, minerals and vitamins. This allows to maintain the optimal daily average amount of nutrients in the child's body (Starostenko & Belokurova, 2016).

The most common complementary foods are vegetable and fruit purees. Nowadays there are many vegetable and fruit purees for baby in Russia from Poland, Italy and Russia. The results of the experiments demonstrates that domestic products are able to compete with imported products, which is important when import substitution is needed

2. Problem Statement

At present, in all developed countries of the world, great attention is paid to the formation of human capital as an important component of the development of modern society (Razinkina, et al., 2018). The formation of human capital begins with childhood (Alexankov, Trostinskaya, & Pokrovskaia, 2018). Health-saving technologies play a large role in the formation of human capital. Such technologies are an important component of biosocial technologies. One of the main tasks of maintaining health is to adhere to the principles of proper nutrition. Skills of healthy eating, education of correct eating behavior and taste habits at an early age are a guarantee of good health.

After birth, the child cannot eat the usual food all adults are used to. The baby requires a special diet that is able to fulfill his needs for energy substances and other useful vitamins and enzymes. Mother's milk contains all the necessary substances for the baby's nutrition. The whole foods need to be gradually introduced into a child's diet as he or she gets older, since mother's milk alone cannot provide all the necessary nutrients for the adequate growth and development of the baby. The food that is added to the normal breastfeeding diet of the baby is called complementary "Food products labeling TR TS 022/2011" (2011). Not only the quality of complementary foods is very important, but also its safety. Complementary foods play an important role in the formation of all the body systems of a child: muscular-skeletal, digestive, urinary and immune (Belokurova, Pankina, & Starostenko, 2016).

In the beginning the child's diet is supplemented with the foods that are easily digested. Such foods are fruits and vegetables. They contain a lot of nutrients, such as carbohydrates, minerals and vitamins. This allows to maintain the optimal daily average amount of nutrients in the child's body (Skurikhin, 2002).

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The most common complementary foods are vegetable and fruit purees. These are food products that are not fermented but are fermentable, obtained by grinding or grating of whole or peeled, fresh or frozen fruits and vegetables. The product can contain one or several varieties of fruits and vegetables, intended for direct food consumption, preserved by physical methods, except for ionizing radiation treatment (Tutelian, Razumov, & Vyalkov, 2010).

Currently, the Russian market has a wide variety of baby food brands, both domestic ones and imported. A large assortment allows you to choose the right food not only according to the age of the child, but also according to the taste preferences. In addition, baby food purees differ in the number of components: they can consist of one or multiple components. The latter have greater energy and nutritional value due to the fact that they contain several components, so these purees are recommended to older children (Surgutsky, 1997). It is recommended to start supplementing the baby's diet with one-component homogenized vegetable purees. As the level of confidence in industrial production increases every year, so does the number of consumed baby food products. In the modern world, the food industry of many developed countries produces a large amount of long-term storage products. This result is achieved by various means: by refining, pasteurization, sterilization, etc. Therefore, ready-made foods are well preserved, but contain less biologically active components, macro- and micronutrients (Shobinger, 2004).

3. Research Questions

Medical research conducted in recent years, indicates the existence of various kinds of diseases associated with food, such as deficiencies of important ingredients: enzymes, vitamins, minerals. At this stage of development of the food processing industry in Russia, it is necessary to take into account the achievements of the nutrition science in food production technology. Since the lack of micronutrients is unsafe for health, Russian nutrition experts consider the enrichment of food with micronutrients one of the important tasks (Borisova, Belokurova, & Pankina, 2013). The following substances are considered micronutrients: vitamins, minerals and microelements, which are found in food in very small quantities, milligrams or micrograms. They are not sources of energy, but involved in the digestion and absorption of food, regulation of functions and growth processes, adaptation and development of the organism (Starostenko & Belokurova, 2015).

4. Purpose of the Study

In the diet of Russians there is a lack of mineral substances, vitamins and other compounds that have antioxidant properties. Such substances are especially necessary in early childhood, since the child's body has to be provided with nutrients that are growth factors such as vitamins, enzymes and minerals (Vegetable based canned baby food. General specifications, 2013). Characteristics of research samples are in the table 01.

