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Analysis Of Labels Of Drinking Table Mineral Waters Sold In Ananindeua In The State Of Pará (Brazil) – 2024.

Aureliano Da Silva Guedes, Phd*
Professor At Federal University Of Pará/Campus Of Ananindeua/Faculty Of Chemistry, Postdoc In ICPD

Aureliano Da Silva Guedes II
Master Of Science In Risk Management And Disasters/UFPA

Francisco Neres Guimaraes Mandu
Student At The Faculty Of Chemistry/Federal University Of Pará/Campus Of Ananindeua

Juliana Da Silva Souza
Student At The Faculty Of Chemistry/Federal University Of Pará/Campus Of Ananindeua

Abstract
Justification: *The consumption of mineral water in the city of Ananindeua has increased and consumers have been paying more attention to the information on product labels. In view of this, this article aims to encourage more accessible and complete information on the labels of mineral waters sold in Ananindeua in the state of Pará (Brazil).*
General objective: *assess the compliance of labels on mineral waters sold in Ananindeua with the regulatory standards in force in Brazil, ensuring transparency of information and consumer safety;*
specific objectives: *compare the labels of different brands of mineral water available on the Ananindeua market, identifying any inconsistencies or gaps in the information provided to consumers; analyse physiochemical parameters in accordance with Brazilian regulations; contribute to the improvement of labeling practices, reinforcing the security and transparency of information in the Brazilian market.*
Methodology: *exploratory-explanatory research, carried out in Ananindeua, from July to December 2024, analysing the physiochemical information on the labels of mineral water packaging sold in the city of Ananindeua, comparing them with the recommendations of current legislation.*
Conclusions: *Although the labels partially meet the requirements established by Brazilian legislation, there are conditions for improvements in terms of clarity, accessibility and detail of the information on the labels, reducing inconsistencies that make it difficult to understand the benefits and specific characteristics of the products, such as details on mineral composition, quality control, therapeutic properties, origin of collections, extraction methods, physiochemical and microbiological analysis methods, in addition to better standardisation of information, ensuring product quality and reliability through communication with the consumer.*
Keywords: *Potable Mineral Water, Physiochemical analysis, Commercial labels; Brazil-State of Pará-Ananindeua.*

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I. Introdução

Water is the most abundant liquid resource on Earth, playing an essential role in the survival of plants, animals and microorganisms. Its importance is unparalleled, as it acts as a means of transporting essential nutrients and as a primary habitat for diverse forms of life[1]. Among the different presentations of water, the mineral stands out for its specific properties derived from natural processes.

Mineral water is defined as water naturally enriched with minerals due to prolonged contact with underground rocks, which determines its chemical composition and gives it specific therapeutic properties and nutritional value[2]. This characteristic differentiates it from water with added salts, regulated by Brazilian legislation, which requires the minimum addition of 30 mg/L of mineral salts to simulate the qualities of natural mineral waters[3]. The distinction between natural mineral water and artificial mineral water or mineralised water is fundamental, especially for consumers seeking the benefits associated with natural mineralisation[4].

In recent years, mineral water consumption in the metropolitan region of Belém has reflected the national trend of growth in demand for bottled water, reaching around 62 litres per capita in 2021. This scenario emphasises the importance of clarity and accuracy in label information, ensuring consumer safety and protection[5].

The general objective of this research was to evaluate the conformity of the labels of drinking table mineral waters sold in Ananindeua with the regulatory standards in force in Brazil, ensuring transparency of information and consumer safety. The specific objectives were: to compare the labels of different mineral waters available in the Ananindeua market, identifying possible inconsistencies or gaps in the information provided to consumers; verify compliance with physiochemical parameters in accordance with regulations from the Brazilian National Environmental Council and the Brazilian Ministry of Mines and Energy; and to contribute to the improvement of labelling practices, reinforcing the security and transparency of information in the Brazilian market.

II. Guidelines For Chemical Parameters For Drinking Water Quality

The chemical quality of drinking water is an important factor for public health, and the World Health Organization (WHO) establishes global guidelines for the monitoring and control of chemical substances in water intended for human consumption. In its most recent update, published in 2017, it emphasizes the importance of keeping water free of chemical contaminants that may pose risks to human health, especially in prolonged exposures. Among the most worrying contaminants are inorganic ones, such as toxic metals and nitrogen compounds, and organic ones, such as pesticides and disinfection byproducts[6].

Within the scope of inorganic contaminants, arsenic (As) stands out as one of the most dangerous, due to its carcinogenic potential. The WHO sets a maximum limit of 0.01 mg/L for As, which is frequently found in groundwater in many parts of the world. Studies indicate that concentrations above this level are associated with an increased risk of skin, lung, bladder and kidney cancer, as well as other health problems such as cardiovascular disease[6].

