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SUBSTANTIATION OF SAFETY AND QUALITY INDICATORS OF NATURAL MINERAL AND SPRING WATERS IN UKRAINE FOR THE PREPARATION OF FOOD FOR INFANTS

The object of the research is regulatory support for the use of natural mineral waters and spring waters for the preparation of food for infants. Along with drinking water, natural mineral water is used for the preparation of food for infants, which is more protected from contamination. Currently, there are no approved safety parameters for natural mineral waters and spring waters in Ukraine, as well as requirements for markings on packaging or labeling that relate to the suitability of these waters for feeding infants. In this work, based on the results of the analysis of the current legal documents of European countries (Poland, Bulgaria, the Czech Republic, France, Germany) on the use of natural mineral waters in the preparation of food for infants, the indicators of the safety and quality of natural mineral and spring waters in Ukraine in the preparation of food are substantiated food for infants. Because of the specific physiological needs of children at an early age, water for cooking is an important factor in their normal psychophysical development. Water for preparing infant food must meet stricter criteria for total mineralization (suggested: ≤500 mg/l), the content of certain macro-components, nitrites (suggested: ≤0.1 mg/l), nitrates (suggested: ≤10 mg/l), ammonium (suggested: ≤0.1 mg/l), fluorides (suggested: ≤0.7 mg/l), sanitary and microbiological indicators (suggested normalization of the indicator of the total microbial number in the finished product). The peculiarities of the technology of industrial packaging of natural mineral waters and spring waters for the preparation of infant food are outlined. These waters are packaged only non-carbonated, without the addition of any preservatives or disinfectants. Packaging of these waters should take place near water points, which should be reliably protected from biological and chemical contamination. The obtained results can be used for the development and approval of a normative legal act in Ukraine on the regulation of the use of natural mineral waters and spring waters for the preparation of infant food.

Keywords: *natural mineral water, spring water, infant food, safety indicators, Directive 2009/40/EC, Directive 2003/40/EC.engineering.*

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1. Introduction

In accordance with the terms of the Agreement on the Association of Ukraine with the European Union (EU) since 2014, harmonization and adaptation of Ukrainian legislation to EU legislation has been taking place sectorally.

In the field of food products, an order [1] harmonized with Directive 2009/54/EC [2] regulating the Hygienic requirements for their production and circulation has been approved in Ukraine regarding natural mineral waters and spring waters.

Order [1] allows some designations and criteria for labeling natural mineral water, in particular, "suitable for cooking food for infants" [3]. However, specific criteria for these waters are not given in the order, just as the safety parameters of natural mineral waters and spring waters have not been approved so far in Ukraine.

According to Clause 3 of Art. 3 of Directive 2009/54/EC [2] "Member States may adopt specific provisions regarding indications, both on packaging or labeling and in advertising, relating to the suitability of natural mineral water for feeding infants".

In the dynamically developing market of bottled water in Ukraine, there are so-called "infant" waters that can be used both for drinking and for diluting breast milk substitutes and dry cereals. Among these waters there are also natural mineral waters. However, according to the Law of Ukraine [4] "water for infant food is drinking water, specially treated for consumption by infants and young children, intended for the preparation of infant food and drinking".

Feeding infants is one of the key conditions for ensuring their harmonious growth. In the first months of life, the only source of water is mother's milk. However, a large number

of infants are formula fed. To provide children with artificial nutrition, dry mixtures are reconstituted with water. Natural mineral waters, which have an underground origin and are protected from anthropogenic and technogenic pollution, are promising for use in children's nutrition.

The aim of research is to substantiate and develop indicators of the safety and quality of natural mineral and spring waters in Ukraine in relation to the preparation of food for infants, studying the peculiarities of the technology of their industrial packaging.

2. Materials and Methods

The object of research is regulatory support for the use of natural mineral waters and spring waters for the preparation of food for infants. In the research process, materials were used that characterize the problems of standardizing indicators of safety and quality of natural mineral waters in Ukraine and European countries (Poland, Bulgaria, the Czech Republic, France, Germany). The current regulatory and legal documentation related to natural mineral waters for cooking food for infants was analyzed. The methodological basis of the work is a systematic approach to the study of the object. Methods of systematic and mathematical analysis were used to solve the scientific problem.

3. Results and Discussion

Water is the main component of the human body at all stages of development. It creates an environment for biochemical processes in which it is both a substrate and a product [5]. In particular, it participates in maintaining homeostasis through thermoregulation and the transfer of nutrients, ions, vitamins, and hormones [6].

