v. 2, n. 5, 2022

International Journal of Health Science

CONSUMER PERCEPTION ABOUT THE NUTRITIONAL PLANT-BASED ALTERNATIVE TO MILK MARKETED IN BRAZIL

Veridiana de Carvalho Antunes
Teacher at the Federal Center for Technological Education Celso Suckow da Fonseca. CEFET/RJ. Valença/RJ Unit – Brazil
ORCID: 0000-0002-2283-4132

Clarice de Deus Avila
Food engineer trained at Cefet/RJ
ORCID: 0000-0003-3911-1501

Alba Regina Pereira Rodrigues
Teacher at the Federal Center for Technological Education Celso Suckow da Fonseca. CEFET/RJ. Valença/RJ Unit – Brazil
ORCID: 0000-00022744-132x

Miguel Meirelles de Oliveira
Teacher at the Federal Center for Technological Education Celso Suckow da Fonseca. CEFET/RJ. Valença/RJ Unit – Brazil
ORCID: 0000-0001-5878-036x

Jamile Maureen de Sousa Oliveira
Teacher at the Federal Center for Technological Education Celso Suckow da Fonseca. CEFET/RJ. Valença/RJ Unit – Brazil
ORCID: 0000-0002-0836-9457

Rafael Jefferson Fernandes
Teacher at the Federal Center for Technological Education Celso Suckow da Fonseca. CEFET/RJ. Valença/RJ Unit – Brazil
ORCID: 0000-0002-8023-1604

Abstract: Milk has important nutritional value in human nutrition. However, the consumer market for plant-based beverages as a substitute for milk consumption has expanded in recent years. It is important to note that plant-based beverages do not have the same bioavailability of nutrients as milk, being deficient in calcium and vitamin D. This substitution may represent a potential reduction in the consumption of important nutrients, especially for children. Assessing the consumer's profile and understanding of the nutritional value of vegetable drinks is essential to support awareness-raising actions on the advantages and disadvantages of this exchange. The research was conducted through the application of an online questionnaire, in which 400 responses were obtained. The most consumed types of vegetable-based drinks were soy and coconut, with approximately 26% of the participants consuming them weekly. The reasons for consumption were: healthy drink (59.4%), flavor (29%), vegetarian and vegan (19.4%), lactose intolerance (12.3%), low fat content (8.4%). %) and others (6.2%). Regarding knowledge about vegetable drinks, most consumers considered this type of drink as a good source of protein and a natural source of calcium. They also stated that milk is better than plant-based drinks for strengthening bones, which indicates that they have contradictory information. Participants demonstrated that they were not sufficiently informed about the nutritional composition of these beverages, regardless of whether they were consumers or not.
Keywords: Plant extract, nutritional composition, consumers.

INTRODUCTION

Vegetable-based drinks, popularly called vegetable "milk", resemble milk in appearance and consistency. They are obtained by grinding plant material based on cereals, legumes, nuts, seeds or pseudo-cereals, followed by extraction in water and homogenization (SETHI, TYAGI and ANURAG, 2016).

The fitness, vegan and lactose intolerant market are driving the consumption of milk alternative products. In 2019, the vegetable beverage market in Brazil grew by 51.5% (EUROMONITOR INTERNACIONAL, 2019 apud CORDOVA, 2019).

Although beverages made from plant extracts are considered healthy, the nutritional composition varies according to the raw materials used (CIRILO, OLIVIERI and MARTINS, 2020). In general, they have lower protein content and quality, different fatty acid composition, higher amount of carbohydrates, lower content of vitamins and minerals, lower calcium bioavailability and presence of anti-nutritional factors (CABILHAS, 2019).

As for milk, it is a source of protein and vitamins, including vitamin E, A, B6, B12, riboflavin, niacin, thiamine, folic acid. In addition, it has minerals such as magnesium, zinc and calcium (SILVA, 2017).

Replacing milk with plant-based beverages poses a potential risk of causing consumers, especially children, to have a deficit of nutrients such as vitamin D and calcium, among other complications (SETHI, TYAGL and ANURANG, 2016). Therefore, knowing the nutritional quality of these beverages is essential for consumers to be able to analyze the advantages and disadvantages of this exchange, since the replacement can impact deficiencies of some nutrients and the supply of others (MELO and MORIMOTO, 2019).