Table 01. Characteristics of the samples

Name of samples	Trademark	Raw material	Manufacturer	Country of origin	Recommendations for use
Sample 1 Puree "Carrot"	"Gerber"	Carrots	Nestle Polska S.A	Poland	from 4 months

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Sample 2 "Carrot" Puree	«Heinz»	Carrots	Heinz Italia S.p.A.	Italy	from 4 months
Sample 3 Carrot puree Fruto-Nyanya	«Fruto-Nyanya»	Carrots	JSC "PROGRESS"	Russia	from 4 months
Sample 4 Puree "Pumpkin".	"Gerber"	Pumpkin	Nestle Polska S.A	Poland	from 5 months
Sample 5 Puree "Pumpkin"	«Heinz»	Pumpkin	Heinz Italia S.p.A.	Italy	from 5 months
Sample 6 Puree Pumpkin Fruto-Nyanya	«Fruto-Nyanya»	Pumpkin	JSC "PROGRESS"	Russia	from 5 months

5. Research Methods

For all puree samples we determined how leak-proof the jars were, the condition of the inner surface of the metal lids, and the net weight of the unit in the package.

After verifying that the information is complete, organoleptic and physicochemical quality parameters were evaluated. Organoleptic parameters were determined by tasting, in which 9 people participated. Sensory analysis evaluated such quality indicators as appearance, texture, color, taste and smell. Physical and chemical parameters included mass fraction of solids, the mass fraction of soluble solids, the mass fraction of titrated acids, the mass fraction of β-carotene, the mass fraction of ascorbic acid. The leak proof test was carried out in accordance with GOST 8756.18-70 by immersion of jars in hot water. It was done by placing the sealed jars, with labels removed, in a container of water heated to 85 ° C so that the water was 25-30 mm above the level of the lids. The jars were kept in hot water for 5-7 minutes (Belokurova, Borisova, & Pankina, 2016).

The condition of the inner surface of the metal lids was determined in the cleaned jars free from the contents, washed with water and thoroughly dried. The lids were inspected for the presence and extent of dark spots formed by the dissolution of the tin and exposure of iron or from the formation of sulfurous and other compounds. The lids were also inspected for the presence and extent of the distribution of rusty spots and the condition of rubber gaskets (Belokurova, Pankina, & Starostenko, 2016). The organoleptic quality indicators of vegetable puree samples were described using the recommendations presented in Table 2 (Belokurova & Pankina, 2016).

Standard methods were used to determine the physicochemical quality indicators of vegetable baby food puree. The mass fraction of dry matter was determined by measuring the total water content which was calculated as the difference in weight of the sample before and after drying. To do this, two pieces of vegetable puree weighing 50 ± 0.01 g were placed in Koch dishes and kept (incubated) in a drying cabinet at 120-130 ° C for 30 minutes to inactivate the enzymes (Borisova, Belokurova, & Pankina, 2013).

The mass fraction of soluble solids in all the test samples was determined in accordance with GOST 28562-90 refractometrically (Method for determination of the appearance, tightness of the container and the condition of the inner surface of metal containers, 2010). For this purpose, 2-3 drops of the test sample were applied to the working fixed prism of the refractometer and covered with a movable prism. The measurement results were rounded to the first decimal point.

For this purpose, we weighed a sample containing 25 g ± 0.01 g and prepared a solution in a 100 ml volumetric flask. 5-10 cm^3 extracts were pipetted into the conical flasks with a volume of 100 ml and titrated

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with a solution of 0.1 N NaOH solution with 4-5 drops of phenolphthalein until the solution had a slightly pink tint. (Canned food products. Methods for determining organoleptic parameters, net weight and mass fraction of constituents, 2010).

To determine the mass fraction of β-carotene, 5-10 g (± 0.01) g of the test sample was weighed out. Acetone was added to the samples which were placed in a glass jar with a ground stopper. Then the sample of the product was ground in acetone, with added 2-3 g of glass sand and soda at the tip of the scalpel. The pulverized mass was transferred to a Buchner funnel and the pigments were extracted with acetone until the sample was completely discolored. Washing and filtration steps were done with vacuum. The end of the β-carotene extraction was determined by colorless run-off filtrate. The obtained volume of the extract was measured (Processed fruit and vegetable products. Methods for determining dry matter and moisture., 2011).

The resulting clear filtrate was then placed in a 1cm cuvette (control - acetone) and the concentration of β-carotene in the sample was measured at a wavelength of λ = 454 nm, in a spectrophotometer with a pre-set Factor-F (Refractometric method for determination of soluble solids, 2014).