Infants need four times more water than adults [7]. This is a consequence of a greater ratio of body surface to mass and lower heat resistance [5, 8]. The European Food Safety Agency (EFSA) recommends consuming 700–1000 ml/day for children aged 0–6 months and 800–1000 ml/day for children aged 6–12 months [9]. Recommendations of the World Health Organization (WHO) regarding the amount of water for infants are 750 ml/day [10]. WHO also recommends an additional amount of liquid for breastfed infants from 6 to 24 months: 400–600 ml per day in temperate climates and 800–1200 ml per day in hot climates [7].

Water used for drinking and cooking is a source of necessary biogenic macro- and microelements (mineral substances) for the human body. Mineral substances belong to the composition of enzymes, hormones and vitamins, ensure normal development of the skeleton, metabolism, etc. [11]. Of the macronutrients, sodium, potassium, calcium, magnesium, chlorine, and iron play an important role in the body. Both food and water should contain trace elements – zinc, copper, fluorine, iodine, etc.

3.1. General mineralization. The amount of total mineralization of water is of great importance for health. Mineralized water cannot be used for daily consumption. They cannot sufficiently perform the role of removing metabolic breakdown products from the body and increase the risk of developing a number of diseases of the cardiovascular system, in particular, hypertension, urinary system, for example, urolithiasis, musculoskeletal system – joint diseases, etc. However, low-mineralized water can also harm health. Prolonged consumption of such water can lead to the leaching of minerals from the body.

3.2. Calcium. Calcium affects bone development, regulates muscle contraction and myocardial activity, is indispensable for blood clotting and transmission of nerve impulses [12]. Insufficient calcium intake in childhood can cause rickets [5]. It is known that calcium from drinking or mineral water is absorbed in the digestive tract as well or even better than calcium from milk and dairy products [13].

3.3. Magnesium. Magnesium is involved in more than 300 basic metabolic reactions in the body. It is necessary for the transport of calcium and potassium ions through cell membranes, thus influencing the conduction of nerve impulses, muscle contraction and normal heart rhythm [5]. Magnesium affects lipid metabolism and protein synthesis, protects against cardiovascular diseases [13].

3.4. Sodium and potassium. Sodium is almost the most important electrolyte in the body due to its osmotic activity. Sodium affects membrane processes, ensures proper hydration of the body. Potassium is the main cation in the intracellular space. Decreased or increased content of potassium in the body can cause cardiac arrhythmias [5].

3.5. Chlorine. Chlorine ions form hydrochloric acid (digestive juice). The increased content of chlorides in the water can affect the functions of the intestine: it can stimulate peristalsis of the intestine and the secretion of water in it, and it can also have a choleretic effect [13].

3.6. Nitrates and nitrites. In normal concentrations for an adult, nitrates are not harmful. However, nitrites, which are formed as a result of metabolic transformations in the body, are dangerous due to the formation of nitrosamines, which have carcinogenic, mutagenic and teratogenic effects. Nitrites oxidize the divalent iron in hemoglobin to trivalent, forming methemoglobin, which loses its ability to bind and transport oxygen. In infants, the breakdown of nitrates and nitrites is difficult. In the first months, infants should not eat food or water with high nitrate content [5].

3.7. Microelements. Microelements are necessary for some biological functions in the body. Cobalt is a component of vitamin B12, a growth factor that ensures the synthesis of nucleic acids and hematopoiesis. Chromium takes part in enzymatic reactions, in particular, regarding the metabolism of carbohydrates, lipids and proteins. Iron is part of blood and muscle tissues: hemoglobin, myoglobin. Fluorides protect teeth and prevent caries, participate in bone development. Iodides are indispensable for the synthesis of hormones involved in the growth and development of the body. Manganese takes part in the synthesis of a number of enzymes, in particular, in the exchange of proteins and sugars, bone development. Molybdenum is responsible for the formation of enzymes related to uric acid. Copper ensures the functionality of some enzymes in the blood, muscles and protects the integrity of the muscle membrane [13].

The balance of mineral substances in water ensures the degree of its physiological completeness. In Ukraine, the approved indicators of physiological completeness for drinking water are presented in [14] (total hardness, total

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alkalinity, iodine, potassium, calcium, magnesium, sodium, dry residue, fluorides). However, all these components can also be harmful in high concentrations in water for infants. Table 1 shows the potential threats to the health of infants from the use of drinking water [5].

