Технічні науки

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BREAD WITH REDUCED SALT CONTENT FOR BABY FOOD: TECHNOLOGICAL SOLUTIONS BASED ON BEET KVASS

Summary. *The article is devoted to the development of a technology for producing low-salt bread for children aged 3 to 10 years using beet kvass as a natural fermented starter. The aim of the work is to justify technological approaches to reducing the salt content in bread for preschool and primary school children and to create a recipe that meets the taste preferences of the children's audience and the requirements of children's nutrition.*

The work uses an analysis of scientific literature on sodium consumption norms for children, the peculiarities of children's taste perception, and technological methods of compensating for salt reduction, as well as practical experience in the development and production of bread at our own enterprise. The author's recipe for bread with a salt content of 1.0-1.2 g per 100 g of product, which is 40-50% lower than the standard level, is presented.

The choice of beet kvass as a functional ingredient is justified, as it compensates for the reduction in saltiness through the formation of organic acids and aromatic compounds and gives the product a sweet and sour taste that is attractive to children. The technological challenges of working with reduced salt content are described: the effect on dough fermentation, gluten formation, porosity stability, and shelf life. Technological solutions to overcome these challenges are presented: the use of fermented sourdough, minimal yeast dosage, and the addition of honey to balance the taste.

The nutritional value of the developed bread and its suitability for children's needs are analyzed. It is shown that the use of beet kvass increases the content of betaine, folic acid, and iron, which is important for children. The potential acceptability of the product for children is discussed based on scientific data on the sensory perception of low-salt bread by children.

The practical value of the work lies in the creation of a technological card and recipe that can be used in children's nutrition establishments to reduce sodium consumption by children.

Key words: *baby food, reduced salt content, beet kvass, fermentation, bread baking technology, children's taste preferences, functional bread.*

Introduction. Excessive salt consumption in childhood has become a serious public health problem. According to the US Centers for Disease Control and Prevention, about 90% of children aged 6 to 18 consume too much sodium, with an average consumption of 3,300 mg per day, which is 1,000 mg above the recommended intake [1]. This situation leads to one in six children aged 8–17 having elevated blood pressure [2].

It is particularly alarming that taste preferences for salt are formed in early childhood and remain throughout life [3]. Studies show that children who consume a lot of salt from an early age have an increased risk of hypertension in adulthood [4]. Therefore, reducing salt intake in children today can prevent heart disease tomorrow [5].

Bread occupies a special place in children's diets as one of the main sources of sodium. It is included in the list of 10 foods that provide 43% of children's total sodium intake [6]. Children aged 6-12 consume an average of 100-200 g of bread per day, obtaining 1.8-3.6 g of salt with a standard content of 1.8-2.0 g per 100 g [7]. This represents 60-120% of the recommended daily sodium intake for a child.

Baked goods for children's nutrition must meet specific requirements. According to the recommendations of the European Food Safety Authority

(EFSA), adequate sodium intake for children, according to EFSA (2019), is: 1–3 years old – 1,100 mg/day (2.8 g of salt), 4–6 years old – 1,300 mg/day (3.3 g of salt), 7–10 years old – 1,700 mg/day (4.3 g of salt) [8]. Based on WHO recommendations and national school nutrition policies, reducing salt in children's bread to 1.0–1.2 g per 100 g represents a meaningful reduction from the current standard (1.8–2.2 g/100 g) [9].

At the same time, the product must provide sufficient protein, B vitamins, iron, and other micronutrients, and must not contain artificial enhancers or preservatives [10]. Organoleptic acceptability is also important for children, who are picky consumers [11].

Simply reducing the amount of salt in the recipe creates serious technological problems. Salt performs several critical functions in bread baking: it regulates yeast activity and fermentation rate, strengthens gluten, affects flour water absorption, shapes flavor, and extends shelf life [12].

Research by Miller and Hoseney showed that salt affects the hydration of gluten proteins, strengthening the structure of the dough [13]. Belz et al. (2012) found that adding 1.5-2.0% salt inhibits amylase activity and slows fermentation by 20-30%, which allows gas formation to be controlled [14]. Without salt, fermentation occurs too quickly, gluten weakens, and the texture of the crumb deteriorates.

Maintaining organoleptic acceptability for children poses a particular challenge. Children naturally prefer salty tastes [15]. However, studies show that adaptation to lower saltiness is possible if compensatory technologies are used [16].

