



Research article

Does the label ‘unconventional food plant’ influence food acceptance by potential consumers? A first approach



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ARTICLE INFO

Keywords:

Sensory evaluation
Extrinsic clues
Wild food plants
Biases in sensory perception
Hedonic evaluation
Confidence attributes

ABSTRACT

In the Brazilian context, many plants have been marketed under the name of unconventional food plants (UFPs). However, it is not known whether this label causes some bias in product acceptance. Thus, two case studies were conducted to fill this gap. The research also sought to determine if the type of fair (agroecological vs. common) where the UFP is sold, the familiarity with the term, and the identification of a UFP when used as an ingredient act as moderating variables of this relationship. This paper presents data from two case studies. The first was conducted with *jenipapo* juice through sensory evaluations at a conventional fair and an agroecological fair in the metropolitan region of Maceió (Northeast Brazil). The product was offered to some attendees without giving them any information, while for other attendees, the presence of a UFP and the underlying concept were mentioned. In this context, the UFP label did not affect the sensory evaluation. In the second case study, *taio* cakes were offered to students from a public university in the same city. In this context, the UFP-labelled product was less accepted than the product without the label only for students who had not heard of UFPs. The differences between the two case studies reinforce the need to expand research on this topic to identify in which contexts the UFP label influences sensory evaluations.

1. Introduction

The acceptance of a food product is determined not only by its characteristics but also by the relevant role of extrinsic factors. The attribution of healthy and sustainable values and the classification of a product as organic positively influence people's impressions of a food (Annett et al., 2008; Ekelund et al., 2007; Hemmerling et al., 2013; Pambo et al., 2018; Silva et al., 2017; Vidigal et al., 2011). In addition, factors such as the names assigned to the food (Okamoto et al., 2009), the food brand (Conti-Silva and Souza-Borges, 2019; Di Monaco et al., 2004; Paasovaara et al., 2012), the origin of a product (Ekelund et al., 2007; Realini et al., 2013), information on its production methods (Lähteenmäki et al., 2002; Lu et al., 2016), and the characteristics of the environment in which a food is served (Edwards et al., 2003) also affect people's impressions of a food.

These relationships may vary according to the profile of potential consumers. Therefore, there are moderating factors for the relationship between extrinsic clues and hedonic evaluations (Fernqvist and Ekelund,

2014). These factors include the attitudes of potential consumers about health and environmental issues. For example, people with more positive attitudes about health or the environment tend to evaluate products more positively when they are informed that these products are organic (Annett et al., 2008; Poelman et al., 2008).

In the Brazilian context, a group of plants has been gaining increasing notoriety among consumers of healthy and sustainable foods: the so-called unconventional food plants (UFPs). These are edible plants that are unknown to or underused by most people, especially in urban areas. This concept encompasses most wild food plants, the commercialization of which often constitutes an additional source of income for small farmers and extractivists (Delang, 2006).

UFPs are not considered to be novel foods in Brazilian legislation. Because they are commercialized “*in natura*” or minimally processed (e.g., pulps), they do not need to be authorized by the National Agency of Sanitary Surveillance (ANVISA) (Brasil, 2000, 2009). Several UFPs are part of the National List of Sociobiodiversity Species (Brasil, 2018). Extractivists and small farmers that commercialize species from this list

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have access to public policies aiming to strengthen value chains for sociobiodiversity products, such as the Program for Food Acquisition (PAA) (Brasil, 2003) and the National Program of School Feeding (PNAE) (Brasil, 2009). Thus, in addition to their commerce and consumption having a strong social appeal, their nutritional (diet diversification and nutrient input) and ecological nature (potential for sustainable harvesting and production) may favour their consumption. However, such arguments are still unknown to most people.

There are strong criticisms of the use of the term ‘unconventional food plants’, especially among ethnoscientists. One of the main criticisms is that by labelling certain plants as unconventional, we end up adopting an ethnocentric perspective (Erice, 2011), considering that many of these plants are quite popular among indigenous communities, farmers, or other non-urban contexts. Despite this criticism, it is undeniable that the term and its acronym have become popular in Brazil to the point that they have amplified the general popularity of plants under this label. However, little is known about the effect of this term on food acceptability.