The absorption of As compounds by the human body takes place through the air, gastric and dermal routes. This exposure allows the development of pathologies that affect the gastrointestinal tract, integumentary tissue and the respiratory system, among other organic systems, presenting a risk of death[7].

Another critical contaminant is lead (Pb), the ingestion of which, even in small quantities, can result in serious damage to the nervous system, especially in children, affecting cognitive development. WHO recommends that Pb in drinking water be limited to 0.01 mg/L, given its cumulative toxicity and long-term harmful effects[6].

Continuous exposure to Pb, regardless of the route of entry (gastrointestinal, dermal and respiratory), poses a health risk due to its cumulative effect. When the concentration of Pb in the body exceeds tolerance limits, disturbances in calcium metabolism, gastrointestinal problems and widespread damage to the central and peripheral nervous systems may occur[7].

Mercury (Hg) is also controlled, with a limit of 0.001 mg/L, as exposure to this metal can cause neurological and kidney damage[8].

Mercury toxicity in the body (ICD10: T56.1) can result in several pathologies, both acute and chronic, mainly in the Central Nervous System, Respiratory Tract, Urinary Tract, Gastrointestinal Tract, Haematopoietic System, resulting in dementia (ICD10: F02.8-T56), depression (ICD10: F32), stomatitis (ICD10: K12-T56.1), insomnia (ICD10: F51.0), among others[7].

The presence of fluoride (F) in drinking water is also taken into account, even though it is used to prevent tooth decay, concentrations above 1.5 mg/L can cause dental fluorosis and, in more severe cases, skeletal fluorosis, which results in damage to bones and joints in areas where F occurs naturally at high levels, strict monitoring is essential to avoid these health problems[6].

Among organic contaminants, attention turns to pesticides and disinfection byproducts (DBPs). Pesticides, widely used in agriculture, can contaminate water resources through leaching and runoff, especially in agricultural areas. In view of this, it establishes guide values for different pesticides, such as Atrazine (0.1 µg/L) and DDT (0.001 mg/L), recognizing their potential carcinogenic and neurotoxic effects[6].

Disinfection byproducts such as trihalomethanes (THMs), which are formed during the water chlorination process, are also addressed in the guidelines. Although disinfection is essential to eliminate pathogens, WHO recommends that the concentration of THMs should not exceed 0.1 mg/L, due to the association with an increased risk of bladder cancer[6].

III. Physiochemical Parameters Of Mineral Waters In The Main Regulations Of Brazil

In Brazil, the regulation of drinking water is determined by several standards, such as the National Environmental Council of Brazil, which is the body responsible, among other things, for establishing specific guidelines for the physiochemical parameters that mineral water bottling companies must comply with, aiming to ensure the potability of water and protection of public health. According to the Brazilian Ministry of Mines and

Energy, although its activities are not focused on the direct regulation of water quality, its activities are also directly related to water resources, especially in sectors such as energy generation and mining, areas where are considered the associated environmental risks[9].

The resolutions of the National Environmental Council of Brazil specify limits for the main physiochemical parameters of drinking water, essential to ensure that the water consumed is safe and meets regulatory standards. According to Resolution 357/2005 of the National Environmental Council of Brazil, water quality standards must consider parameters such as pH, turbidity, dissolved oxygen, temperature and the presence of chemical compounds. For example, in water intended for human consumption, such as Classes 1 and 2, the pH must be between 6.0 and 9.0, a range that avoids risks to public health and preserves the integrity of water distribution systems[10].

Another important parameter is turbidity, which measures the particles suspended in the water and must be kept below 100 NTU (nephelometric turbidity unit) before treatment, as high levels can compromise purification processes and indicate the presence of contaminants[10]. Furthermore, dissolved oxygen must be maintained above 6 mg/L, which is crucial for sustaining aquatic ecosystems and preventing the proliferation of pathogenic organisms[10].

Resolution 396/2008 of the National Environmental Council of Brazil also regulates the quality of groundwater collection, establishing limits for pH between 6.0 and 9.0, necessary to avoid risks of corrosion or incrustation in distribution systems[2]. This regulation considers electrical conductivity, an indicator of dissolved ions, the presence of which in excess can signal contamination by polluting substances. In addition, it establishes the limit for nitrates, which may indicate contamination by domestic sewage or agricultural fertilizers, should not exceed 10 mg/L, since high levels can cause conditions such as blue baby syndrome in infants[2].