Assessing consumers' perceptions of the nutritional value of these beverages provides support for promoting awareness-raising actions on the nutritional quality of different products. This study aimed to evaluate the consumer's perception of the nutritional value of vegetable drinks, in addition to verifying the profile of consumers, the frequency and

type of beverage most consumed.

MATERIAL AND METHODS

SAMPLE

The sample size was based on the formula $N=1/Erro^2$, in which an error of 0.05% was adopted, resulting in a total of 400 interviews (BARBETTA, 2005).

DATA COLLECTION

The quizz:"*Consumer perception of the nutritional value of plant-based beverages that are alternatives to milk sold in Brazil*" was forwarded to the Ethics Committee in Research with Human Beings, under registration 31097120.4.0000.5237 and opinion 4.078.029. After approval, the questionnaire was sent online, via e-mails and social networks to participants from all states of Brazil.

The first five questions addressed sociodemographic characteristics and the others focused on consumption and knowledge about plant-based beverages. In this phase, sentences were presented that expressed consumers' beliefs and knowledge about milk and plant-based beverages. Respondents must read each sentence and express their degree of agreement and disagreement with each item, based on the 5-point Likert scale (BEHRENS and DA SILVA, 2004).

The data were analyzed in the program: *StatisticalPackage for the Social Sciences* (SPSS) and by Excel.

RESULTS AND DISCUSSION

CHARACTERISTICS OF THE PARTICIPANTS

In this research, 400 people from all over Brazil participated, being 2.3% from the Midwest region, 15% from the Northeast, 7.8% from the North, 70.5% from the Southeast and 4.5% from the South. Regarding the profile of the participants, the majority were female, aged between 25 and 35 years old, with a postgraduate level of education and with a monthly income ranging from 1 to 5 minimum wages (Table 1).

In a study developed by Cordova (2019), the profile of the participants was also composed mostly of women, young people and adults.

Most of the interviewees were from the Southeast region, a fact that may have occurred due to the research dissemination vehicle having focused on the social networks of the researchers residing in this region, in addition to the fact that this is the region with the largest Brazilian population (IBGE, 2010).

CONSUMERS OF VEGETABLE DRINKS

Of the total number of respondents, 38.8% (155 people) consumed vegetable drinks, distributed according to the sociodemographic characteristics of Table 2.

Among the participants who declared themselves consumers of plant-based drinks, women stand out, with undergraduate or graduate degrees and income greater than 3 minimum wages. A similar profile was found in the study by Cordova (2019), for participants with a high frequency of consumption.

Among the reasons given for the consumption of these drinks, the most reported were: healthy drink (59.4%); flavor (29%); vegetarian and vegan people (19.4%); lactose intolerant (12.3%); low fat content (8.4%) and others (6.2%), in which milk protein allergy was cited as a reason for consumption.

People with lactose intolerance or vegetarians declared similar reasons for consuming these drinks (CORDOVA, 2019), in addition to milk protein allergy (SETHI, TYAGI and ANURAG, 2016).

When asked about the type of beverage most consumed, respondents answered soy

VARIABLES	SAMPLE	%
GENDER		
FEMALE	298	74,5%
MALE	100	25,0%
I PREFER NOT TO OPINION	2	0,5%
AGE		
18-24	120	30,0%
25-35	154	38,5%
36-50	96	24,0%
≥ 51	30	7,5%
REGION		
MID-WEST	9	2,3%
NORTHEAST	60	15,0%
NORTH	31	7,8%
SOUTHEAST	282	70,5%
SOUTH	18	4,5%
EDUCATION		
ELEMENTARY SCHOOL	2	0,5%
HIGH SCHOOL	61	15,3%
TECHNICAL EDUCATION	20	5,0%
UNIVERSITY LEVEL	128	32,0%
POST-GRADUATION	178	44,5%
MONTHLY INCOME		
1-2 MINIMUM WAGES	144	36,0%
3-5 MINIMUM WAGES	136	34,0%
6-10 MINIMUM WAGES	56	14,0%
≥ 10 MINIMUM WAGES	53	13,3%

Table 1. Sociodemographic data of respondents.

Source: Prepared by the authors.

