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MARKET INDICATORS OF CHARUTINHO (*Hemiodus* spp.) PICKLE

INDICADORES DE MERCADO DO PICLES DE CHARUTINHO (Hemiodus spp.)

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ABSTRACT: Fresh samples of charutinho (*Hemiodus* spp.) were used to prepare four fish pickles formulations: F1 = 55v4s, F2 = 55v5s, F3 = 45v4s e F4 = 45v5s), which differ in the percentual content of alcohol vinegar and common iodized salt, indicated by numbers before the letters "v" and "s" of formulations code. They were analyzed by 78 untrained judges as following indicators and hedonic scale: acceptability (seven points), purchase intention (five points), and consumption frequency (mixed scale). Mostly, the judges accepted the formulations with minor vinegar content (F3 and F4). Of them, that with more salt content had the highest average. This same formulation has the best notes as purchase intention and consumption frequency. The charutinho pickle showed promising results by market indicators. The formulation with minor vinegar and more salt is better for entrepreneurial initiatives.

KEYWORDS: sensory analyses, acceptability, marinated, fish.

RESUMO: Exemplares frescos de charutinho (*Hemiodus* spp.) foram utilizados na elaboração de quatro formulações de picles: F1 = 55v4s, F2 = 55v5s, F3 = 45v4s e F4 = 45v5s, diferentes entre si quanto ao percentual de vinagre de álcool e sal comum iodado, indicados respectivamente pelos números anteriores às letras "v" e "s" das formulações. Elas foram analisadas por 78 julgadores não treinados quanto aos indicadores e escala hedônica: aceitabilidade (sete pontos), intenção de compra (cinco pontos) e frequência de consumo (mista). Somente as formulações com menos vinagre (F3 e F4) foram aceitas, e entre elas, aquela com o mais sal (F4) alcançou maior média. Essa mesma formulação também recebeu as melhores avaliações quanto à intenção de compra e frequência de consumo. Os picles de charutinho apresentaram resultados

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promissores quanto aos indicativos mercadológicos. A formulação contendo menos vinagre e mais sal é a mais adequada para iniciativas empreendedoras.

PALAVRAS-CHAVE: análise sensorial, aceitabilidade, marinado, peixe.

1. INTRODUCTION

Fish food consumption in Brazil differs among geographic regions, highlighting the North region, where fishes are preferred (Begossi et al., 2019). These fishes are mainly commercialized in natura, cold, or frozen, characteristics that discourage their consumption in other Brazilian regions because, similar that observed in other parts of the World, many species present intramuscular spines that increase the risk of accidents in the swallow moment (Lopes et al., 2016; Antonucci et al., 2017; Temesi *et al.*, 2020; Chathurika *et al.*, 2023; Lopes e Freitas, 2023).

The growing urbanization and sociocultural changes experienced by modern people turn easy-to-prepare foods more attractive (Santos et al., 2007; Lopes e Freitas, 2023; Romero *et al.*, 2024), as the pickle, traditionally made from vegetables but usable on fish foods. This product, when prepared under adequate hygienic conditions, is an easy and safe semi-conservation method (Shikha et al., 2018; Isra et al., 2022).

The fish pickle, already sold in Poland (Mielcarek et al. 2020) for example, is an alternative not yet consolidated in the Brazilian market and that deserves attention. For its production, it is necessary to combine sodium chloride and organic acids, capable of increasing the shelf life, softness, and juiciness, as well as differentiated taste when compared to the raw material (Delbem *et al.*, 2013; Isra *et al.*, 2022; Chathurika *et al.*, 2023).

In the searching for this combination, sensory tests are important tools because they contribute to the success of the product to be launched on the market, as they will more closely reflect the needs of consumers. In these tests, groups of individuals trained or untrained for tasting food proposals can be used, following the recommendations contained in the most appropriated standard to the chosen method (for example: ABNT NBR ISO 8586: 2016, ABNT NBR ISO 13299:2017 and/or ABNT NBR ISO 6658: 2019). In general, there are no crucial differences between the results comparing these groups, despite the smaller number of individuals and significant reduction in study cost when using trained individuals (Atayde et al., 2022).