In this sense, this research presents two case studies with different UFPs to answer the following question: Does the name ‘unconventional food plants’ affect the acceptance of these plants by potential consumers? The theoretical scenario that encompasses this question is quite vast and may point to different paths. On the one hand, foods that people are unfamiliar with, such as insects in Western countries, tend to be less accepted by potential consumers (Orsi et al., 2019; Tan et al., 2017). Food neophobia may interfere in this process because people can be reluctant to consume unknown foods (Henriques et al., 2009; Knaapila et al., 2007). This trait has a strong evolutionary component and was important in an ancestral setting for helping people avoid ingesting toxic substances when exploring new food sources (Knaapila et al., 2007; Sigman-Grant, 2008). Thus, the term ‘unconventional’ could amplify the perception that a food is new and unknown, which could strengthen neophobic reactions.

On the other hand, the ‘gourmetization’ or ‘exoticization’ of foods can help to generate interest and stimulate the consumption of some products. UFPs have increasingly gained ground in the media and in *haute cuisine* (Kinupp and Lorenzi, 2014; Oliveira and Ranieri, 2017), and they are present on the menu of several gourmet restaurants in the country. Thus, this process could lead to a positive bias in the sensory evaluation of plants under this label. In this study, ‘label’ is employed as a synonym for immediate information about a product (Tuorila et al., 1994).

Thus, based on the possible moderating roles of some variables, the following hypotheses were formulated: (h1) The negative impact of the label ‘unconventional food plant’ on food acceptance is greater among consumers who attend common fairs than it is for those who attend agroecological fairs. (h2) The negative impact of the label ‘unconventional food plant’ is greater among consumers who do not recognize the UFP in a food. (h3) The negative impact of the label ‘unconventional food plant’ is greater among consumers who have never heard of this concept compared to those who are already somewhat familiar with it.

The rationale behind the first hypothesis is that agroecological fairs have been the places where these plants have gained popularity in several regions of Brazil (see, for example, Souza, 2019). Thus, those who attend these fairs may already be more familiar with underused products – regardless of whether or not they know the term ‘UFP’ – and they are less susceptible to the negative effect of an ‘unconventional’ label than those who attend common fairs. For the second hypothesis, it is known that a person’s previous experience with a food is also an important predictor of its acceptance (Caparros Megido et al., 2016; Oude Ophuis, 1994). Therefore, when a consumer already knows a product, he/she has already created a perception of the product even before its presentation under the label of ‘unconventional’, which decreases the effect of the label itself. The third hypothesis has to do with the fact that people who are already familiar with the concept of a UFP have more information about its appeal and/or its ‘gourmetization’ process, which could counterbalance the negative effects of the term.

To test these hypotheses, two case studies were conducted in the metropolitan region of Maceió (Northeast Brazil). The first study with *jenipapo* (*Genipa americana* L.) was conducted at street fairs, and h1, h2, and h3 were tested. The second study was developed with *taioaba* (*Xanthosoma sagittifolium* (L.) Schott) in a public university, and h3 was tested.

UFP is used as an acronym for the phrase ‘unconventional food plants’ throughout the text. In Portuguese, PANC is the acronym for *Plantas Alimentícias Não Convencionais*. Although the translated acronym is used for practical reasons (text simplification), the effects of introducing the acronym to potential consumers could have been different from that of introducing the complete term. Additionally, this article is a ‘first approach’ because it does not intend to give a definitive answer on the subject, considering that it studied specific contexts with small sample sizes.

2. Methods

2.1. Ethical aspects

The study protocol was approved by the Human Research Ethics Committee of the Federal University of Alagoas (UFAL, CAAE 49703315.0.0000.5013), and the participants signed an informed consent form.