Table 1

Potential threats to the health of infants from the use of water for drinking and preparation of milk formulas [5]

Chemical component	The most important possible health effects
Sodium	Kidney damage, hyperemic dehydration
Sulfates	Diarrhea, dehydration
Fluorine	Fluorosis
Nitrates	Methemoglobinemia
Heavy metals	Genotoxicity, neurotoxicity, etc.
Xenoestrogens from plastic bottles	Disorders of the male reproductive system

In addition to chemicals in drinking water from the Table 1, micro-organisms, in particular, Escherichia coli, coliform bacteria, enterococci, Pseudomonas aeruginosa, sulfite-reducing bacteria can also pose a danger to the health of infants.

3.8. Regulatory requirements regarding the safety and quality indicators of natural mineral waters in Ukraine regarding the preparation of food for infants. In 2003, WHO approved the Global Strategy for Infant and Young Child Feeding [15]. The strategy reiterates the importance of exclusively breastfeeding infants in the first six months. If it is impossible to feed infants with breast milk, it is necessary to use its substitutes. These substitutes (mixtures) must meet Codex Alimentarius standards. As an alternative, it is possible to use mixtures prepared at home with trace element additives [16].

The quality of the water used to reconstitute the mixtures is confirmed by the Scientific Committee on Food (SCF) of the European Commission [17]. However, these recommendations give the recommended energy per 100 ml of the finished mixture. They were developed on the basis of the composition of cow's milk and protein (Table 2).

The list of components and their approximate values for human health in drinking water of the fourth revision of WHO recommendations in 2017 [10] differs from the list of recommendations of the second revision (1996) [18]. It is worth noting that the complete list of safety indicators for drinking water according to WHO data [10] is much larger.

Since the object of the research is, in addition to natural mineral waters, spring waters, we also paid attention to drinking waters. According to the requirements of European and national legislation, spring water must meet the requirements for both natural mineral waters and drinking water. In this regard, it is appropriate to cite another European document on drinking water – Directive 2020/2184 on the quality of water for human consumption [19].

In Ukraine, the requirements for bottled drinking water for infants (from the first days of life to 3 years) are regulated by the current DSanPiN 2.2.4-171-10 [14]. Here are the main ones:

– water is not treated with reagents, does not contain preservatives and is not artificially mineralized;
– packaged in glass containers and single-use containers with a volume of no more than 6.0 liters, indicating on the label the expiration date "Use by" and storage conditions after depressurization of the container;
– ammonium content does not exceed 0.1 mg/l.

Regarding natural mineral and spring waters, their safety parameters in Europe are regulated by Directive 2003/40/EC [20]. These safety parameters have not yet been approved in Ukraine. Partly harmonized European requirements are contained in the national standard DSTU 878-93 [21].

According to Clause 3 of Art. 3 of Directive 2009/54/EC [3] the legislation of different EU member states contains different requirements regarding the suitability of natural mineral waters for feeding infants. Table 3 shows summarized data of some European countries regarding the chemical parameters of these waters.

From the Table 3, it can be seen that the largest number of parameters that are standardized in natural mineral waters for cooking food for infants is contained in French legislation (an exhaustive list of standardized indicators is given in [29]). This list includes indicators for both mineral and drinking waters. However, the vast majority of these indicators have stricter values for infant waters than for mineral waters. These values are close to the values of indicators of drinking water.

It is worth emphasizing once again that in addition to the special indicators for water for cooking food for infants, this water must meet all the requirements for both mineral and drinking water.

Table 2

Recommendations on the content of trace elements in drinking water [16]

Mineral	Drinking water, recommendations (WHO 1996 [18]), no more than	Drinking water, recommendations (WHO 2017 [11]), no more than	EC, SCF 2003 (2) (recommended energy/content: 60–70 kcal/100 ml; based on 65 kcal/100 ml, formula based on cow's milk and protein)
Calcium, mg/l	–	–	325–910 (Ca:P = 1–2)
Iron, mg/l	0.3[2]	–	1.95–8.40
Zinc, mg/l	3.0[2]	–	3.25–9.75
Copper, mg/l	1.0[2]; 2.0[1] (P)	2.0[1]	0.228–0.65
Selenium, μg/l	10[1]	40[1]	20–59
Fluorine, mg/l	1.5 (P)	1.5	≤0.65
Magnesium, mg/l	–	–	33–98
Sodium, mg/l	200[1]	–	130–390
Sulfates, mg/l	250[1]	–	–
Chlorides, mg/l	250[1]	–	325–1040
Manganese, μg/l	100[2]; 500[1] (P)	–	6.5–650.0