Ascorbic acid measurement is based on its reducing properties. It is based on ascorbic acid extraction from the sample with a solution of hydrochloric acid and subsequent titration of the reduced form of ascorbic acid with the 2,6 dichlorophenolindophenol sodium salt solution (Tilmans reagent). This reagent in a neutral and alkaline solution has a dark blue color, and in an acidic solution it is pink-red. During the titration the acid extract of the product with Tilmans reagent, ascorbic acid is oxidized, and the Tilmans reagent is reduced to a colorless form. The titrated liquid remains colorless until oxidation of ascorbic acid is completed. The first drop of excess Tilmans reagent gives the solution a pale pink color. The mass fraction of ascorbic acid is calculated from the amount of Tillmans' reagent spent on titrating the acidic extract (Vytovtov, 2009).

6. Findings

The leak proof test of the jars showed that all six samples were sealed. The condition of the inner surface of the metal lids of all six samples was characterized by the absence of dark and rusty spots, as well as the excellent condition of rubber gaskets and sealing (paste) in the lids.

Organoleptic evaluation is a generalized result of quality assessment, performed with the help of organs of sense. Due to its simplicity and availability, the organoleptic method of quality control is very common in trade, since it allows us to judge right from the start the product's appearance and advantages for the consumer

The summarized result of the organoleptic evaluation is presented in Table 2.

Table 02. Results of organoleptic evaluation of vegetable puree samples

Quality characteristics	**Samples**					
	1	2	3	4	5	6
Appearance	6,0	5,2	4,8	4,8	4,0	6,0
Consistency	9,0	7,2	6,0	6,0	6,3	6,3
Color	5,6	4,8	4,8	4,4	3,6	6,0
Taste and smell	9,0	5,4	7,8	6,0	6,3	8,3
TOTAL	29,6	22,6	23,4	21,2	20,2	26,6

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An excellent combined quality score was obtained for sample 1 (29.6 points). This sample received the maximum points in all categories: appearance, consistency, smell and taste. The worst organoleptic evaluation score was obtained for sample 5 (20.2 points). It received the lowest score for such characteristics like appearance, color, and a somewhat liquid consistency. All other samples received an excellent quality score and had a homogeneous, soft consistency, a natural rich taste with a pronounced inherent smell and a uniform color which is characteristic of freshly prepared purees. The best combined organoleptic evaluation score was given to a sample of Polish carrot puree (sample 1) and a domestic sample of pumpkin puree (sample 6) (26.6 points).

The soluble solids mass fraction is a standard indicator of quality and should be 4%-11% in vegetable purees. All the tested baby food samples met the requirements of the standard. Samples 4 and 5 of pumpkin purees contained 6% of soluble solids. Sample 6 was slightly inferior to the other two samples, however the soluble solids mass fraction was consistent with the declared value on the label. In sample 1 of carrot puree, the soluble solids mass fraction was 8.9%, in sample 2 6.4% and in sample 3 it was 7.6%. According to the analysis results of a physicochemical index such as the mass fraction of dry substances, “Gerber” carrot puree stood out, it contained 9.5% of dry substances. This sample turned out to be the leader by physicochemical evaluation results. Among the samples of pumpkin puree, sample 5, manufactured by "Heinz", scored the highest, it contained 7.5% of dry substances. Carrot puree by "Fruto-Nyanya" (sample 3) was found to contain smaller amount of dry substances, as was the case for pumpkin puree from "Gerber" (sample 4). This explained the spreading mass and partially separated purees in samples 3 and 4. These samples received a low organoleptic evaluation score for their consistency.