Mineral water is defined as water that undergoes a natural mineralisation process when it comes into prolonged contact with geological formations, absorbing minerals from the rocks that give it particular characteristics[2]. This water has therapeutic and nutritional value due to the natural elements present[11]; in contrast, water with added salts is defined by Brazilian legislation as water suitable for consumption that receives a minimum quantity of 30 mg/L of mineral salts, aiming to simulate the characteristics of natural mineral water[12].

Mineralised or artificial water refers to water that has had mineral salts added to it in an industrialized way, differing from natural mineral water, which receives its minerals spontaneously. This differentiation is crucial for the consumer seeking the specific benefits of natural mineral water[4].

IV. Methodology

Exploratory-explanatory research, carried out in Ananindeua, from July to December 2024, analysing the physiochemical information contained on the labels of mineral water packaging sold in the city of Ananindeua in the State of Pará in Brazil and comparing with the recommendations of current legislation in Brazil.

Supermarkets in the city of Ananindeua were visited and the labels of mineral waters sold were analysed in comparison with Brazilian legislation and their compliance. It is noteworthy that an alphanumeric code was used to refer to the companies whose labels were researched.

V. Main Brands Of Mineral Water Commercialised In Ananindeua

Table 1: Chemical composition of water

MAIN BRANDS OF MINERAL WATER COMMERCIALISED IN ANANINDEUA										
Product	Source	V (mL)	Chemical composition (mg/L)							
			Cl^-	Br^-	Ca	K	Mg	Na	SO_4^{2-}	NO_3^-
A1	Ananindeua	500	7,24	0,05	1,125	0,898	0,404	8,891	0,66	16,62
A2	Benevides	500	2,48	0,02	0,140	0,157	0,277	1,281	2,64	0,68
A3	Benevides	350	2,48	0,02	0,140	0,157	0,277	1,281	2,64	0,68
A4	Castanhal	350	17,88	–	4,325	3,085	1,848	26,086	22,20	36,71
A5	Castanhal	350	2,64	–	0,100	–	0,140	1,426	0,39	0,63
A6	Sta. Rita/PB	500	15,36	0,04	0,298	0,825	0,615	10,421	0,96	4,32

Table 2: Physiochemical characteristics of water commercialised in Ananindeua

PHYSICAL CHEMICAL CHARACTERISTICS					
Product	pH at 25 ºC	Temp at 25 Cº	Electrical conductivity (µS/cm)	Evaporation residue at 180 ºC (mg/L)	Radioactivity at source at 20 ºC of 760 mmHg (maches)
A1	4,54	27,8	72,6	41,63	0,20
2	4,35	26,8	38,3	18,80	0,10

A3	**4,34**	**26,8**	**43,1**	**20,18**	**0,13**
A4	**3,87**	**28,6**	**238,0**	**124,23**	**0,50**
A5	**4,86**	**26,6**	**25,2**	**11,90**	**0,13**
A6	**4,95**	**28,8**	**76,5**	**44,45**	**–**

According to the Brazilian Health Regulatory Agency, natural mineral waters cannot contain concentrations above the limits assigned in RDC nº 717, of July 1, 2022, which defines the ideal concentrations of salt addition for the water to be intended for human consumption[3].

The chloride (Cl^-) and bromide (Br^-) parameters were not considered in this analysis because there are no records of regulations in the RDC nº 717/2022[3] standard in force in Brazil, in this sense the analysis was focused only on chemical parameters with clear regulation.

A1 has a pH of 4.54, below 6.0 to 9.5, recommended by Brazilian Health Regulatory Agency's RDC 717 of 2022, indicating acidity; as for chemical composition, according to the same recommendation, the values of calcium (1.125 mg/L, Maximum Allowed Value MAV = 250 mg/L), potassium (0.898 mg/L, MAV = 500 mg/L), magnesium (0.404 mg/L, MAV = 65 mg/L), sodium (8.891 mg/L, MAV = 600 mg/L) and sulphate (0.66 mg/L) which does not have a VMP determined. The nitrate content is 16.62 mg/L, not exceeding the MAV of 50 mg/L. Electrical conductivity (72.6 μS/cm) and evaporation residue (41.63 mg/L) indicate low mineralisation, while radioactivity (0.20 maches) is within safe levels.

A2 has a pH of 4.35, below the recommended minimum, indicating an acidic character. In the chemical composition, the levels of calcium (0.140 mg/L, MAV = 250 mg/L), potassium (0.157 mg/L, MAV = 500 mg/L), magnesium (0.277 mg/L, MAV = 65 mg/L), sodium (1.281 mg/L, MAV = 600 mg/L), sulphate (2.64 mg/L, MAV = undetermined) and nitrate (0.68 mg/L, MAV = 50 mg/L) are all within the established limits. The electrical conductivity (38.3 μS/cm) and the evaporation residue (18.80 mg/L) confirm that it is a water with low mineralisation. The radioactivity of the source (0.10 maches) is within safe levels.