Notes: 1 – indicative value for health, (P): preliminary; 2 – parameters of drinking water that may cause complaints from consumers

With regard to the microbiological composition of mineral waters for the preparation of food for infants, these waters must meet all the requirements that are put forward for mineral waters regarding the microbiological state. General European requirements are specified in Directive 2009/54/EC [3] (Table 4).

In the Czech Republic, additional requirements for CFU for mineral water and spring water for cooking food for infants have been established – the indicator is standardized for the finished product until the moment of sale to the final consumer [22].

Table 3

Physical and chemical parameters of natural mineral waters for cooking for infants

No.	Indicator	Units of measurement	Maximum permissible content levels								
			Natural mineral waters, EC [20]	Water for cooking food for infants							
				Czech Republic [22]	Germany [23]	Poland [24]	Hungary [25]	Austria [26]	Switzerland [27]	Bulgaria [28]	France [29]	Ukraine (project)
1	Antimony	mg	0.005	–	–	–	–	–	–	–	0.005	–
2	Arsenic	mg	0.010	–	0.005	–	0.005	–	0.005	0.005	0.010	–
3	Barium	mg	1.0	–	–	–	–	–	–	–	0.7	–
4	Boron	mg	–	–	–	–	–	–	–	–	0.3	–
5	Cadmium	mg	0.003	–	–	–	–	–	–	–	0.003	–
6	Chrome	mg	0.050	–	–	–	–	–	–	–	0.005	–
7	Copper	mg	1.0	–	–	–	–	–	–	–	0.2	–
8	Cyanide	mg	0.070	–	–	–	–	–	–	–	0.010	–
9	Fluorides	mg	5.0	–	0.7	0.7	0.7	1.5	0.7	0.7	0.5	0.7
10	Lead	mg	0.010	–	–	–		–	–	–	0.010	–
11	Manganese	mg	0.50	0.05	0.05	–	0.05	–	0.05	0.05	0.05	–
12	Mercury	mg	0.001	–	–	–	–	–	–	–	0.001	–
13	Nickel	mg	0.020	–	–	–	–	–	–	–	0.002	–
14	Nitrates	mg	50	10	10	10	10	10	10	10	10	10
15	Nitrite	mg	0.1	0.1	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.1
16	Selenium	mg	0.010	–	–	–	–	–	–	–	0.01	–
17	Zinc	mg	–	–	–	–	–	–	–	–	0.10	–
18	Conductance	mS/m	–	70	–	–	–	–	–	–	–	–
19	pH	unit pH	–	5–8	–	–	–	–	–	–	–	–
20	Dissolved substances	mg	–	500	–	–	650	–	–	–	–	500
21	Sodium	mg	–	–	20	20	30	20	20	20	200	30
22	Potassium	mg	–	–	–	–	–	10	–	–	–	–
23	Chlorides	mg	–	–	–	20	100	50	–	250	250	100
24	Sulfates	mg	–	–	240	–	150	240	240	240	140	–
25	Uranus	mg	–	–	0.002	–	–	–	0.002	–	–	–
26	Iodides	mg	–	–	–	–	0.45	0.1	–	–	–	–
27	Hydrocarbons	mg	–	–	–	–	–	550	–	–	–	–
28	General stiffness	CaO/l, mg	–	–	–	–	50	–	–	–	–	–
29	Calcium	mg	–	–	–	–	–	175	–	–	100	–
30	Magnesium	mg	–	–	–	–	–	50	–	–	50	–

Table 4

Sanitary and microbiological safety indicators of mineral waters

No.	Characteristics	Values	
		Directive 2009/54/EC [3]	The Czech Republic [22], a project for Ukraine
1	Total microbial count (TMC) at a temperature of (36±1) °C after 24 hours, CFU/ml, no more	100*	60**
2	Total microbial count (TMC) at a temperature of (22±1) °C after 72 hours CFU/ml, no more	100*	300**
3	Total coliform bacteria in 250 ml	Absence	
4	Thermotolerant coliform bacteria (*E. coli*) in 250 ml	Absence	
5	Pseudomonas aeruginosa (*Pseudomonas aeruginosa*) in 250 ml	Absence	
6	Intestinal enterococci in 250 ml	Absence	
7	Spore-forming sulfite-reducing anaerobes in 50 ml	Absence	

