LWT - Food Science and Technology 178 (2023) 114600

Contents lists available at ScienceDirect

LWT

journal homepage: www.elsevier.com/locate/lwt

Attitudes of consumers toward *Spirulina* and açaí and their use as a food ingredient

Bárbara Franco Lucas [a,b,*], Jorge Alberto Vieira Costa [b], Thomas A. Brunner [a,**]

[a] Food Science and Management, School of Agricultural, Forest and Food Sciences (HAFL), Bern University of Applied Sciences (BFH), Länggasse 85, 3052, Zollikofen, Switzerland

[b] Laboratory of Biochemical Engineering, College of Chemistry and Food Engineering, Federal University of Rio Grande (FURG), P.O. Box 474, 96203-900, Rio Grande, RS, Brazil

ARTICLE INFO

Keywords:
Açaí berry
Consumer acceptance
Health foods
Microalga
Survey

ABSTRACT

The microalga *Spirulina* and açaí fruit are foods with high concentrations of bioactive compounds. This work aimed to evaluate consumers' perceptions and attitudes toward these foods. A paper and pencil survey were sent to addresses in Switzerland. A total of 479 questionnaires were returned, 442 of which were valid. According to the results, more than 50% of the participants did not demonstrate any previous knowledge about *Spirulina* or açaí. In general, *Spirulina*-enriched foods most likely to be included in the participants' diets were pasta and cereal bars. For açaí, the enriched foods most likely to be consumed regularly were yogurt and juice. Preference varied with age, with cereal bars (fortified with *Spirulina* or açaí) being more likely to be consumed by young people. These results can help entities who develop, produce, and market these foods (or foods enriched with these ingredients) and serve as a basis for developing strategies for different consumer groups.

1. Introduction

Consumers are becoming increasingly interested in foods that can reduce the risk of disease, thereby benefitting their health and well-being (Vecchio et al., 2016). *Spirulina* and açaí are known as "superfoods," given their high nutrient concentrations and other beneficial health properties. Currently, several types of foods containing microalgae *Spirulina* and açaí are available in the market.

With its high nutrient concentration, *Spirulina* has been used as food for decades and is currently recognized for its superior bioactive compound composition, which includes polyunsaturated fatty acids, phycocyanin, and carotenoids. Furthermore, this microalga has the possibility of being cultivated without the need for arable land, in addition to using solar energy and CO_2 as a carbon source (Lucas, Morais, et al., 2018).

The açaí berry, a fruit from Brazil, exhibits high concentrations of bioactive compounds (Lucas, Zambiazi, & Costa, 2018, Lucas et al., 2022) and is consumed in different regions of the country. Its production increased by more than 9% from 2013 to 2018, and exceeded 221 thousand tons in 2018 (IBGE, 2018), being exported worldwide by Brazil (Yamaguchi et al., 2015).

Researchers have evaluated consumers' perceptions of *Spirulina* and the açaí fruit. Moons et al. (2018) showed that health consciousness motivates Belgian consumers to consume *Spirulina*. Rzymski and Jaśkiewicz (2017) applied a survey to analyze the habits of Polish consumers ($n = 150$) concerning microalgae. The authors observed that the main reasons for participants to consume *Spirulina*, *Chlorella*, and *Aphanizomenon* as food or dietary supplement were related to improving and maintaining health.

Sabbe et al. (2009) evaluated the importance of health claims in the acceptance of açaí-based beverages by consumers in Belgium. Vidigal et al. (2011) analyzed the effect of health claims on the acceptance of Brazilian exotic fruit juices (including açaí) by Brazilian consumers ($n = 106$).