CHARACTERISTICS	THE PERSON ConsUMES	THE PERSON DOES NOT CONSUME
GENDER		
FEMALE	39,9%	60,1%
MALE	34,0%	66,0%
I PREFER NOT TO OPINION	100%	0,0%
AGE		
18-24	63%	37%

25-35	59%	41%
36-50	63%	38%
≥ 51	60%	40%
EDUCATION		
ELEMENTARY SCHOOL	0,0%	100%
HIGH SCHOOL	28,6%	71,4%
UNIVERSITY LEVEL	42,3%	57,7%
TECHNICAL EDUCATION	23,8%	76,2%
POSTGRADUATE STUDIES	41,8%	58,2%
MONTHLY INCOME		
FROM 1 TO 2 MINIMUM WAGES	41,9%	58,1%
FROM 3 TO 5 MINIMUM WAGES	35,5%	64,5%
FROM 6 TO 10 MINIMUM WAGES	39,7%	60,3%
GREATER THAN 10 MINIMUM WAGES	37,5%	62,5%

Table 2. Sociodemographic data of vegetable drink consumers.

Source: Prepared by the authors

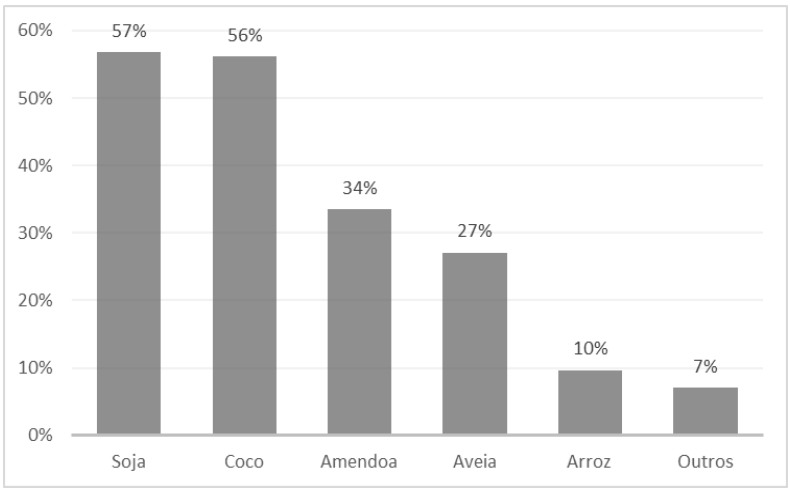
and coconut (Figure 1a), which approximately 26% consume weekly (Figure 1b). In this study, the types of vegetable drinks most consumed were similar to those found by Cordova (2019), in which the coconut-based vegetable drink occupied the first place (43%), followed by the beverage made with soy (35%). This fact may be associated with the price of the raw material used, since the other varieties of vegetable drinks have raw materials with high prices.

Despite being pioneers in the market, soy-based beverages showed a drop in sales of 19% between 2017 and 2018, while the consumption of beverages made from coconut and almonds increased (MILKPOINT, 2018).

Most consumers agreed that plant-based drinks are "a good source of protein" and "a natural source of calcium". They also agreed that milk is better for strengthening bones, demonstrating that they have contradictory information. Half of consumers also agreed that the plant-based beverage nutritionally replaces milk and that "vegetable fat is better than animal fat" (Table 3).

For Scholz-Ahrens (2019), legume-based drinks have a high protein content, while cereal-based drinks have a medium content and drinks based on some nuts and rice have a very low content. In Cirilo (2020), 24.5% of the analyzed vegetable drinks, present in the market in the city of São Paulo, had protein content equal to or higher than pasteurized and UHT milk. The analysis also showed that for calcium, 98% of the samples obtained values equal to or higher than the evaluated milks. However, these drinks were not fortified with protein, but only with calcium, vitamins D and B12.