2.2. Case study 1: *jenipapo* (*Genipa americana* L.)

Despite being considered a UFP by the main manuals on the subject (Kinupp and Lorenzi, 2014), *jenipapo* is widely known among urban and rural populations in Northeast Brazil.

The research was conducted at two street fairs in the metropolitan region of Maceió, the capital of the state of Alagoas, Northeast Brazil. One of the fairs only sells agroecological products (Praça do Centenário fair), and the other fair sells conventional products (Rio Largo fair). Each fair was visited twice, and in total, 100 attendees were interviewed (50 per fair). The interviews included a sensory evaluation of *jenipapo* juice. The juice bottles were prepared with 400 g of *jenipapo* pulp, 80 g of demerara sugar, and 1 L of mineral water.

Volunteers were recruited by chance, and once they agreed to participate in the study, they were taken to a more private place at the fair, where the research team had set up a stand. This procedure sought to avoid interference from third parties during the interviews. Initially, the volunteers were invited to sign an informed consent form. The form included questions about the socioeconomic profile of the volunteer. Before the sensory evaluation, the participants were asked if they had any food restrictions or allergies. If not, the team proceeded with the *jenipapo* juice sensory evaluation.

Each volunteer received 50 mL of *jenipapo* juice in a small plastic cup. At each fair, half of the volunteers (25) were informed that the juice had been made with a UFP before they tasted it. Next, the research team explained the following concept: UFPs are vegetables that serve as foods but are not commonly consumed by most people. Many of them are present in forests and other areas of native vegetation, in addition to vacant lots, roadsides, and other areas. For the other half of the interviewees, the juice was simply offered without giving any information about it. In all of the cases, the identity of *jenipapo* was not revealed until the sensory evaluation ended.

The volunteers evaluated the juice according to attributes such as colour, texture, smell, flavour, and overall evaluation. For each attribute, they assigned values following the 9-point hedonic scale, which is widely used in sensory evaluation studies (Lawless and Heymann, 2010). The extreme values of the scale are 1 (‘disliked extremely’) and 9 (‘liked extremely’). After the sensory evaluation, the volunteers were asked if they had heard of the term ‘unconventional food plant’, whether the juice was familiar to them, and if so, what fruit it was made from.

Hypotheses h1, h2, and h3 were tested using the same cumulative link model with flexible thresholds and a complementary

log–log function. Cumulative link models are specific regression models for dealing with an ordinal response variable. This method was selected because it assumes that the distances between ordered rankings are not necessarily the same. For example, the mathematical difference between ‘moderately liked’ and ‘liked very much’ may not be the same as between ‘liked very much’ and ‘liked extremely’.

To estimate the model, the values on the hedonic scale for the overall impression of the juice were employed as a response variable. The main independent variable was the designation of a UFP assigned to the juice (here called the UFP label, even though it was not a written label), which is a categorical variable with the categories of yes (with the use of the label) and no (without using the label). The UFP label variable was entered into the model in isolation and in combination with the variables fair (Praça do Centenário fair × Rio Largo fair), prior knowledge of the term (yes × no), and identification of *jenipapo* after sensory evaluation (yes × no). The explanatory variables were correlated using the Spearman correlation coefficient to verify the presence of autocorrelation, which was rejected, as all correlations obtained $r < 0.3$ and $p > 0.05$.

The ‘clm’ function of the ‘ordinal’ package of R was used for the analyses, which was accessed through RStudio version 1.2.5001.

2.3. Case study 2: *taioba* (*Xanthosoma sagittifolium* (L.) Schott)

This study was conducted with undergraduate students from the Engineering and Agricultural Sciences Campus of the Federal University of Alagoas. The campus is located in the municipality of Rio Largo, which is part of the metropolitan region of Maceió. The recruitment of students was announced for a study on eating habits. The research team performed a call on social networks linked to the campus. This call did not mention that the study dealt with UFPs.

The product used in the sensory evaluation was a cake baked in an oven with bleached *taioba* leaf, wheat flour, mashed potatoes, onions, garlic, olive oil, salt, and black pepper. Each cake weighed approximately 20 g.