Despite the various studies on the nutritional and sensory properties of either *Spirulina* or açaí, few have explored consumer attitudes toward these foods (Menezes et al., 2011; Moons et al., 2018; Sabbe et al., 2009). According to Lafarga et al. (2019), more studies are needed aiming to increase microalgae consumption. Given this gap, this study aimed to explore consumers' attitudes toward the microalga *Spirulina*

* Corresponding author. Laboratory of Biochemical Engineering, College of Chemistry and Food Engineering, Federal University of Rio Grande (FURG), P.O. Box 474, 96203-900, Rio Grande, RS, Brazil.
** Corresponding author.
E-mail addresses: barbarafranco_eng@hotmail.com (B.F. Lucas), jorgealbertovc@gmail.com (J. Alberto Vieira Costa), thomas.brunner@bfh.ch (T.A. Brunner).

https://doi.org/10.1016/j.lwt.2023.114600
Received 25 October 2022; Received in revised form 19 January 2023; Accepted 3 February 2023
Available online 18 February 2023
0023-6438/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

source: https://doi.org/10.24451/arbor.18887 | downloaded: 12.10.2024

and açaí fruit, as well as their use as an ingredient in various foods.

2. Material and methods

2.1. Data collection and participants

After extensive bibliographic research, a survey questionnaire containing items related to consumption of and perceptions about the microalga *Spirulina* and açaí fruit was created. The survey was conducted according to Lucas et al. (2021) between March and April of 2019. The questionnaire included questions about personality, behavior patterns, and sociodemographic characteristics.

2.2. Questionnaire

Items related to the microalga *Spirulina* and açaí fruit were evaluated. The questions were coded, and the participants were asked to select options based on their personal characteristics, opinions, or preferences as consumers. The first part of the questionnaire required the participants to rate their level of previous knowledge about these foods. Based on Brunner et al. (2018), this previous knowledge was assessed by the items "I have read/heard about *Spirulina*" and "I have read/heard about açaí." The participants were asked to indicate their knowledge using a 6-point hedonic scale, ranging from 1 (strongly disagree) to 6 (strongly agree).

Next, the participants were provided information about the microalga *Spirulina* and açaí, specifically with regard to their I) sustainability aspects, II) health benefits, and III) sensory properties (Table 1). Each category of information was accompanied by the sentence "These arguments could make me eat this food regularly," and the participants were asked to respond on a 6-point scale, ranging from 1 (strongly disagree) to 6 (strongly agree).

Table 1
Information presented to the participants about the benefits of *Spirulina* and açaí.

Category of information	*Spirulina*	Açaí
Sustainability aspects	- *Spirulina* uses solar energy efficiently to accumulate nutrients in its biomass; - It does not require arable land for its cultivation; and - Less water is required produce *Spirulina* compared to that for other foods, such as meat.	- Some açaí producers have earned the Forest Stewardship Council (FSC) international certification. This certification guarantees that the fruit is grown in an ecologically appropriate way, ensuring that the Amazon forest is protected while doing so.
Health benefits	- *Spirulina* can be consumed to maintain an adequate protein intake while eating less meat; - *Spirulina* has a high protein content (~60%) and contains all essential amino acids; - This seaweed also contains polyunsaturated fatty acids that are good for your health; and - Studies have shown the benefits of consuming *Spirulina* to treat malnutrition.	- Açaí is an Amazonian fruit with a high concentration of minerals, fibers, and polyunsaturated fatty acids; - The fruit contains compounds such as anthocyanins and carotenoids, which are very important for health; and - Studies have shown the health benefits of consuming açaí.
Sensory properties (related to consumption)	- Research shows that the taste of *Spirulina* is considered acceptable by consumers when this microalga is added to different foods; - Adding *Spirulina* to foods includes a fun component, because most products turn green after its addition due to its green pigment; and - Swiss supermarkets offer *Spirulina* powder and foods containing *Spirulina*.	- Researchers have shown that açaí enjoys a high acceptance as a food ingredient; - Foods developed with açaí are appreciated by different consumers; - Swiss supermarkets sell products containing açaí, as well as açaí in the form of capsules and powder; and - People in many countries already consume açaí.