The charutinho (*Hemiodus* spp.) is a low commercial importance fish species in the Amazonian region, despite being valorized as a fish finger in the Western region of Pará, Brazil, mainly in the Ponta de Pedras community, in Santarém, where is inspiration since 2002 to an annual gastronomic festival by locals (G1 SANTARÉM, 2019; Faria Junior et al., 2020).

Their anatomical characteristics – fusiform format, standard length among 7 to 30 cm – motivated the authors of this study to idealize their utilization as pickles, because of their easy accommodation in the cylindrical flasks, more indicated to marinated products.

Only in the Curitiba city, State of Paraná, southern region of Brazil, there is a company called Serra do Mar (https://conservasserradomar.com.br/) that has been producing a sardine fillet pickle combined with cucumber or onion since the year 2004, but which is not yet distributed to other Brazilian regions due to the type of inspection license obtained by the company until now (May 2024).

The use of Amazonian fishes as the main item on pickle is incipient, being unprecedented the use of charutinho. This study elaborated pickle formulations using this ethnospecie and analyzed the market indicators – acceptability, buyer intention, and consumption frequency. These data will be useful for improvements on this product, public politics, or business private initiatives.

2. MATERIALS AND METHODS

Attending the ethical aspects, this study was previously registered on Plataforma Brasil, protocol CAEE n° 13789219.8.0000.5168, being approved by Comitê de Ética em Pesquisa com Seres Humanos (Ethics Committee on Research with Human Beings), opinions n° 3.508.846 and 5.301.114.

2.1. Sampling and processing

Fresh samples of charutinho (*Hemiodus* spp.) eviscerated and "ticados" (local expression indicative of fish submitted to narrow cuts parallel each other, in their dorsal section and both body sides, in transversal direction to fish length, without separate it, and with goal to cut the intramuscular spines in small pieces) were acquired in Feira do Pescado, in Santarém – PA and processed in the Laboratório Multidisciplinar de Recursos Aquáticos (Multidisciplinary

Laboratory of Aquatic Resources) of Universidade Federal do Oeste do Pará (Federal University of Western Pará).

In this laboratory, only the samples characterized as fresh according to Brazilian legislation (Brasil, Ordinance n° 9013, 29th March 2017 and actualizations) were chosen and submitted to dressed cut format (cut off the scales, fins, visceral residuals, and decapitation) and cleaning with chlorinated water.

2.2. Pickle preparation

Were made adaptations in the methodology adopted by Chandrashekar et al. (1978), increasing the duration of initial marination (to improve the palatability), not sautéing the other items (to obtain a light food) and without adding preservatives (to characterize it as artisanal product, not using additives recognized as chemicals).

The pickle preparation was made by soaking the samples in a saline solution 10% for ten minutes, draining and conditioning them in cylindrical glass flasks (internal capacity of 500 mL), previously sterilized and dried. In these flasks were inserted the other items previously washed with chlorinated water, and topping sauce, according to Table 1.

Table 1 – Formulations of charutinho (*Hemiodus* spp.) fish pickle

Ingredients and measuring unity	**Formulations**			
	F1 55v4s	F2 55v5s	F3 45v4s	F4 45v5s
	Quantities of each ingredient			
Fish:				
Charutinho (*Hemiodus* spp., in g)	255	255	255	255
Other ingredients:				
Garlic (*Allium sativum*, in g)	5	5	5	5
Onion (*Allium cepa*, in g)	45	45	45	45
Fragrant chilli (*Capsicum chinense*, in g)	10	10	10	10
Topping sauce:				
Chlorinated water (in mL)	135	135	165	165
Alcohol vinegar (in mL)	165	165	135	135
Iodized salt (in g)	12	15	12	15

These flasks containing the ingredients were submitted to gentle heating (ten minutes counted from the starting movement of topping sauce) followed by rapid cooling in the trays (immediate immersion of flasks in ice water [approx. 15 °C], in enough volume to reach the neck

of the bottle and enough time required to reach room temperature). All the flasks were stored for 20 days, under refrigeration, thus obtaining four charutinho pickle formulations.