The research team was divided into two groups. The first group conducted questionnaires throughout the day after presenting the cakes to volunteers under the UFP label, while the second group applied the questionnaire without mentioning to the volunteers that the cakes were made with a UFP. The questionnaire procedure followed the same principle as that in case study 1, with the collection of socioeconomic data before the sensory evaluation, the use of a 9-point hedonic scale, and questions about the respondent’s familiarity with the product and previous knowledge about the term ‘UFP’ after evaluation.

A total of 65 volunteers participated in the sensory evaluation, including 26 with the UFP label and 39 without the label. Thus, to have the same number of cases with and without a label, 13 cases without the label were randomly excluded. For this purpose, the interviews were numbered according to the order in which they were conducted, and the R ‘sample’ function was used to generate the 13 numbers that would be excluded. Thus, the data from this study refer to 52 interviews.

Only h3 could be tested with the *taioba* data because (1) the study was applied outside the context of fairs and was not designed to test h1. In addition, (2) *taioba* is not widely known by potential consumers, and the method of preparing the cake with multiple ingredients further reduced the likelihood of identifying the recipe components, making the experiment inadequate for testing h2.

In the *taioba* experiment, a cumulative link model with flexible thresholds and a complementary log–log function was also used. The values on the hedonic scale that the respondents gave for their general impressions about the *taioba* cake were the response variable. In the explanatory model, the UFP label variable was entered separately and in combination with the variable prior knowledge of the term.

3. Results

3.1. Case study 1

In general, *jenipapo* juice was well accepted by potential consumers. They gave the highest score to the overall impression and the lowest score to the smell (Table 1). Ninety-one percent of the volunteers who tasted the juice classified the flavour as familiar, and 73% identified *jenipapo* as an ingredient of the juice, which indicates a high degree of previous experience with the product. However, only 35% were already familiar with the term ‘unconventional food plant’, which points to a greater familiarity with the fruit itself than with the term associated with it.

The UFP label did not affect the acceptance of *jenipapo* juice (Table 2). In addition, none of the three hypotheses was confirmed because the interaction between the variable ‘label’ and the variables ‘prior knowledge of the term’, ‘identification of *jenipapo*’, and ‘fair’ did not significantly explain the values on the hedonic scale for the overall evaluation of the juice (Figure 1).

3.2. Case study 2

The *taioba* cake was relatively well accepted by the university students, who gave the highest score to the overall evaluation and the lowest score to the colour (Table 3). A total of 90.4% of the volunteers who tasted the cake classified the taste as familiar, but no one recognized *taioba* as one of the ingredients, so familiarity with the flavour was derived from the conventional ingredients. In the university context, 73.1% were already familiar with the term ‘unconventional food plant’.

The UFP label alone did not interfere with acceptance (Table 4), but the case study with students provided evidence favourable to h3, given that the label negatively influenced acceptance only among the group of students who did not know the term (Table 4).

4. Discussion

4.1. Effect of the UFP label

Although the results differed in the case studies with *jenipapo* and *taioba*, some trends were identified. In both cases, it is important to note that the overall impression scored higher than the attributes of flavour, texture, smell, and colour. Thus, when people provide an overall impression of a product, emergent sensory properties and/or aspects that escape the sensory experience itself can be embedded in the evaluation.

Another aspect common to both case studies was the indication that the UFP label, at least in isolation, did not influence the acceptance of the products. Thus, when there is no specific target audience for popularization programmes, the use of the term does not seem to contribute much to or take much away from the acceptability of specific products. However, this result does not delegitimize the importance of the term in reuniting several underused plants into a unifying label.

The differences between the two case studies show that the target-audience issue requires special attention in the context of the use of

Table 1. Mean scores on the hedonic scale for evaluation of the sensory attributes of *jenipapo* juice (*Genipa americana* L.) by 100 volunteers at fairs in the metropolitan region of Maceió, Northeast Brazil.