In the next step, participants were asked to respond to the following statement: "*Spirulina* and açaí-based foods can be presented in different ways. How likely is it that the following products might become a regular part of your menu?" Different foods enriched with *Spirulina* or açaí were cited to the participants, namely a cereal bar with açaí, a cereal bar with *Spirulina*, açaí juice, pasta containing *Spirulina*, yogurt with açaí, snacks with *Spirulina*, cookies fortified with açaí, a *Spirulina*-based protein shake, snacks enriched with açaí, green *Spirulina* juice, breakfast cereal with açaí, and cookies containing *Spirulina*. The responses were rated on a 6-point hedonic scale ranging from 1 (very unlikely) to 6 (very likely).

Sociodemographic questions related to family size, sex, age, place of residence, occupation, and education were included at the end of the questionnaire. In addition, the participants answered whether they were responsible for cooking and purchasing food for their home.

2.3. Data analysis

All analyses were performed using IBM SPSS Statistics (version 25). Differences were considered statistically significant at $p < 0.05$.

3. Results and discussion

Post-questionnaire processing, 37 were excluded for containing missing data beyond the permissible limit (>50%) or failing the consistency test. A total of 442 questionnaires were used in the analysis. The rather low response rate (14.1%) may be attributed to the lack of knowledge about the foods and terms presented in the survey (Lucas et al., 2021). The valid sample was composed of 56% of women (44% of men), 63% of workers, 51% living in urban places (49% rural), and 41% between 18 and 50 years old (59% with more than 51 years old). Furthermore, among the participants, 78% were responsible for cooking and 85% for buying food.

3.1. Previous knowledge about Spirulina and açaí

According to the results pertaining to the participants' previous knowledge about the microalga *Spirulina,* approximately 50% of the total participants were completely uninformed about this food (1, on a scale of 1–6). Approximately 9%, of which 6% were women and 3% men, mentioned that they were aware about *Spirulina*. The average score obtained for this item was 2.42 ± 1.78. With regard to awareness about *Spirulina*, Lafarga, Rodríguez-Bermúdez, et al. (2021) made observations similar to those of this study; more than 50% of their participants reported not knowing the meaning of the term "microalgae." When asked about the term *Spirulina* or *Chlorella*, they observed that 36% of their respondents had never heard these terms before.

The average results obtained show low awareness, demonstrating the need to offer more information about *Spirulina* to consumers. Lafarga, Rodríguez-Bermúdez, et al. (2021) observed that knowledge about the term microalgae was high among consumers with a Ph.D. (>80% of them reported having heard about microalgae and knowing what they are). According to these authors, lack of knowledge about microalgae is one reason they are not a common food ingredient.

The results concerning previous knowledge of açaí were even lower, with an average score of 1.90 ± 1.46. The results showed that 62% of the participants did not demonstrate any knowledge about the açaí fruit, and only 4.3% of the participants (3% women and 1.3% men) confirmed having heard/read about açaí.

The results demonstrate that Swiss consumers are more familiar with *Spirulina* than with açaí. This can be attributed to the fact that *Spirulina*

and other microalgae are generally produced in Europe (Lafarga, Pieroni, et al., 2021; Vigani et al., 2015) and therefore are better known than açaí (a fruit produced mainly in Brazil) (Yamaguchi et al., 2015). Research has revealed that the willingness to pay for food decreases with its transportation distance (Grebitus et al., 2013). More generally, some consumers tend to prefer local foods, criticizing higher volumes of imported foods in their domestic markets (Feldmann & Hamm, 2015); this is also the case for açaí. For these consumers, the consumption of local foods supports the local economy and simultaneously helps the environment (Feldmann & Hamm, 2015; Grebitus et al., 2013).

3.2. Influence of providing information on sustainability aspects, health benefits, and sensory properties related to consumption

Providing additional information associated with the effects of foods on the environment and health is important to increase willingness to pay for those foods (Asioli et al., 2017; Vecchio et al., 2016). In this study, consumers were asked whether certain arguments would encourage them to consume *Spirulina* or açaí. The means obtained for the health, sustainability, and sensory arguments concerning *Spirulina* were 3.82 ± 1.67, 3.81 ± 1.61, and 3.22 ± 1.59, respectively, on a scale of 1 (totally disagree) to 6 (totally agree).