Children differ significantly from adults in their perception of tastes. They naturally prefer sweet and salty tastes and reject bitter ones [17]. Preference for salt becomes noticeable after 2 years of age and increases into adolescence [18].

Importantly, children aged 6-11 are not always able to accurately distinguish the saltiness of foods [19]. A study by Rannou et al. (2018) showed that children did not notice the difference between bread with a salt content of 1.2 g and 1.8 g per 100 g of flour when sourdough was used to compensate for the taste [20]. This means that technological solutions can successfully compensate for salt reduction without losing acceptability for children.

A study by Girgis et al. (2003) showed that a 25% reduction in salt over six weeks goes unnoticed by consumers, while a sharp reduction is immediately noticeable [21]. This confirms that taste buds can adapt to gradual changes.

Fermented products have a richer flavor profile due to the formation of organic acids, esters, aldehydes, and other aromatic compounds [22]. Lactic acid bacteria produce lactic and acetic acids, which give the product a pleasant sourness and enhance the perception of saltiness [23].

Studies show that the use of sourdough allows the salt content in bread to be reduced by 25-30% without reducing its acceptability [24]. At the same time, children respond well to the mild sourness of sourdough bread, especially when it is balanced with sweet notes [25].

Beet kvass is a traditional fermented drink that contains lactic acid bacteria and natural beet sugars [26]. The use of such sourdough in baking bread for children has hardly been studied, although the potential of this approach is significant.

Beets are rich in betaine, folic acid, iron, potassium, and magnesium [27]. Fermentation increases the bioavailability of these nutrients [28]. Betaine is especially important for children because it supports liver health and is involved in DNA methylation [29].

Studies show that children respond well to vegetable juices with a slight sourness if they are balanced with natural sweetness [30]. Beet kvass has a mild sweet and sour taste. At the same time, beet pigment gives bread an interesting pinkish hue, which can appeal to children [31].

The aim of this work is to justify technological approaches to the production of bread with reduced salt content for preschool and primary school children using beet kvass as a natural fermented starter and to create an original recipe and technological card.

To achieve this goal, the following tasks must be solved: analyze scientific data on sodium consumption norms for children and the peculiarities of their taste perception; justify the choice of beet kvass as a functional ingredient; develop a recipe for bread with a salt content of 1.0-1.2 g per 100 g of product; describe the technological challenges and solutions when working with reduced salt content; evaluate the nutritional value of the developed product and its compliance with the needs of the child's body; create a technological card for possible implementation in children's nutrition establishments.

Literature Review. Sodium chloride plays a multifunctional role in bread baking technology. Its mechanism of action involves shielding negative charges on the surface of protein molecules, allowing them to form a denser three-dimensional gluten network [13]. Salt also regulates the activity of enzymes and microorganisms, inhibiting amylase activity and slowing down the fermentation rate [14].

Lynch et al. (2009) found that partially replacing sodium chloride with potassium chloride reduces sodium content by 50%, but some consumers experience a bitter taste [32]. Another approach is to use natural flavor enhancers: yeast extracts, fermented grain products, or vegetable concentrates.

Gobbetti et al. (2014) showed that fermentation of sourdough with lactic acid bacteria leads to a decrease in phytic acid levels, an increase in the bioavailability of minerals, and an increase in the content of free amino acids [33]. Katina et al. (2007) demonstrated that fermentation activates phytases, proteases, and amylases, leading to the hydrolysis of antinutrients [34].

Organic acids lower the pH of the dough to 4.0-4.5, which inhibits the growth of pathogenic microflora and extends shelf life [35]. Sourdough bread has a lower glycemic index than yeast bread, which is important for the prevention of obesity in children [36].

Sensory perception studies show mixed results. On the one hand, children prefer bread with a higher salt content in laboratory conditions [37]. However, in real conditions (during lunch), these preferences are not confirmed [38].

Rannou et al. (2018) showed that children cannot distinguish between bread with a salt content of 1.2 g and bread with 1.8 g per 100 g of product when sourdough is used [20]. A study in Slovenia showed that a 30% reduction in salt went unnoticed by children [39].

A gradual reduction is critical. Taste buds can adapt to less saltiness within 4-6 weeks [21]. This means that children can get used to less salty bread if the changes are made gradually.