Attribute	Mean	Standard deviation
Flavour	7.88	1.69
Texture	8.01	1.69
Smell	7.51	2.11
Colour	7.87	1.71
Overall impression	8.16	1.50

Table 2. Cumulative link model to explain the acceptance (scores on the hedonic scale for overall impression) of *jenipapo* juice (*Genipa americana* L.) by potential consumers in street fairs in the municipality of Maceió, Northeast Brazil.

Parameter	Estimate	Standard error
Coefficients		
Label (without label)	-0.35211	0.73443
Label (with label): Prior knowledge of the term (with knowledge)	-0.21210	0.44929
Label (without label): Prior knowledge of the term (with knowledge)	-0.48141	0.45987
Label (with label): Identification of genipap (with identification)	0.48088	0.45307
Label (without label): Identification of genipap (with identification)	0.58703	0.51934
Label (with label): Fair (Rio Largo)	-0.20009	0.45272
Label (without label): Fair (Rio Largo)	-0.07463	0.45031
Threshold coefficients		
1 3	-3.9681	0.8427
3 5	-3.5552	0.7369
5 6	-2.8388	0.6132
6 7	-2.5377	0.5785
7 8	-1.7212	0.5184
8 9	-0.5997	0.4828

the term UFP. In some situations, the use of the label can have a negative effect. In the case of the students, the negative effect of the label only affected those who had no prior knowledge of the term. This indicates that by becoming familiar with the concept, students come to know the motivations, whether ecological, social, or nutritional, for the consumption of these plants, which can counterbalance the eventual negative effect of the term. This is possibly reinforced by the context of knowledge acquisition about UFPs by students in the agricultural sciences. In such a context, a significant portion of the knowledge may have been obtained in the academic environment, which could have generated a deeper understanding of the importance of UFPs. In another study with students, this behaviour was observed towards insects, as people with prior information about entomophagy gave mealworm-based hamburgers better evaluations (Caparros Megido et al., 2016).

Thus, it is also possible that the context of the second case study aligns with the findings in the literature about organic and healthy foods, which shows that knowledge on a subject is an important moderating factor (Annett et al., 2008). The difference is that, in the cases cited, knowledge led to greater acceptance, while in our case, it counterbalanced a negative bias. However, to successfully elucidate this issue, it is necessary to establish appropriate experimental designs that more deeply explore the degree of knowledge about UFPs.

4.2. Conclusions and future perspectives

This study provides evidence that, in specific contexts, the UFP label may have a negative effect on individuals who are unfamiliar with the term. However, this shall not be used as an argument to recommend the rejection of the term in the context of popularization strategies. Thus, such strategies should be accompanied by the promotion of a deeper understanding of the ecological, nutritional, and social importance of UFPs. One example could be the implementation of marketing strategies in partnership between fair traders and other actors from government agencies and universities. Such strategies could include the dissemination of information on UFPs in local markets and on social and conventional media.

This study is a first attempt to determine the effect of the term 'unconventional food plant' on food acceptance. It encompassed more general questions to fill gaps and provide insights for future studies. The discrepancy between case studies 1 and 2 demonstrates the need to expand this field of research to different plants and to target audiences to identify general trends. Additionally, this research was limited by the small sample size, especially in study 2, and future investigations need to consider larger sample sizes.

In addition, the research design did not provide a comparative basis for potential consumers. People make relative judgements more accurately than absolute judgements (Kemp et al., 2009). Thus, future studies could test the hypotheses proposed by this study (and additional hypotheses) with evaluations that compare a UFP-based product and an analogous product based on a conventional plant. In this case, the difference between the evaluations of conventional and unconventional plants by the same person could serve as a response variable to test the effect of the label.

Because this is the first study on the subject, the research design was not conceived to provide excessive clues or additional information about the importance of UFPs. However, evidence from case study 2 indicates the need to investigate the effect of expanding UFP information on sensory evaluations. Thus, efforts should be made to test the hypothesis that providing information about the nutritional, ecological, and social benefits of UFPs will nullify possible negative biases towards the term itself or even overpower them, leading to a more positive evaluation of a product with this label. In a similar context, with fruits native to Brazil, a previous study found that providing information on health benefits contributes to the acceptance of juices based on these plants (Vidigal et al., 2011), which strengthens the hypothesis proposed here for future research.