Notes: * – the total number of viable microorganisms must be measured only at the water point, during the production and packaging process for 12 hours, during which the water must be maintained at a temperature of (4±1) °C; ** – in finished production before the moment of sale to the final consumer

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3.9. Development of indicators of safety and quality of natural mineral and spring waters in Ukraine for preparing food for infants. The results of the preliminary analysis showed that the general mineralization, the content of some macro- and micro-components, sanitary-chemical and microbiological indicators should be attributed to the main determinants of water selection for cooking food for infants. This water should not even potentially have a negative effect on infants.

When developing indicators of the safety and quality of natural mineral and spring water in Ukraine for cooking food for infants, in addition to the regulatory and legislative framework of European countries, the provisions of the report of the Scientific Committee of the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN) were taken into account [30]. When developing criteria for indicators of water for infants (reference value) for the parameter under consideration, the members of this committee took into account the permissible daily consumption level (*PDCL*), the average weight of an infant of 5 kg and water consumption of 750 ml/day in accordance with WHO guidance [10]. For the calculation, the contribution of water to the daily consumption of the indicator under consideration was taken into account at the level of 50 %.

According to [10], for non-carcinogenic substances (with a threshold dose), the normative value (*NV*) of the indicator is calculated on the *PDCL* basis in accordance with:

$$NV = \frac{PDCL \cdot BW \cdot P}{C}, \quad (1)$$

where *BW* – body weight, *P* – PDCL share that refers to drinking water (the contribution of water to the total daily consumption of the substance in question), *C* – the volume of daily consumption of drinking water.

However, the calculated BW for adults according to this formula will not always be acceptable for infants [30]. Therefore, an individual approach to its development should be applied to each safety indicator.

3.9.1. General mineralization. The maximum level of total mineralization for natural mineral waters for cooking food for infants is regulated in the Czech Republic [22] (500 mg/l) and Hungary [25] (650 mg/l). According to [14], the norm of the dry residue of the physiological quality of drinking water in Ukraine is 200–500 mg/l. Taking into account the physiological differences of infants, for example, a lower ability to excrete dissolved minerals with urine, low-mineralized spring or natural mineral waters (≤500 mg/l) are recommended [5, 31]. We propose to regulate such a standard for Ukraine.

3.9.2. Sodium. Sodium is the main cation of the extracellular water space, which determines its osmolarity. In addition, sodium helps maintain the acid-base state of the blood, regulates water exchange in the body, increases neuromuscular conduction, excitability of sympathetic nerve endings, and vascular tone. Violations of sodium homeostasis pose a serious danger to the patient's life and health. Significant deviations from the norm in the direction of hypo- or hypernatremia lead to the appearance and increase of neurological symptoms [32]. Infants have a low osmotic load of urine due to an immature excretory system. Therefore, the removal of sodium traces from the body does not occur in the same way as in adults. Infants who are not adequately breastfed are also at risk for hypernatremia. Hence [14] the norms of physiological adequacy of drinking water regarding the content of sodium ions in Ukraine are 2–20 mg/l. The value of the permissible level of sodium content in water for infants is 20 mg/l in the legislation of most countries. In Hungary [25] – 30 mg/l, and in France [29] – 200 mg/l – the value is similar to the value for drinking water [19]. It is worth noting that there are few natural mineral waters and spring waters with a sodium content of <20 mg/l in Ukraine. There are a number of waters with a value of up to 30 mg/l of sodium. Therefore, we propose a norm of sodium content for Ukraine – 30 mg/l.

3.9.3. Sulfates. Water with a high content of sulfates can cause an irritating effect on the gastrointestinal tract in infants, in particular, weakness and dehydration. It is possible to note that the value of the permissible level of sulfate content in the legislation of the countries: Bulgaria [28], Germany [23], Austria [26], Switzerland [27] has the same value of 240 mg/l (close to the requirements for drinking water [19, 10]). In Hungary [25] and France [29] – 140 mg/l.