The results demonstrate that the information about health and sustainability rather than that on its sensory attributes had a greater influence on the consumption of *Spirulina*. Similar results were observed by Grahl et al. (2018) for consumers from Germany, France, and the Netherlands, who reacted more positively to the health benefits of *Spirulina*.

For açaí, the means were 3.54 ± 1.64, 3.36 ± 1.63, and 3.35 ± 1.61, for the health, sustainability, and sensory arguments, respectively. Previous studies have shown the high importance attached to health claims in the acceptance of açaí (Sabbe et al., 2009; Vidigal et al., 2011).

According to Delley and Brunner (2019) and Menezes et al. (2011), women are typically more concerned about health; however, the results of this study reveal that both women and men show great potential with respect to increasing the consumption of these foods, as no significant difference ($p > 0.05$) was noted between the means obtained for the men and the women.

3.3. Attitudes of the participants toward food enriched with Spirulina and açaí

Studies show that microalgae can potentially be used as nutritional enhancers in several traditional foods while providing high sensory acceptance (Lafarga et al., 2019; Lucas, Morais, et al., 2018). In this study, the participants were asked about the likelihood of regularly including *Spirulina*- or açaí-enriched foods in their diets. In general, foods with açaí had higher means compared to foods with *Spirulina* (Table 2).

Among the examples presented, the *Spirulina*-enriched food most likely to be adopted by consumers was pasta, followed by cereal bars. Grahl et al. (2018) observed similar results when evaluating consumer perceptions of filled pasta, sushi, and meat enriched with *Spirulina*. The authors observed that consumers would be most accepting of the filled pasta.

Table 2
Participants' attitudes toward foods enriched with açaí or *Spirulina*.

Foods enriched with açaí		Foods enriched with Spirulina	
Yogurt	3.33 ± 1.68	Pasta	3.25 ± 1.64
Juice	3.26 ± 1.63	Cereal bars	3.09 ± 1.64
Cereal bars	3.23 ± 1.68	Snacks	2.84 ± 1.63
Breakfast cereal	3.19 ± 1.69	Cookies	2.76 ± 1.49
Cookies	2.97 ± 1.55	Green juice	2.52 ± 1.47
Snacks	2.76 ± 1.59	Shake	2.40 ± 1.49

$n = 436$; Introduction: "*Spirulina*- and açaí-based foods can be presented in different ways. How likely is it that the following products might become a regular part of your menu?" The 6-point hedonic scale ranged from 1 (very unlikely) to 6 (very likely).

The results showed that the açaí-based product most readily adopted by the Swiss respondents in this study was yogurt. More than 30% of the participants reported that they would likely include this food regularly in their diet, as indicated by their scores, which ranged between 5 and 6. The next most likely item reported to be included in these consumers' diets was açaí juice. This result is consistent with that observed by Menezes et al. (2011), who evaluated North American consumers and reported high acceptance of açaí juice.

In addition to behavioral patterns, sociodemographic characteristics such as age and sex influence the acceptance of foods with health claims (Sabbe et al., 2009). When analyzing participants' ages, it was observed that the cereal bar with açaí was more likely to be included regularly by the younger consumers (18–35 years; $n = 60$) in their diets, the average score being 4.00 ± 1.71 (Fig. 1A and B). This was followed by breakfast cereal fortified with açaí (3.93 ± 1.60), cereal bars with *Spirulina* (3.92 ± 1.68), and pasta containing *Spirulina* (3.92 ± 1.47). For consumers between 66 and 79 years old ($n = 83$; Fig. 1C and D), the corresponding responses were yogurt with açaí (3.11 ± 1.59) and cereal bars containing açaí (3.06 ± 1.58) and *Spirulina* (2.96 ± 1.59).

The results obtained (Fig. 1) can be considered promising, since the evaluated population did not show much knowledge about açaí and *Spirulina*. The information presented in Table 1 could have modified the interest of the respondents who did not have any previous knowledge of these foods. For instance, Vidigal et al. (2011) observed greater acceptance of açaí juice after consumers were provided information about the health benefits of consuming this fruit.