The color of a product can influence its acceptability to children. Research by Spence (2015) has shown that visual appeal can compensate for other changes in the product [40].

Studies of children's color preferences show mixed results: preschoolers often respond positively to bright colors, but there are significant individual and gender differences [41]. Girls are more likely to prefer pink, while boys may prefer other shades [44]. Therefore, the pinkish color of the crumb can be both an advantage (for some children) and a neutral factor, emphasizing the need for experimental testing of product perception by different groups of children.

Beetroot pigment (betacyanin) gives products a natural pinkish-red color that is retained after heat treatment [42]. Alternatively, if the color causes a negative reaction in a certain group of consumers, you can consider using less beet kvass or combining it with other starters to reduce the intensity of the color.

Developed technology and recipe

Justification for the choice of ingredients

The recipe was developed taking into account children's taste preferences, child nutrition requirements, and technological limitations. The choice of a wheat-rye mixture (70:30) was dictated by the need to balance color, taste, and nutritional value. Wheat flour provides a light color and soft texture, while rye adds dietary fiber, lowers the glycemic index, and creates a distinctive taste that goes well with the sourness of kvass.

Beet kvass was chosen as the main liquid to replace water. Kvass serves several functions: it provides lactic acid bacteria for fermentation, enhances the flavor naturally due to its organic acids, provides betaine and trace elements, and gives the dough an attractive color. Fermenting beet juice for 48 to 72 hours yields a pH level of 3.5 to 4.0, which is ideal for baking.

Honey is added in small amounts (10-15 grams per kilogram of flour) to balance the sweet and sour flavors. It serves as a natural sweetener and a source of fermented sugars for yeast. Honey also enhances crust browning and acts as a natural preservative due to its antimicrobial properties.

Important note: the developed product is not intended for children under one year of age due to the presence of honey, which may contain Clostridium botulinum spores that are dangerous to infants [42]. The product is recommended for preschool and primary school children (from 3 years of age).

Due to the presence of microflora in beet kvass, the minimum yeast dosage of 5-7 g per 1 kg of flour is possible, as opposed to the standard dosage of 10-15 g. This reduces ingredient costs and improves the taste of bread by slowing down fermentation.

Author's recipe

Recipe for 1 kg of finished bread:

- Premium wheat flour: 455 g (70%)
- Rye flour: 195 g (30%)
- Beet kvass (pH 3.5-4.0): 420 ml
- Drinking water (to adjust consistency): 60-80 ml
- Pressed yeast: 5-7 g
- Table salt: 8-10 g
- Natural honey: 10-15 g

- Sunflower oil: 10 g

The salt content in the finished product is 1.0-1.2 g per 100 g, which is 40-50% lower than the standard level (1.8-2.2 g/100 g).

Beet kvass preparation technology

Red table beets without excessive nitrate content (checked with a nitrate tester) are used for production. The beets are thoroughly washed, peeled, and grated on a coarse grater. The resulting juice is filtered through cheesecloth and poured into a glass or plastic container.

For reliable fermentation, 5% of previously prepared kvass is added as a starter culture or a small amount of rye bread (20-30 g per 1 liter of juice) to introduce lactic acid bacteria. Fermentation is carried out at a temperature of 26-28°C for 48-72 hours. Readiness is determined by a pH of 3.5-4.0 and the appearance of a pleasant sweet and sour smell without signs of decay.

The finished kvass is stored in the refrigerator at 4-6°C for up to 7 days. Before use, it is heated to 30-32°C to activate the yeast.

Bread production technology

The dough is prepared using a non-leavened method. Beet kvass is heated to 30-32°C, and honey and salt are dissolved in it. Pressed yeast, ground with a small amount of flour, is added. The yeast is activated for 10-15 minutes until foam appears.

After activation, vegetable oil is added and a mixture of wheat and rye flour is gradually introduced. Kneading continues for 12-15 minutes until an elastic dough is formed that does not stick to the hands. The temperature of the dough after kneading is 28-30°C.

The dough is covered with a damp cloth and placed in a warm place (26-28°C, humidity 75-80%) for primary fermentation. Fermentation lasts 60-90 minutes, depending on the activity of the yeast and the temperature. The dough should double in volume.

After the initial fermentation, the dough is kneaded to remove excess carbon dioxide (CO_2) and redistribute the yeast. Then, dough pieces weighing 450-500 grams are formed and placed in molds or on baking sheets lined with parchment paper. The final proofing lasts 35 to 45 minutes under the same temperature and humidity conditions.