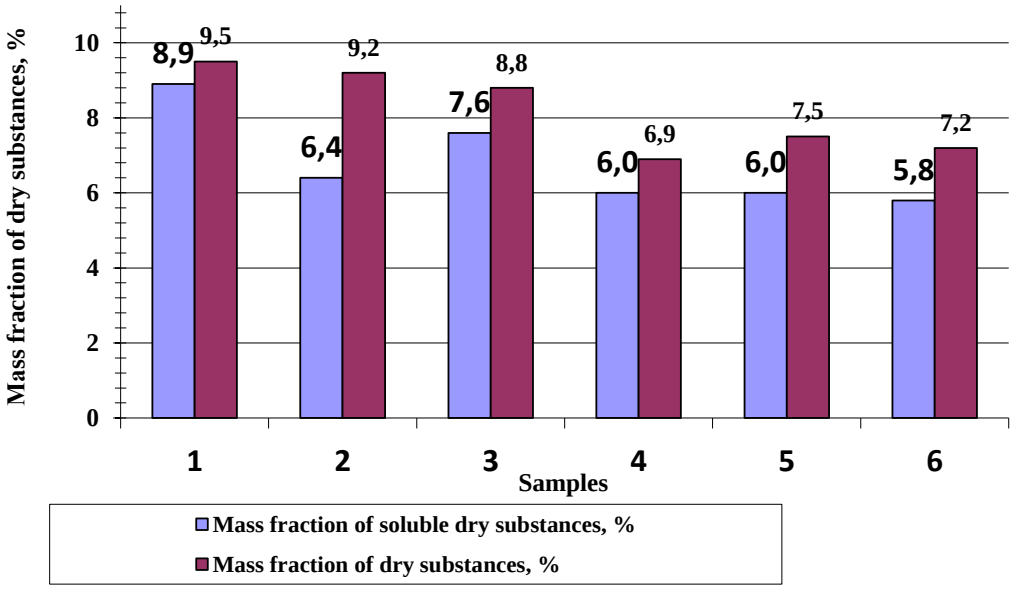

Figure 01. Mass fraction of dry substances in samples of vegetable purees, %.

The mass fraction of ascorbic acid is not normalized in baby food vegetable purees, however, vitamin C plays an important role in the human body, actively participating in metabolism of proteins and carbohydrates. It’s particularly important for the baby. The human body is not able to synthesize vitamin C, so the necessary amount must be supplied daily with food. Ascorbic acid is the most unstable vitamin, its quantity decreases during various manufacturing processes; therefore many baby food producers practice

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the exogenous introduction of this vitamin into the product during manufacturing (Rational nutrition. Recommended levels of consumption of food and biologically active substances, 2004).

According to the results of analysis it was determined that carrot puree contained 3.9-6.4 mg/100g of Ascorbic acid; pumpkin puree contained 3.9-6.2mg/100g of vitamin C. The vitamin C content is shown in Figure 2

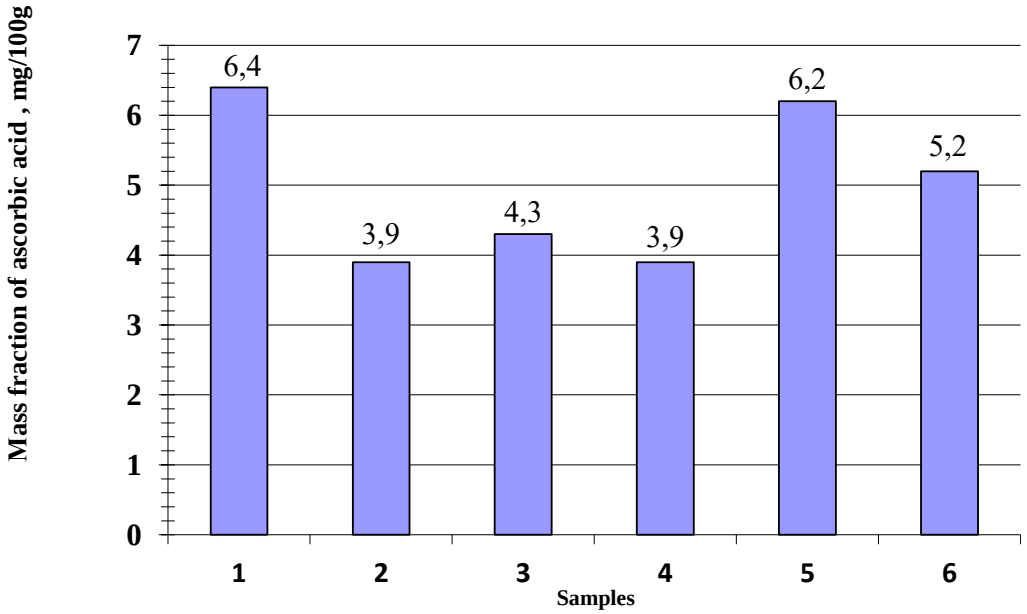

Figure 02. Mass fraction of ascorbic acid in puree samples

Figure 2 shows that the samples of carrot and pumpkin puree were not enriched with additional additives of ascorbic acid.