The formulations of this study differed from each other in terms of topping sauce, which contained different combinations of vinegar and salt. One control formulation was not established because the charutinho pickle is a new product and there are no commercial preparations available using some Amazonian fish morpho and taxonomically similar.

In the pH analysis, the gauged index – 4.0 – was considered as maximum and ideal (Chandrashekar et al., 1978; Shenderyuk e Bykowski, 1990; Chathurika et al., 2023) for this product. The microbiological analysis required by Brazilian legislation (Brasil, Dictum RDC No. 12, January 02, 2001, operative at the moment of the study) demonstrates that the charutinho pickle was "in satisfactory sanitary conditions and accordance with current legal standards", so, able to human consumption. Later, the samples were submitted to market indicators analysis, as described below.

2.3. Market indicator analysis

Each formulation was submitted to degustation by 78 untrained tasters, mainly members of the university community. Each taster received two individual forms – the voluntary consent and the sensory file - and a codified sample of each pickle formulation. The individual impressions about each pickle formulation were registered in the sensory file that contained the hedonic scales adapted from Minim (2018), which was the base for manifestation.

The market indicators analyzed were acceptability, purchase intention, and consumption frequency, subdivided into (a) numeric factors: acceptability index, mean acceptability, mean purchase intention and mean consumption frequency; and (b) not-numeric factors (obtained by the relation between the rounded mean and the sensory scale utilized for that indicator): sensory trend, purchase trend and consumption trend.

The acceptability was evaluated by a seven-point hedonic scale ranging from "I dislike extremely" to "I like extremely", being the acceptability index calculated by the sum of positive points [$\sum$P(+) = "I like moderately" + "I like very much" + "I like extremely"] percentuals pointed by judges. Only the pickle formulations with P(+) $\geq$ 70% were considered acceptable, the same criteria used by Bispo et al. (2004), Atayde *et al.* (2021) e Figueiredo *et al.* (2023).

The purchase intention was evaluated by a five-point hedonic scale: "I certainly don't buy", "I probably don't buy", "Maybe I buy it, maybe don't", "I probably buy" and "I certainly buy".

The frequency of consumption was evaluated by mixed hedonic scale, with the closed options "I would never consume", "I would consume it once a month", "I would consume it once a fortnight", "I would consume it once a week" and one open option, where the judge would freely register any other desired frequency.

2.4. Data analysis

The data analysis was evaluated after the verification of sensory analysis files (n= 78), being utilized only that totally filled (n= 64), and this amount was sufficient to reach the scientific validation of this study. Due to this, for acceptability and purchase intention, were used data from 64 tasters. The others (n = 14) were excluded due to incomplete filling or no signature of the voluntary consent form.

For the consumption frequency, in these 64 sensory files were verified the coherency between this factor and the purchase intention pointed by the judge, i.e., when the judge chose some hedonic point between "I probably don't buy" till "I certainly buy", the consumption frequency appointed by him/her would be some non-zero number. In the end, only the data from 40 judges were utilized to estimate the consumption frequency. The other 24 judges pointed out some following answer combinations: a) "I would never consume" and some consumption index non-zero, or b) "I probably don't buy" and "I would never consume"; and because of it, considered incoherent.

The data were submitted to statistic descriptive and, later, variance analysis and Tukey test a posteriori, done by BioEstat 5.0 program. The differences were considered statistically significant when p-value < 0.05.