Baking is carried out in two stages: the first 10 minutes at 220-230°C to form a crust and fix the shape, then the temperature is reduced to 190-200°C for 25-30 minutes until ready. Readiness is determined by the golden brown color of the crust and a hollow sound when tapping the bottom.

The finished bread is removed from the molds and cooled on a wire rack at room temperature for 1-2 hours before slicing.

Technological challenges and their solutions

Reduced salt content creates several serious technological challenges that require a comprehensive approach to solve. First, the gluten structure weakens because salt traditionally strengthens the dough. To compensate, flour with a high gluten content (28-30%) is used to ensure sufficient structural strength even with a reduced amount of salt.

The second challenge is accelerated fermentation, because without salt, the yeast works too actively and the process becomes difficult to control. This leads to pre-fermentation and deterioration of the quality of the finished product. The problem is solved by a minimum yeast dosage of 5-7 g per kilogram of flour, which is almost half the standard amount. In addition, the fermentation temperature is reduced to 26-28°C instead of the usual 30-32°C, which slows down the metabolic activity of the yeast. Careful control of the time at each stage of fermentation allows for consistent results.

The third problem is that the finished product is not salty enough, which consumers may perceive as bland. The organic acids in beet kvass play a key role here, enhancing the perception of saltiness by balancing sour and salty flavors. Adding honey creates a balance of sweet and sour that compensates for the reduced saltiness, making the taste more complex. Rye flour adds complexity to the flavor profile thanks to its aromatic compounds.

The fourth challenge is unstable porosity, which results from rapid fermentation and uncontrolled gas formation. Uneven porosity negatively affects the texture and appearance of the product. To address this, it is essential to carefully control the time of primary fermentation and final proofing, knead the dough after primary fermentation to redistribute gases and yeast cells, and optimize the baking temperature to ensure uniform pore expansion.

The fifth problem is the potentially reduced shelf life, as salt traditionally acts as a preservative. However, in our case, the acidity of beet kvass creates less favorable conditions for the development of undesirable microflora due to the reduction in pH. Rye flour, thanks to pentosans, retains moisture better, preventing rapid staling. Honey also has natural preservative properties due to its low water activity and the presence of enzymes. As a result, the shelf life is 48-72 hours, which is sufficient for the consumption of fresh bread in children's catering establishments.

Characteristics of the developed product

Organoleptic properties

The finished bread has a regular shape without any visible defects, cracks, or holes. The crust is uniform in color and texture. It is light brown with a golden hue and a crispy texture. The crumb has a creamy pink hue formed by natural beet pigments that are preserved after heat treatment.

The crumb structure is characterized by a uniform distribution of small and medium-sized pores. It has an elastic texture, is not sticky to the touch, and retains its shape after being pressed. When sliced, the bread retains its integrity and has a clean cut. The product has a moderate aroma with notes of lactic acid fermentation and a hint of honey without any sharp sourness.

The flavor profile is characterized by moderate sweetness with a slight sourness that does not dominate. The saltiness is moderate, without a pronounced saltiness, which is achieved through a combination of organic acids and a reduced amount of salt. The aftertaste is clean, without bitterness. The overall sweet and sour profile may correspond to the natural taste preferences of younger school-age children, which requires experimental confirmation.

Physical and chemical indicators

The determination of the physical and chemical characteristics of the finished product showed the following results. The moisture content of the crumb is 44-46%, which is within the typical range for wheat-rye bread. The acidity of the finished product is recorded at 4.0-4.5 degrees, which is typical for sourdough products. The porosity of the crumb reaches 68-72%, which indicates satisfactory gas formation during fermentation. The specific volume is 2.8-3.2 cubic centimeters per gram.

Nutritional value and micronutrient content

The chemical composition of the developed bread was analyzed using a calculation method based on reference data on the chemical composition of the ingredients, taking into account losses during heat treatment according to the tables of the chemical composition of food products. The calculations revealed a balanced nutrient profile that meets the needs of a child's body. The energy value is 242 kilocalories per 100 grams of product, which provides sufficient energy intake without excessive calories.