Thus, it is expected that when consumers receive more information about the benefits of adding these foods to their diets, the likelihood of consuming these products will rise. Lafarga, Rodríguez-Bermúdez, et al. (2021) reported that increasing consumer knowledge about microalgae can result in greater consumption of this food and, consequently, a greater variety of foods enriched with it.

One strategy to improve consumer awareness of *Spirulina* and açaí would be to offer foods enriched with them more widely, namely in supermarkets, rather than mainly on websites. The inclusion of creative recipes on food packaging and the promotion of gastronomic events introducing a variety of creative meals using *Spirulina* and açaí as ingredients could also be considered as a means to encourage the consumption of these foods (Lucas et al., 2021).

Although the present study found interesting results, a limitation should be highlighted. The sample could be considered non-representative of the Swiss population. Therefore, we suggest that the next research on the topic should be conducted with a larger sample.

4. Conclusions

This study showed that the foods in question, *Spirulina* and açaí, are not known by a large part of the evaluated population. With regard to information on the benefits of consuming *Spirulina* and açaí, the sensory aspects of *Spirulina* influenced consumption the least. According to the results, the *Spirulina*-enriched products most likely to be included in the participants' diets were pasta and cereal bars. The açaí-enriched products that were most likely to be consumed were yogurt and juice. The age of the participant also influenced the choice of food.

Alternatives and strategies to increase awareness of these foods among consumers were proposed, such as the inclusion of creative recipes on the packaging of these foods and the promotion of gastronomic events using *Spirulina* and açaí as ingredients. The results obtained may help those who develop and market *Spirulina*, açaí, and/or foods enriched with these ingredients. In addition, the findings of this work contribute to the existing literature by expanding knowledge about consumer attitudes toward these foods.

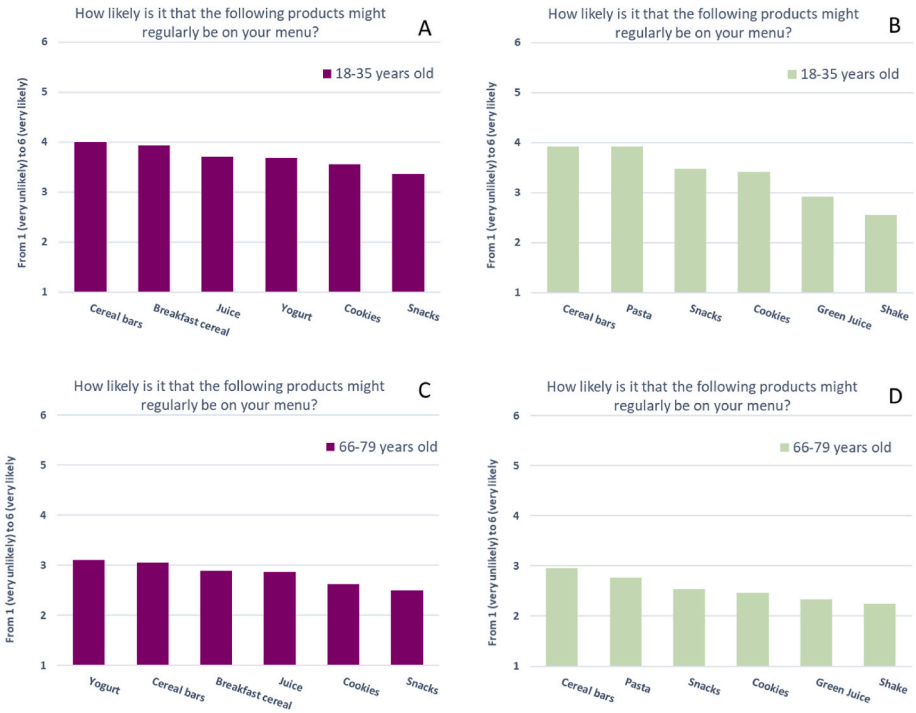

Fig. 1. Enriched foods most likely to be included in the participants' menus. A) and C) foods fortified with açaí; B) and D) *Spirulina*-enriched foods. *n*=60 for consumers from 18 to 35 years, and *n*=83 for consumers from 66 to 79 years.