It is also important to know what type of information contributes to the greater acceptance of UFPs. In the context of organic foods, information about health and nutrition is, in some cases, more important than attitudes towards the environment as a moderator of this acceptance (Annett et al., 2008). Thus, it is necessary to know if the UFP context follows this same logic.

In addition, other moderating variables of the label \times acceptance relationship must be sought. One of the investigated variables was the fair attended by the volunteers. However, there are a number of limitations to this approach, including (1) the absence of replicates in this study

Table 3. Mean scores on the hedonic scale for evaluation of the sensory attributes of the *taio*ba cake (*Xanthosoma sagittifolium* (L.) Schott) by 52 volunteers at fairs in the metropolitan region of Maceió, Northeast Brazil.

Attribute	Mean	Standard deviation
Flavour	7.23	1.72
Texture	7.29	1.73
Smell	6.88	2.08
Colour	6.56	2.31
Overall impression	7.42	1.94

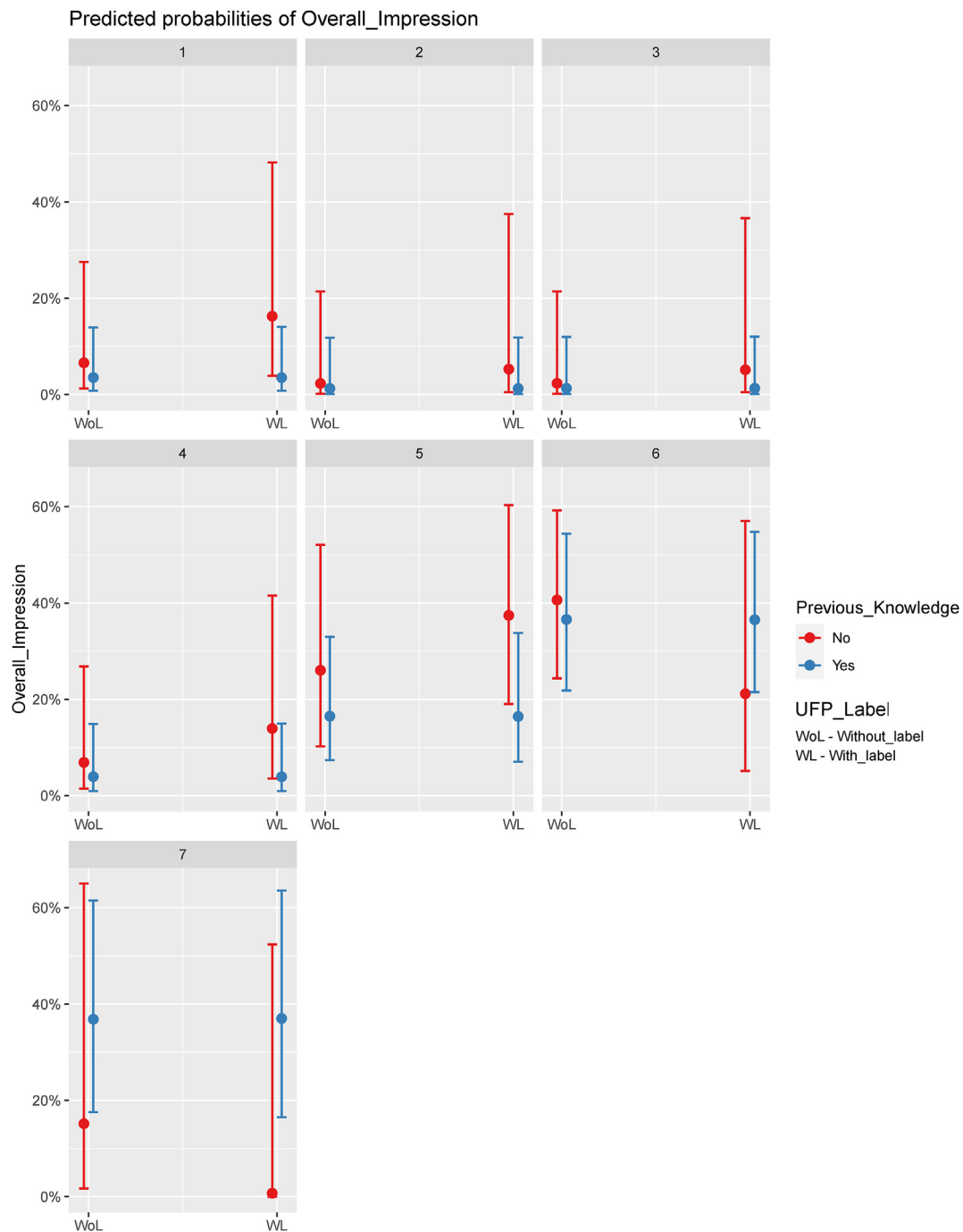


Figure 1. Predicted probability for the overall impression of *taioba* cake (*Xanthosoma sagittifolium* (L.) Schott) by university students in the city of Rio Largo, Northeast Brazil, considering the interaction between the presence of UFP labels and previous knowledge about the term. The numeric values in the grey boxes represent the scores from the overall impression. There are seven scores in the nine-point scale because the values 2 and 3 were not used by any volunteer in the sensory evaluation. The numeric values on the axis represent the percentage of respondents who attributed the score and this percentage label is the same for all the panels from a given line.

of common and agroecological fairs and (2) a lack of detail on the attitudes and behaviours of the fair visitors. The latter aspect is especially relevant given that in Maceió, many people attend the agroecological *Praça Centenário* fair because it is located in a region of the city where many people circulate. Therefore, people do not necessarily pay attention to the UFPs that are occasionally sold there or share positive attitudes towards agroecological-based foods. For this reason, the study of attitudes may enlighten these relationships. Future work could focus on understanding which types of attitudes function as major moderators of the relationship between the UFP label and acceptance (for example,