3.9.4. Chlorides. The daily rate of chloride consumption in water is considered safe for infants 0–6 months – 300 mg/day, for 6–12 months – 270–570 mg/day, and the average content in breast milk – 400 mg/l [33]. Artificial infant milk formulas contain 400–500 mg/l of chlorides, so the water used to dilute these formulas should not contain chlorides. However, chloride has low toxicity. Analyzing the regulatory requirements for *BW* chlorides of some countries (Table 3), it is possible to observe a large difference in values: Poland [24] – 20 mg/l, Austria [26] – 50 mg/l, Hungary [25], Bulgaria [28] and France [29] – 250 mg/l. Analyzing the above, a reference value of 100 mg/l can be accepted for natural mineral waters for infants.

3.9.5. Nitrates. Regarding the regulation of the content of nitrates in water for infants, it is worth noting the absolute solidarity of all countries – 10 mg/l.

3.9.6. Nitrite. Norms of nitrites in water for infants in different countries are slightly different. In the Czech Republic [22], 0.1 mg/l is accepted, similar to Directive 2003/40/EC [20], in France [29] – 0.05 mg/l. The same regulatory values or nitrite content – 0.02 mg/l – are adopted in Germany [23], Poland [24], Hungary [25], Austria [26], Switzerland [27], Bulgaria [28]. It should be noted that such a low value of nitrites is almost equal to the detection limit of some measurement methods. For Ukraine, it is proposed a norm of 0.1 mg/l – in accordance with Directive 2003/40/EC [20].

3.9.7. Ammonium. Taking into account the current requirements for bottled drinking water for infants, which regulate [14], the ammonium content should not exceed 0.1 mg/l.

3.9.8. Fluorine. The regulation of fluorides in natural mineral waters according to Directive 2003/40/EC [20] – 5.0 mg/l – does not ensure sufficient water safety for infants. Therefore, the norm of fluoride content in many countries is 0.7 mg/l, except for France [29] – 0.5 mg/l and

Austria [26] – 1.5 mg/l (obviously by analogy with drinking water). For Ukraine, we propose to limit the fluoride content to ≤0.7 mg/l.

3.9.9. Sanitary and microbiological indicators. For Ukraine, in addition to other indicators, it is proposed to standardize the CFU indicator in the finished product similarly to the Czech Republic [22] (Table 4).

Other components should be standardized according to the requirements for the corresponding type of water (natural mineral water [20], drinking water [14, 19]).

Regarding the peculiarities of the technology of industrial packaging of water for cooking food for infants, it is worth noting that these waters are packaged only non-carbonated; at the same time, no preservatives and disinfectants (silver chloride preparations, etc.) can be used. However, processing methods are allowed: separation of iron, manganese and sulfur compounds by air and (or) oxygen treatment; separation of insoluble elements by filtration or decantation; release from carbon dioxide by physical means. These waters are packaged near the water point and can only be transported already packaged [1, 2]. Water points must be reliably protected from biological and chemical contamination. As for prepackaged products, it is necessary to establish the expiration date and storage conditions after depressurization of the container.

The obtained results can be used for the development and approval of a normative legal act in Ukraine on the regulation of the use of natural mineral waters and spring waters for the preparation of infant food. This will bring the national legislative and regulatory framework closer to European requirements.

3.10. Research limitations and directions of its development. The research results should be considered in light of some limitations. First of all, the number of specialists in standardization and regulation of water safety indicators is very small. The authors, in addition to the materials presented in the article, were guided by their many years of experience in this field. During the development of a project of a legal document on the safety and quality indicators of natural mineral and spring waters in Ukraine regarding the preparation of food for infants, a working group should be created, which should include a larger number of specialists in this field and producers (technologists) of these waters.

The research results can also be used to develop safety parameters of natural mineral waters and spring waters in Ukraine.

4. Conclusions

Because of the specific physiological needs of children at an early age, water for cooking is an important factor in their normal psychophysical development. According to the results of the analysis of the requirements of the current legislation of different countries, water for cooking food for infants must meet stricter criteria regarding total mineralization (suggested: ≤500 mg/l), the content of certain macro-components, nitrites (suggested: ≤0.1 mg/l), nitrates (suggested: ≤10 mg/l), ammonium (suggested: ≤0.1 mg/l), fluorides (suggested: ≤0.7 mg/l), sanitary and microbiological indicators (suggested normalization of the indicator of the total microbial number in the finished production).

Conflict of interest

The authors declare that they have no conflict of interest about this research, whether financial, personal, authorship or otherwise, that could affect the study and its results presented in this paper.

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Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the presented work.

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