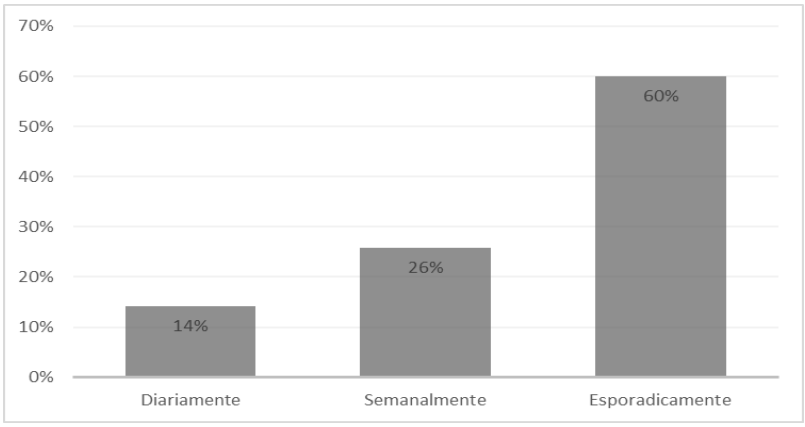
Although the vast majority of vegetable drinks on the market are fortified with calcium, this does not guarantee that this product has nutritional equivalence, as the bioavailability of calcium varies significantly in fortified drinks (SIGHAL, 2017), being lower due to anti-nutritional factors present in



Soy / Coconut / Almond / Oat / Rice / Other Items

Figure 1a. Types of vegetable drinks most consumed among respondents.

Source: Prepared by the author herself.



Daily Weekly Sometimes

Figure 1b. Frequency of consumption of respondents.

Source: Prepared by the author herself.

ASSERTIONS	I TOTALLY AGREE	I PARTIALLY AGREE	I DO NOT AGREE NOR DISAGREE	I PARTIALLY DISAGREE	I TOTALLY DISAGREE
IT IS A GOOD SOURCE OF PROTEIN	27,1%	44,5%	9,0%	13,5%	5,8%
IT IS A NATURAL SOURCE OF CALCIUM	22,6%	27,7%	18,7%	16,8%	14,2%
TO STRENGTHEN BONES, ANIMAL MILK IS BETTER THAN VEGETABLE DRINKS	24,5%	21,3%	20,0%	20,6%	13,5%
IT NUTRITIONALLY REPLACES ANIMAL MILK	23,9%	24,5%	7,1%	21,9%	22,6%
FAT FROM VEGETABLE DRINKS IS BETTER FOR HEALTH THAN FAT FROM ANIMAL MILK	23,9%	31,6%	16,8%	19,4%	8,4%

ITS MOST SUITABLE SALES DESIGN IS FOOD BASED ON (NAME OF VEGETABLE)	49,0%	30,3%	7,7%	7,1%	5,8%
ITS MOST SUITABLE SALES DENOMINATION IS DRINK BASED ON (NAME OF THE VEGETABLE)	29,0%	30,3%	13,5%	9,0%	18,1%

Table 3. Proportion of responses in relation to statements about plant-based beverages by consuming participants.

Source: Prepared by the authors

vegetables. such as oxalate, tannin and phytate (CABILHAS, 2019), while milk has a high calcium content that is highly bioavailable.

It is evident the lack of information or knowledge of the interviewees who believe that the fat of vegetable drinks is better than the fat of milk, since the content of saturated fatty acids and the content of cholesterol present in milk is considered important for the developing brain. (SETHI, TYAGI and ANURAG, 2016; SINGHAL, 2017). Furthermore, dairy fat intake may be associated with a lower risk of developing central obesity (HOLMBERG and THELIN, 2013). Although non-dairy beverages are lower in saturated fat, most products contain energy equivalent to milk, which is derived from sugars, usually added, and other carbohydrates (SINGHAL, 2017).

Compared with milk, the nutrient content of plant-based drinks is lower. This is due to the low content and lower quality of protein. They also have higher sugar content and lower vitamins and minerals, in addition to differing in fatty acid composition. (CABILHAS, 2019).

The protein content of the soy-based drink is closest to that of milk. Coconut and rice drinks are nutritionally poor, as in addition to lower total phosphorus, they also have saturated fat and high sugar content, respectively (CABILHAS, 2019). Cirilo (2020) stated that only 18.4% of the plant-based drinks, present in the São Paulo market, had equal or higher values for vitamin D and 20.4% for vitamin B12, compared to milk. However, it is important to emphasize that the drinks were fortified with these nutrients.

Regarding the reading of the ingredients list, most of the participants in this research (79%) say that they read what is in the drink and fully and/or partially agree that it is a healthy drink (51%).

Similarly, in a survey conducted in the United States, 70% of respondents agreed that plant-based drinks are healthy for children, a figure close to those who also stated that milk is healthy (SINGHAL, 2017).