Ethical statement

The study (which did not present any risks to participants nor did it deal with sensitive topics) was explained on the first page of the questionnaire. The participants acknowledged an informed consent statement. No identifying information was collected.

CRediT authorship contribution statement

Bárbara Franco Lucas: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration, All authors have read and agreed to the published version of the manuscript. **Jorge Alberto Vieira Costa:** Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition, All authors have read and agreed to the published version of the manuscript. **Thomas A. Brunner:** Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition, All authors have read and agreed to the published version of the manuscript.

Declaration of competing interest

None.

Data availability

Data will be made available on request.

Acknowledgements

The authors would like to thank the Coordination for the Improvement of Higher Education Personnel (CAPES) for granting a scholarship under Program Sandwich PhD Abroad (PDSE; process no. 88881.186834/2018-01).

References

Asioli, D., Aschemann-Witzel, J., Caputo, V., Vecchio, R., Annunziata, A., Næs, T., & Varela, P. (2017). Making sense of the "clean label" trends: A review of consumer food choice behavior and discussion of industry implications. *Food Research International, 99*, 58–71. https://doi.org/10.1016/j.foodres.2017.07.022

Brunner, T. A., Delley, M., & Denkel, C. (2018). Consumers' attitudes and change of attitude toward 3D-printed food. *Food Quality and Preference, 68*, 389–396. https://doi.org/10.1016/j.foodqual.2017.12.010

Delley, M., & Brunner, T. A. (2019). Breakfast eating patterns and drivers of a healthy breakfast composition. *Appetite, 137*, 90–98. https://doi.org/10.1016/j.appet.2019.02.006

Feldmann, C., & Hamm, U. (2015). Consumers' perceptions and preferences for local food: A review. *Food Quality and Preference, 40*, 152–164. https://doi.org/10.1016/j.foodqual.2014.09.014

Grahl, S., Strack, M., Weinrich, R., & Mörlein, D. (2018). Consumer-oriented product development: The conceptualization of novel food products based on Spirulina (*Arthrospira platensis*) and resulting consumer expectations. *Journal of Food Quality, ID1919482*, 1–11. https://doi.org/10.1155/2018/1919482, 2018.

Grebitus, C., Lusk, J. L., & Nayga, R. M., Jr. (2013). Effect of distance of transportation on willingness to pay for food. *Ecological Economics, 88*, 67–75. https://doi.org/10.1016/j.ecolecon.2013.01.006

IBGE - Instituto Brasileiro de Geografia e Estatística. (2018). *Produção da extração vegetal e da silvicultura*. https://sidra.ibge.gov.br/pesquisa/pevs/quadros/brasil/2018. (Accessed 6 February 2020).

Lafarga, T., Acién-Fernández, F. G., Castellari, M., Villaró, S., Bobo, G., & Aguiló-Aguayo, I. (2019). Effect of microalgae incorporation on the physicochemical, nutritional, and sensorial properties of an innovative broccoli soup. *Lebensmittel-Wissenschaft und -Technologie, 111*, 167–174. https://doi.org/10.1016/j.lwt.2019.05.037

Lafarga, T., Pieroni, C., D'Imporzano, G., Maggioni, L., Adani, F., & Acién, G. (2021). Consumer attitudes towards microalgae production and microalgae-based agricultural products: The cases of almería (Spain) and livorno (Italy). *ChemEngineering, 5*, 27. https://doi.org/10.3390/chemengineering5020027

Lafarga, T., Rodríguez-Bermúdez, R., Morillas-España, A., Villaró, S., García-Vaquero, M., Morán, L., Sánchez-Zurano, A., González-López, C. V., & Acién-Fernández, F. G. (2021). Consumer knowledge and attitudes towards microalgae as food: The case of Spain. *Algal Research, 54*, Article 102174. https://doi.org/10.1016/j.algal.2020.102174