3. RESULTS AND DISCUSSION

According to the acceptability index (Table 2), only the F3 and F4 formulations were considered acceptable, because the presented index was higher than the limit established by Bispo et al. (2004), Atayde *et al.* (2021) and Figueiredo *et al.* (2023).

Table 2. Acceptability of artisanal charutinho (*Hemiodus* spp.) pickle

Charutinho pickle*	Points of hedonic scale	Qty.** (%)	AI*** (∑ P(+), %)	Mean ± standard deviation and sensory trend
F1	I like extremely	3.1	64.1 a	4.65 ± 1.04 a
	I like it very much	31.3		I liked moderately
	I like moderately	29.7		
	I neither like nor dislike	23.4		
	I dislike moderately	9.4		
	I dislike it very much	3.1		
	I dislike extremely	0.0		
F2	I like extremely	6.3	67.2 a	4.91 ± 1.05 a b
	I like it very much	28.1		I liked moderately
	I like moderately	32.8		
	I neither like nor dislike	25,0		
	I dislike moderately	6.3		
	I dislike it very much	1.6		
	I dislike extremely	3.1		
F3	I like extremely	7.8	82.9 a	5.01 ± 0.88 a b
	I like it very much	25.0		I liked moderately
	I like moderately	50.0		
	I neither like nor dislike	14.1		
	I dislike moderately	1.6		
	I dislike it very much	1.6		
	I dislike extremely	0.0		
F4	I like extremely	7.8	78.2 a	5.23 ± 0.91 b
	I like it very much	43.8		I liked moderately
	I like moderately	26.6		
	I neither like nor dislike	20.3		
	I dislike moderately	1.6		
	I dislike it very much	0.0		
	I dislike extremely	0.0		

*Codified formulation.
**Percentual quantity of answers to each point of hedonic scale, in each formulation.
***Acceptability Index, calculated by the somatory of percentual indexes from positive points of the hedonic scale, in each formulation.
In the same column, the minor letters superscript and different means significant differences among the formulations by Tukey's test ($p < 0.05$).

Statistically, F3 and F4 were equal and highlighted the higher index to "I like very much" point for F4. It is noteworthy that both F3 and F4 presented a minor quantity of alcohol vinegar among all formulations, suggesting that higher acidity in F1 and F2 negatively influenced the consumers preference.

Therefore, it is important to prefer a minor volume of alcoholic vinegar (or other organic acid solution) to prepare the charutinho pickle, since that its been enough to achieve the pH 4.0 –

index considered adequate for fish pickles by Chandrashekar et al. (1978), Shenderyuk e Bykowski (1990) e Chathurika et al. (2023).

This perception of the higher acidity was appointed as a demerit point to clupeid fish *Sprattus sprattus* marinade elaborated by Babikova et al. (2020). Thus, is recommended the use of minor indexes of vinegar in pickle formulations.

For average acceptability (Table 2), even though all of them present sensory trend to "I like moderately", the highest absolute index was obtained in F4. Perhaps, the salt indexes are being influenced in this perception by tasters.

Table 3. Purchase intention of charutinho (*Hemiodus* spp.) pickle

Charutinho pickle*	Points of hedonic scale	Qty.* (%)	Mean ± standard deviation and purchase trend
F1	I certaintly buy	21.9	3.34 ± 1.31 a
	I probably buy	32.9	Maybe I buy it, maybe don't
	Maybe I buy it, maybe don't	12.5	
	I probably don't buy	23.4	
	I certainly don't buy	9.4	
F2	I certainly buy	21.9	3.39 ± 1.32 a b
	I probably buy	34.4	Maybe I buy it, maybe I won't
	Maybe I buy it, maybe I won't	17.2	
	I probably don't buy	14.1	
	I certainly don't buy	12.5	
F3	I certainly buy	25.0	3.72 ± 1.09 a b
	I probably buy	39.1	I probably buy
	Maybe I buy it, maybe I won't	25.0	
	I probably don't buy	4.7	
	I certainly don't buy	6.3	
F4	I certainly buy	31.3	3.89 ± 0.98 b
	I probably buy	37.5	I probably buy
	Maybe I buy it, maybe I won't	20.3	
	I probably don't buy	10.9	
	I certainly don't buy	0.0	

*Codified formulation. **Percentual quantity of answers to each point of hedonic scale, in each formulation. The different lowercase letters in the same fourth column mean significant differences among the formulations by Tukey's test ($p < 0.05$).