In another study also in the United States, consumers of plant-based beverages (49%), parents and children under 18, drink at least once a day, indicating its association with heart health and weight loss as a reason for consumption (MARRAPODI, 2016).

NON-CONSUMERS OF PLANT-BASED BEVERAGES

In the present study, it was observed that most of the interviewees (61.3%) do not consume vegetable-based drinks. According to the data analyzed, the participants stated that the biggest reason for not eating the food is the preference for milk (58%), with other reasons being pointed out, such as flavor (24.9%), price (24, 9%) and unhealthy (2.4%).

The low consumption of these drinks in Brazil was also found in the work of Cordova (2019), in which 74% of the participants stated that they did not consume this type of drink, or that they only tried it. This fact is probably

related to the income of the participants and may be related to the high cost of plant extracts for the preparation of beverages, which corroborates the data of this study, since the participants attributed non-consumption to the value of this type of beverage.

Non-consumers' conceptions about vegetable drinks are presented in Table 4.

Among non-vegetable drinkers, the majority, similarly to consumers, also believed that they were a good source of protein. Likewise, they partially agreed or were unbiased about the fact that these drinks are a natural source of calcium. However, a large part did not agree or disagreed that milk was better than vegetable drinks for strengthening bones, and that it could replace it, demonstrating, again, contradictory information.

A third of the respondents partially agreed that plant-based drinks can nutritionally replace milk, despite the majority neither agreeing nor disagreeing that the fat in the plant-based drink is better than the fat in milk, thus confirming a misunderstanding.

Non-consumers of plant-based drinks also declare that they read the list of ingredients (72.2%) and partially agree that it is a healthy food (46.1%).

SALES DENOMINATION AND PRICE

All interviewees, regardless of whether they are consumers of vegetable drinks or not, pointed out that the sales designation must be: food based on "the name of the vegetable". Beverages recently launched on the market by well-known brands, aimed at children, already have the name "food based on" or "food of", meeting, in this case, the expectations of the research participants.

Regarding the price, the participants would be willing to pay from R$2.01 to R$4.00 for 200 ml of the product. On the other hand, in the work by Silva et al. (2018) respondents would pay a much lower amount, a maximum of R$5.00 per liter of vegetable drink.

ASSERTIONS	I TOTALLY AGREE	I PARTIALLY AGREE	I DO NOT AGREE NOR DISAGREE	I PARTIALLY DISAGREE	I TOTALLY DISAGREE
IT IS A GOOD SOURCE OF PROTEIN	38,0%	38,4%	12,7%	8,6%	2,4%
IT IS A NATURAL SOURCE OF CALCIUM	18,0%	33,1%	26,9%	14,3%	7,8%
TO STRENGTHEN BONES, ANIMAL MILK IS BETTER THAN VEGETABLE DRINKS	30,6%	22,4%	34,3%	8,2%	4,5%
IT NUTRITIONALLY REPLACES ANIMAL MILK	11,0%	30,6%	19,6%	20,0%	18,8%
FAT FROM VEGETABLE DRINKS IS BETTER FOR HEALTH THAN FAT FROM ANIMAL MILK	17,1%	21,6%	37,1%	16,3%	7,8%
ITS MOST SUITABLE SALES DENOMINATION IS FOOD BASED ON (NAME OF VEGETABLE)	47,8%	33,5%	13,1%	3,3%	2,4%
ITS MOST SUITABLE SALES DENOMINATION IS DRINK BASED ON (NAME OF THE VEGETABLE)	27,3%	31,0%	20,0%	10,6%	11,0%

Table 4. Proportion of responses in relation to statements about plant-based beverages from non-consumer participants.

Source: Prepared by the authors.

CONCLUSION

The consumption of plant-based drinks in Brazil is still low, with sporadic frequency, especially soy and coconut-based drinks, which are common consumption among adult women.

Regardless of whether they are consumers or not, the participants show that they have incorrect information, as they are not well informed about the nutritional composition of these beverages, which can contribute to a nutritionally inadequate replacement.

For plant-based drinks to be nutritional substitutes, they will need fortification with calcium, vitamins D and B12, as well as adequate protein content. This way, its substitution by milk can affect the health of the consumer, generating possible deficiencies.