Product A3 has a pH of 4.34, below the 6.0 to 9.5 recommended by RDC 717 of 2022, indicating acidity. The physiochemical parameters presented on the label of this mineral water present the following values: calcium (0.140 mg/L, MAV = 250 mg/L), potassium (0.157 mg/L, MAV = 500 mg/L), magnesium (0.277 mg/L, MAV = 65 mg/L), sodium (1.281 mg/L, MAV = 600 mg/L), sulphate (2.64 mg/L, MAV = undetermined) and nitrate (0.68 mg/L, MAV = 50 mg/L). The electrical conductivity (43.1 μS/cm) and evaporation residue (20.18 mg/L) characterize low mineralisation water. Radioactivity at the source (0.13 maches) is at safe levels.

A4 has a pH of 3.87, the lowest among commercial brand products, outside the index of 6.0 to 9.5 established by RDC 717 of 2022 from Brazilian Health Regulatory Agency. In the chemical composition, calcium (4.325 mg/L, MAV = 250 mg/L), potassium (3.085 mg/L, MAV = 500 mg/L), magnesium (1.848 mg/L, MAV = 65 mg/L), sodium (26.086 mg/L, MAV = 600 mg/L) and sulphate (22.20 mg/L, MAV = undetermined) are all within the limits. However, the nitrate content (36.71 mg/L) comes closest to the MAV of 50 mg/L. The electrical conductivity (238.0 μS/cm) and evaporation residue (124.23 mg/L) indicate medium mineralisation. The radioactivity (0.50 maches) remains safe; however, it is the highest among the products of the brands analysed.

A5 has a pH of 4.86, also below the recommended minimum of 6.0 to 9.5. In the chemical composition, the values of calcium (0.100 mg/L, MAV = 250 mg/L), magnesium (0.140 mg/L, MAV = 65 mg/L), sodium (1.426 mg/L, MAV = 600 mg/L), sulphate (0.39 mg/L, MAV = undetermined) and nitrate (0.63 mg/L, MAV = 50 mg/L) are below the maximum permitted limits. The electrical conductivity (25.2 μS/cm) and evaporation residue (11.90 mg/L) indicate low mineralisation of the water. The radioactivity at the source (0.13 maches) is within safe standards.

Product A6 has the highest pH, 4.95, however, still below 6.0 to 9.5, indicating slight acidity. In the chemical composition, calcium (0.298 mg/L, MAV = 250 mg/L), potassium (0.825 mg/L, MAV = 500 mg/L), magnesium (0.615 mg/L, MAV = 65 mg/L), sodium (10.421 mg/L, MAV = 600 mg/L), sulphate (0.96 mg/L, MAV = undetermined) and nitrate (4.32 mg/L, MAV = 50 mg/L) are all within the permissible limits. The electrical conductivity (76.5 μS/cm) and evaporation residue (44.45 mg/L) indicate low mineralisation. There is no data on radioactivity on the label.

VI. Conclusions

It was found that, although all products partially meet the requirements established by Brazilian national legislation, there is significant room for improvement, especially with regard to the clarity, accessibility and detail of the information presented on the labels.

Labelling, as an essential element for informing and educating consumers, still presents inconsistencies that make it difficult to understand the benefits and specific characteristics of each product. Details about mineral composition, therapeutic properties and extraction methods are examples of aspects that could be explored to add value to products and foster public trust. Such improvements would also contribute to increasing the competitiveness of brands in the market, especially in a context in which consumers are increasingly attentive to health and quality information.

The results highlighted that the mineral water market requires a more uniform and standardized approach to product labelling. Implementing more detailed practices, such as the inclusion of quality seals, explanatory graphics and accessible language, could significantly expand the reach and acceptance of products. Brands that adopt these measures will be better positioned to meet the demands of an expanding market and, at the same time, contribute to raising awareness among the population about the importance of safe, quality hydration.

Another relevant point identified was the importance of promoting greater transparency in relation to quality control processes and the origin of water. The presentation of information about the source of collection and the methods used in the physiochemical and microbiological analysis are factors that can strengthen the credibility of the brands' products among consumers.

There is a need for joint actions between companies, regulatory bodies and consumers to ensure the quality and reliability of the mineral water sector. Investing in improvements in labelling, compliance with standards and communication with the public is essential for the consolidation of a more transparent and efficient market, capable of meeting the demands of an increasingly demanding and aware society. By identifying these gaps and suggesting ways to overcome the challenges, this research seeks to contribute to the evolution of the sector and to the promotion of conscious and informed consumption of mineral waters.

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