There are no current standard values for the mass fraction of titrated acids in samples of baby food vegetable purees, however, the evaluation of these compounds allows for better characterization of the taste differences in the samples. The highest acidity among all samples was found in sample 3 (0.3%), which coincided with the results of an organoleptic evaluation, where the sour taste of this puree was noted. In the remaining samples of carrot puree, the acidity was 0.20% and 0.23% (sample 1 and 2, respectively). The lowest acidity was determined in samples 4 (0.06%) and 5 (0.09%). Sample 6 of pumpkin purée from a domestic producer had the acidity of 0.12%. The analysis results of the titratable acidity of the tested samples of vegetable purees are shown in figure 3

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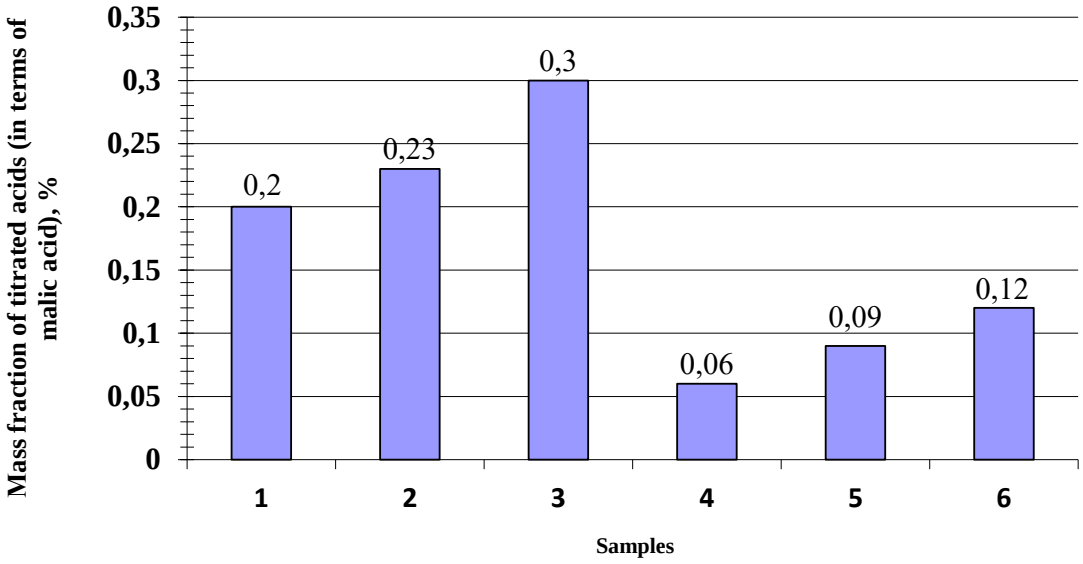

Figure 03. The mass fraction of titrated acids (in terms of malic acid)

From the data presented in Figure 3, it can be concluded that the acidity of carrot puree was higher than the acidity of the pumpkin puree. In carrot puree there is a small variation in values and in pumpkin purees the difference in values was doubled between samples 4 and 6.

Carotenoids play an important role in protecting the human body from various infectious diseases. They release free radicals from the body, as well as strengthen the nervous system. Carotenoids are not synthesized by the human body and can only be obtained from food. The carotenoid content of the tested vegetable puree samples is shown in Figure 4.