Lucas, B. F., Costa, J. A. V., & Brunner, T. A. (2021). Superfoods: Drivers for consumption. *Journal of Food Products Marketing, 27*(1), 1–9. https://doi.org/10.1080/10454446.2020.1869133

Lucas, B. F., Guelpa, R., Vaihinger, M., Brunner, T. A., Costa, J. A. V., & Denkel, C. (2022). Extruded snacks enriched with açaí berry: Physicochemical properties and bioactive constituents. *Food Science and Technology, 42*, Article e14822. https://doi.org/10.1590/fst.14822

Lucas, B. F., Morais, M. G., Santos, T. D., & Costa, J. A. V. (2018). *Spirulina* for snack enrichment: Nutritional, physical and sensory evaluations. *Lebensmittel-Wissenschaft und -Technologie, 90*, 270–276. https://doi.org/10.1016/j.lwt.2017.12.032

Lucas, B. F., Zambiazi, R., & Costa, J. A. V. (2018). Biocompounds and physical properties of açaí pulp dried by different methods. *Lebensmittel-Wissenschaft und -Technologie, 98*, 335–340. https://doi.org/10.1016/j.lwt.2018.08.058

Menezes, E., Deliza, R., Chan, H. L., & Guinard, J.-X. (2011). Preferences and attitudes towards açaí-based products among North American consumers. *Food Research International, 44*, 1997–2008. https://doi.org/10.1016/j.foodres.2011.02.048

Moons, I., Barbarossa, C., & Pelsmacker, P. D. (2018). The determinants of the adoption intention of eco-friendly functional food in different market segments. *Ecological Economics, 151*, 151–161. https://doi.org/10.1016/j.ecolecon.2018.05.012

Rzymski, P., & Jaśkiewicz, M. (2017). Microalgal food supplements from the perspective of polish consumers: Patterns of use, adverse events, and beneficial effects. *Journal of Applied Phycology, 29*, 1841–1850. https://doi.org/10.1007/s10811-017-1079-5

Sabbe, S., Verbeke, W., Deliza, R., Matta, V., & Damme, P. V. (2009). Effect of a health claim and personal characteristics on consumer acceptance of fruit juices with different concentrations of açaí (*Euterpe oleracea* Mart.). *Appetite, 53*, 84–92. https://doi.org/10.1016/j.appet.2009.05.014

Vecchio, R., Van Loo, E. J., & Annunziata, A. (2016). Consumers' willingness to pay for conventional, organic and functional yogurt: Evidence from experimental auctions. *International Journal of Consumer Studies, 40*, 368–378. https://doi.org/10.1111/ijcs.12264

Vidigal, M. C. T. R., Minim, V. P. R., Carvalho, N. B., Milagres, M. P., & Gonçalves, A. C. A. (2011). Effect of a health claim on consumer acceptance of exotic Brazilian fruit juices: Açaí (*Euterpe oleracea* Mart.), Camu-camu (*Myrciaria dubia*), Cajá (*Spondias lutea* L.) and Umbu (*Spondias tuberosa* Arruda). *Food Research International, 44*, 1988–1996. https://doi.org/10.1016/j.foodres.2010.11.028

Vigani, M., Parisi, C., Rodríguez-Cerezo, E., Barbosa, M. J., Sijtsma, L., Ploeg, M., & Enzing, C. (2015). Food and feed products from microalgae: Market opportunities and challenges for the EU. *Trends in Food Science & Technology, 42*, 81–92. https://doi.org/10.1016/j.tifs.2014.12.004

Yamaguchi, K. K. L., Pereira, L. F. R., Lamarão, C. V., Lima, E. S., & Veiga-Junior, V. F. (2015). Amazon açaí: Chemistry and biological activities: A review. *Food Chemistry, 179*, 137–151. https://doi.org/10.1016/j.foodchem.2015.01.055