attitudes towards the environment, health and nutrition, or social justice).

The importance of food neophobia also needs to be elucidated, as more neophobic individuals may be more susceptible to the effect of the UFP label. In addition, it is possible that individuals who are more open-minded about new foods are more easily affected by positive information than neophobic individuals (Fernqvist and Ekelund, 2014).

Finally, the role of previous experiences in the acceptance of UFPs should also be evaluated. A relevant question is whether or not there are interactive effects between different UFPs; that is, does having previous

Table 4. Cumulative link model to explain the acceptance (scores on the hedonic scale for overall impression) of the *taio*ba cake (*Xanthosoma sagittifolium* (L.) Schott) by potential consumers in street fairs in the municipality of Maceió, Northeast Brazil. ** <0.01.

Parameter	Estimate	Standard error
Coefficients		
Label (without label)	0.9566	0.6178
Label (with label): Prior knowledge of the term (with knowledge)	1.5971	0.5266**
Label (without label): Prior knowledge of the term (with knowledge)	0.6362	0.5421
Threshold coefficients		
1 4	-1.7278	0.6397
4 5	0.5743	0.5743
5 6	0.5323	0.5323
6 7	0.4602	0.4602
7 8	0.3975	0.3975
8 9	0.4507	0.4507

positive or negative experiences with a UFP affect an individual's evaluation of a new UFP?

Declarations

Author contribution statement

Déborah Monteiro Barbosa: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Gabriela Maria Cota dos Santos, Danúbia Lins Gomes, Élide Monique da Costa Santos: Performed the experiments; Wrote the paper.

Rafael Ricardo Vasconcelos da Silva: Conceived and designed the experiments; Wrote the paper.

Patrícia Muniz de Medeiros: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Funding statement

This work was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (442810/2016-4, 302786/2016-3), L'Oréal Brasil (For Women in Science Awards), and L'Oréal (International Rising Talents Awards).

Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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