Consumer awareness work is needed so that they understand the nutritional table and make conscious choices about the quantity and quality of nutrients in the different plant-based drinks. Regulatory bodies need to pay attention to the information that is allowed on the label, including the name of sale, in order to protect the consumer.

REFERENCES

BARBETTA, P. A. **Estatística aplicada a ciências sociais**. 5 ed., Universidade Federal de Santa Catarina, 2005.

BEHRENS, J. H.; DA SILVA, M. A. A. P. Atitude do consumidor em relação à soja e produtos derivados. **Ciênc. Tecnol. Aliment.**, v. 24, n. 3, p. 431-439, 2004.http://dx. doi. org/10.1590/S0101-20612004000300023.

CABILHAS, A. G. O. Alternativas vegetais aos lácteos: perfil nutricional e potencial impacto na saúde. 2019. Revisão Temática. Faculdade de Ciências da Nutrição e Alimentação, Porto, 2019.

CIRILO, G. M. D.; OLIVIERI, C. M. R.; MARTINS, M. C. T. Bebidas vegetais alternativas ao leite: comparação nutricional com leite de vaca. **LifeStyle Journal**, v. 7, p. 15-25, 2020. https://doi.org/10.19141/2237-3756.lifestyle.v7.n1.p15-25.

CORDOVA, A. G. **Consumo de bebidas vegetais no Brasil: análise da percepção do consumidor, pelo uso de *Word Association***. 2019. Monografia (Departamento de Engenharia Química e Engenharia de Alimentos). Universidade Federal de Santa Catarina, Florianópolis, 2019.

HOLMBERG, S; THELIN, A. High dairy fat intaker related to less central obesity: A male cohort study with 12 years follow-up. **Scandinavian Journal of Primary Health Care**, v. 31, p. 89-94, 2013. https://doi.org/10.3109/02813432.2012.757070.

IBGE – Instituto Brasileiro de Geografia e Estatística. **Censo Demográfico**. 2010. Disponível em: https://censo2010.ibge.gov.br/sinopse/index.php?dados=8. Acesso: 27 fevereiro 2021.

MARRAPODI, A. The Dairy and Nondairy Beverage Market. **Natural Products Insider**, 2016. Disponível em: www.naturalproductsinsider.com/articles/2016/02/the-dairy-and-nondairy-beverage-market.aspx. Acesso em: 23 abril 2021.

MELO, J. D. M; MORIMOTO, J. M. **Avaliação de rotulagem de substitutos de leite animal: qualidade nutricional de bebidas de extratos vegetais**. *In:* Jornada de Iniação Científica e Mostra de Iniciação Tecnológica, nº 15, 2019, São Paulo. Anais. São Paulo: Universidade Presbiteriana Mackenzie, 2019, ISSN 2526-4699.

MILKPOINT. **Mercado de bebidas vegetais cresce dois dígitos no Brasil**. 2018. Disponível em: <https://bit.ly/2PxqeKo>. Acesso em: 15 março 2021.

SETHI, S.; TYAGI, SK; ANURANG, RK. **Plant-based milk alternatives an emerging segment of functional beverages: a review.** J. Food Sei. Technol. 2016, 53, 3408–3423.

SINGHAL, S.; BAKER, RD; BAKER, SS. **A comparison of the Nutritional Value of Cow's Milk and Nondairy Beverage.** J. Pediatr. Gastroenterol. Nutr. 2017, 64, 799–805.

SILVA, C. M. E. **A intolerância à lactose e as consequências na absorção do cálcio**. Revista Eletrônica Atualiza Saúde, Salvador, v. 6, n. 6, p.29-35, dez. 2017.

SILVA, Cíntia Dias da *et al*. Realização de teste de aceitabilidade e intenção de compra de diferentes leites vegetais de marcas comerciais. **Revista Eletrônica Acervo Saúde**, [s.l.], v. 10, n.2, p.1522-1528, 2018. Revista Eletronica Acervo Saude. http://dx.doi.org/10.25248/reas171_2018.

SCHOLZ-AHRENS, K. E.; AHRENS, F.; BARTH, C. A. Nutritional and health atributes of milk and milk limitations. **European Journal of Nutrition**, v. 59, p. 19-34, 2019. https://doi.org/10.1007/s00394-019-01936-3.