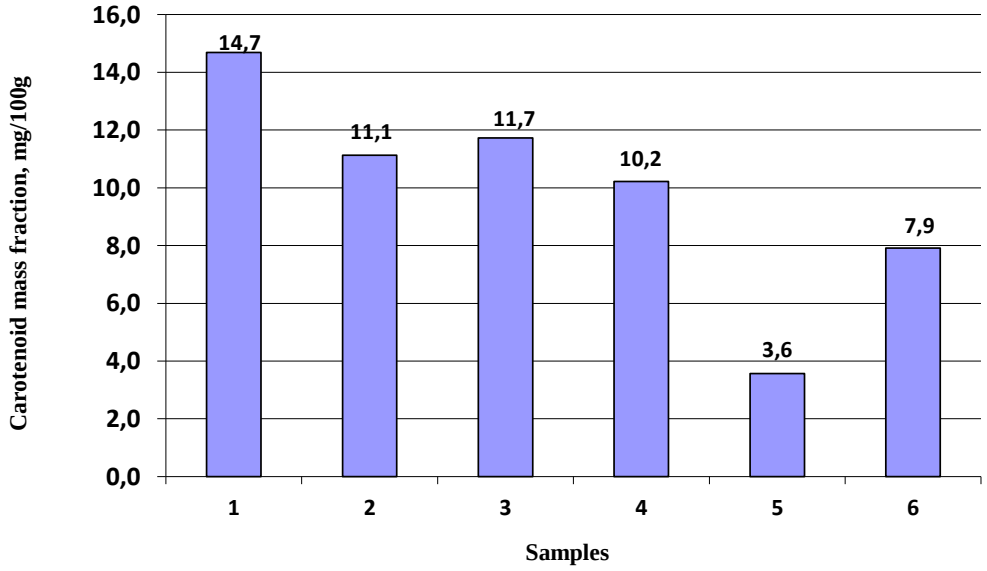

Figure 04. Mass fraction of carotenoids in vegetable puree samples, mg / 100g

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Fig. 4 diagram shows that the smallest amount of carotenoids was found in the sample 5 of pumpkin puree (3.6 mg / 100 g). The largest amount was found in sample 4 (10.2 mg / 100 g). Among the carrot purees, the greatest amount of carotenoids was found in sample 1 (14.7 mg / 100 g). In samples 2 and 3, the carotenoids were approximately at the same level - 11.1 and 11.7 mg / 100 g, respectively. Carotenoids are natural pigments, so the bright color of baby food vegetable puree is due to the carotenoid content.

7. Conclusion

The quality analysis and comparison of six baby food puree samples produced by popular brands like Gerber (Poland), Heinz (Italy) and Fruto-Nyanya (Russia) showed that all samples are packed in glass jars without mechanical damages and spills, hermetically sealed with metal lids. The labeling of the samples was complete and the information presented on all the labels of baby food vegetable puree samples (three samples of carrot puree and three samples of pumpkin puree) complied with the requirements of the normative documents (Food products labeling (2011) TR TC 022/2011).

All the six samples of vegetable purees were tested for tightness of the jar closure, and the condition of the inner surface of the metal lids proved to be safe. Based on the results of the organoleptic evaluation of the samples, we can conclude that sample 1(29.6 points) took a leading position in the evaluation. It received the maximum score in all the categories: appearance, consistency, smell and taste. Sample 5 turned out to be the worst (20.2 points). The quality level of that sample was good but, it received the lowest score for appearance, and in addition, had a liquid consistency. The quality of all the other samples was excellent; they all had a homogeneous, tender consistency, a natural rich taste with a pronounced inherent smell, a uniform color, characteristic of freshly prepared purees. The best on the organoleptic evaluation were a sample of Polish carrot puree (sample 1) and a domestic sample of pumpkin puree (sample 6 - 26.6 points).

Comparison of the actual net weight of the samples of vegetable puree with the net weight indicated on the label revealed insignificant deviations within the permissible norms established in GOST 8.579-2002. This indicates that the exact dosing of the product is observed by all the manufacturers of the studied puree samples. The mass fraction of soluble dry substances met the requirements of the standard in all samples of vegetable baby food. Samples of pumpkin puree showed fairly close values: samples 4 and 5 contained 6% soluble solids, sample 6 had a slightly lower value, however it corresponded to the value declared on the label (5.8%). Among samples of carrot puree, the leader was sample 1 (8.9%).

The best sample for the β-carotene content in carrot puree was sample 1 (1,8 mg / 100 g); the rest of the samples showed fairly close values (sample 2-1,4 mg / 100 g; sample 3-1,5 mg / 100 g). In pumpkin puree samples 5 and 6, the amount of β-carotene did not exceed 1 mg / 100 g (0.4 and 0.9 mg / 100 g, respectively). Sample 4 had the highest value - 1.2 mg /100 g of β-carotene among pumpkin purees. The relatively low quantitative ascorbic acid content in the samples can be explained by the fact that carrot and pumpkin puree samples were not enriched with additional ascorbic acid. According to the results of a study of the quality of vegetable baby food, it can be concluded that all samples met the requirements of the Russian standard. The best carrot puree was manufactured in Poland, and the best pumpkin puree turned

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out to be the domestic brand "Fruto-Nyanya." It demonstrates that domestic products are able to compete with imported products, which is important when import substitution is needed.

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