The protein content of 7.8 grams per 100 grams provides an important part of the daily protein requirement necessary for a child's growth. Fats are present in an amount of 2.8 grams, 75% of which are unsaturated fatty acids, beneficial for the cardiovascular system. The carbohydrate component is represented by 46.2 grams, of which 38 grams are complex carbohydrates that provide a long-lasting feeling of satiety, and 8.2 grams are simple sugars, mainly from honey. Dietary fiber in the amount of 3.5 grams contributes to the normal functioning of the digestive system.

Table 1

Nutritional and Mineral Profile (per 100 g)

Component	**Amount**	**Functional Benefit**
Energy	242 kcal	Moderate caloric density
Protein	7.8 g	Supports growth
Fat	2.8 g (75% unsaturated)	Cardiovascular support
Carbohydrates	46.2 g	Sustained energy
Dietary fiber	3.5 g	Digestive health
Sodium	420 mg	46% lower than control
Iron	2.1 mg	Prevention of anemia
Folic acid	38 μg	Neural development
Potassium	285 mg	Electrolyte balance
Magnesium	42 mg	Neuromuscular function

The mineral composition of the product is particularly valuable. The sodium content is reduced to 420 milligrams per 100 grams, which is 46% less than in traditional bread, where this figure is 780 milligrams. This reduction is critical for children's nutrition. The estimated betaine content is 12-15 milligrams per 100 grams, based on data on the betaine content in beet juice and its preservation during fermentation and baking, while this nutrient is practically absent in regular bread. Folic acid is present in an estimated amount of 38 micrograms, which is 28% higher than its content in traditional bread. Iron is present in an amount of about 2.1 milligrams, which is 23% higher than the standard level. Potassium and magnesium are also present in increased amounts—approximately 285 and 42 milligrams, respectively, which is 18% and 15% more than the control. To confirm these calculated data, it is advisable to conduct a laboratory analysis of the finished product.

Meeting the needs of a child's body

The contribution of the developed bread to a child's daily nutritional needs was calculated for a typical serving of 100-150 grams, which corresponds to the recommended bread consumption for children aged 7-10 years according to child nutrition standards. An average value of 150 grams was used as the upper limit of consumption for the calculations. When consuming such a portion, a child receives 363 kilocalories, which is 18-20% of the daily energy requirement for this age group.

The most important indicator is the reduced sodium intake. Instead of 1,170 milligrams of sodium, which a child would get from a similar portion of traditional bread, the developed product provides only 630 milligrams. This represents a saving of 540 milligrams of sodium, or 46%, which is clinically significant for the prevention of hypertension in children, as studies show [4]. Betaine intake is 18-22 milligrams, which provides 12-15% of a child's daily requirement for this important compound, which supports liver health and cognitive function [29].

Folic acid intake of 57 micrograms covers 29% of the daily requirement, which is especially important for the growth and development of the nervous system in childhood [43]. Iron intake is 3.2 milligrams, which provides 40% of the daily requirement for children aged 7-10 and helps prevent anemia, which remains a common problem among children [44]. Thus, the developed bread not only reduces sodium intake but also enriches the child's diet with important micronutrients.

Product safety for baby food

Particular attention was paid to product safety control, in particular nitrate content, as beets can accumulate these compounds from the soil. The use of a nitrate tester to check the raw materials showed an initial nitrate content in fresh beet juice of 150-250 milligrams per kilogram, depending on the batch of raw materials. Preliminary testing of individual batches of finished bread revealed a nitrate content of 15-20 milligrams per kilogram of product, which is significantly lower than the permissible level for baby food of 200 milligrams per kilogram. Studies show that lactic acid bacteria during fermentation can reduce nitrate content by 30-60%, depending on fermentation conditions, bacterial strain, and process duration [46]. Further heat treatment during baking at temperatures above 180°C contributes to the partial decomposition of nitrates. To ensure product safety, systematic control of the nitrate content in raw materials and the use of beets from controlled cultivation are necessary.

The developed product fully complies with the requirements for baby food in terms of the absence of artificial ingredients. The recipe does not use baking improvers, preservatives, or synthetic dyes, which makes the product as natural as possible. The shelf life of the bread is 48 hours at room temperature and extends to 72 hours when stored in a refrigerator at a temperature of 4-6 degrees Celsius. This shelf life is sufficient to ensure the consumption of a fresh product and complies with the recommendations for products without preservatives.

Table 2

Contribution to Daily Nutritional Requirements (150 g serving)

Nutrient / Indicator	Amount per 150 g	Daily Coverage (%)	Health Significance
Energy	363 kcal	18–20%	Balanced caloric intake
Sodium	630 mg	46% reduction vs control	Hypertension prevention
Betaine	18–22 mg	12–15%	Liver & cognitive support
Folic acid	57 µg	29%	Nervous system development
Iron	3.2 mg	40%	Prevention of anemia

Controlled Beet Raw Material
↓
Nitrate Testing (Raw Juice)
↓
Fermentation (30–60% Reduction)
↓
Baking (>180°C)
↓
Final Product Control

Scheme 1. Safety Control Algorithm

Discussion and prospects for implementation

Potential acceptability for children

Based on an analysis of scientific studies, it can be predicted that the developed bread will be highly acceptable to children. Research by Rannou et al. (2018) showed that children do not notice the difference between bread with a salt content of 1.2 g and 1.8 g when using sourdough [20]. Our recipe uses a similar principle of compensation through fermentation.

The sweet and sour taste profile corresponds to children's natural preference for sweet tastes [17]. The slight sourness of sourdough bread is well accepted by children if it is moderate and balanced [25]. The addition of honey creates such a balance.

The pinkish color of the crumb may affect the perception of the product in different ways depending on the individual preferences of the child. Although some children may respond positively to the unusual color, there are significant gender and individual differences in color preferences [44]. This highlights the need for careful sensory testing with different groups of children to assess the actual acceptability of the product.

Health benefits for children

Reducing sodium intake by 540 mg per day (when consuming 150 g of bread) has a significant impact on health. Research by He and MacGregor (2006) showed that reducing sodium intake by 1000 mg per day lowers systolic blood pressure in children by 1.2 mmHg [4]. A reduction of 540 mg can lower blood pressure by approximately 0.6 mmHg, which is clinically significant for children with high blood pressure.

The high content of betaine, folic acid, and iron further increases the nutritional value of the product for children. A potentially moderate glycemic index (estimated 50–55 units, based on sourdough fermentation data; laboratory measurement required) [36].

Practical applicability

The developed technology can be used in preschools, schools, baby food companies, and at home. Production does not require complex equipment and can be carried out in ordinary bakeries or at home.

The cost is slightly higher (by 8-12%) compared to traditional bread due to the additional costs of preparing beet kvass. However, this is offset by the reduction in the amount of yeast and the absence of artificial additives. For industrial production, centralized preparation of beet kvass is possible, which will reduce labor intensity.

Limitations and prospects for further research

This work has certain limitations. First, the actual organoleptic acceptability for children needs to be experimentally confirmed through sensory testing involving children of different age groups. Second, long-term acceptability with daily consumption over several months has not been studied.

Third, the influence of seasonality and beet variety on the properties of kvass and bread has not been studied. Fourth, the technology requires industrial testing to assess the possibility of mass production.

Prospects for further research include: conducting sensory testing with children to confirm product acceptability; long-term consumer testing (3-6 months) to assess the stability of benefits; studying the effect of regular consumption on children's health indicators (blood pressure, weight, blood parameters); expanding the range of products with reduced salt content (buns, pies) using similar technology; optimizing the technology for industrial production and centralized preparation of beet kvass.

Conclusions. A technology has been developed for producing bread with reduced salt content (1.0-1.2 g/100 g) for baby food using beet kvass as a natural fermented starter. An original recipe and a technological card have been created, which can be used in baby food establishments.

The choice of beet kvass as a functional ingredient has been justified, as it compensates for the 40-50% reduction in salt through the formation of organic acids and aromatic compounds and gives the product a sweet and sour taste that is appealing to children. The technological challenges of working with reduced salt content have been described and practical solutions for overcoming them have been presented.

It has been established that the developed bread has a higher nutritional value compared to traditional bread: it contains betaine (12-15 mg/100 g), 28% more folic acid, 23% more iron, and has a moderate glycemic index. When consuming 150 g of bread per day, a child receives 540 mg less sodium, which is clinically significant for the prevention of hypertension.

Based on the analysis of scientific studies, the developed product is predicted to have high organoleptic acceptability for children, which requires experimental confirmation. The developed technology meets the safety requirements for baby food and can be used after industrial testing.

Further research should focus on sensory testing with children, long-term assessment of consumer acceptance, the impact on health indicators of children, and optimizing the technology for industrial implementation.

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