In the clinical trial made by Villela et al. (2019) was verified that, independent of life stage, normotensive individuals always prefer less salty foods, and the opposite was observed in hypertensive patients. Among the judges of charutinho pickle, it is not possible indicate which individuals belongs to normal or hypertensive group because any question about their health was asked, but the saltiest pickle formulation received the highest score. So, even that the reduced salt

quantity is preferable for consumption because it preserves the health of consumers, probably the combination of this mineral with the vinegar content favored the F4 acceptation.

For purchase intention (Table 3), only F3 and F4 showed positive trend, being categorized as "I probably buy".

For the consumption frequency of charutinho pickles, fully adjusted for "times per month" (Table 4), the "four times" had the highest frequency among all pickle formulations, which an interesting data considering it is a new food product in this regional market.

However, when analyzing the mean index of this factor (which indicates the consumption trend, Table 4), even though they were statistically equal among formulations, F4 was the only one with a different consumption trend from the others, even maintaining the classification "four times per month" of the hedonic scale.

Table 4 – Consumption frequency of charutinho (*Hemiodus* spp.) artisanal pickle

Charutinho pickle*	Points of hedonic scale	Qty. (%)	Mean ± standard deviation and consumption trend
F1	Twelve times per month	2.5	3.10 ± 1.22 a
	Eight-time per month	2.5	Twice per month
	Four times per month	42.5	
	Twice per month	17.5	
	Once per month	27.5	
	Less than once per month	7.5	
F2	Twelve times per month	2.5	3.08 ± 1.40 a
	Eight-time per month	2.5	Twice per month
	Four times per month	47.5	
	Twice per month	15.0	
	Once per month	22.5	
	Less than once per month	10.0	
F3	Twelve times per month	0.0	3.10 ± 1.15 a
	Eight-time per month	12.5	Twice per month
	Four times per month	32.5	
	Twice per month	27.5	
	Once per month	22.5	
	Less than once per month	5.0	
F4	Twelve times per month	2.5	3.60 ± 0.98 a
	Eight-time per month	10.0	Four times per month
	Four times per month	50.0	
	Twice per month	17.5	
	Once per month	0.0	
	Less than once per month	0.0	

*Codified formulation.
In the same column, different lowercase letters mean differences statistically significant among the formulations by Tukey test ($p < 0.05$).

As both favorite formulations (F3 and F4) were statistically equal in terms of numeric indicators, we chose to define the best charutinho pickle formulation by direct comparison among the percentual points on the hedonic scales of all factors analyzed and the consumption trend (a non-numeric factor) of these formulations.

Thus, for acceptability, F4 was the one that obtained the highest index in the points "I like very much" and none "I dislike very much" and "I dislike extremely. For purchase intention, F4 either was the only one who presented the highest index on "I certainly buy" point, the highest on the hedonic scale used. For consumption frequency, F4 had the highest mean. Associating this data with consumption trend, the only factor that differentiated the formulas, F4 is identified as the best option for formulating charutinho pickle.

It was found that entrepreneurial initiatives using charutinho pickle should be encouraged because it is an innovative food product and adds value to Amazonian fish of lesser commercial importance.

4. CONCLUSION

It was demonstrated that charutinho pickle is a promising product for business initiatives as it obtained positive responses regarding the marketing indicators used in this research. To improve the product, tests using other quantities of vinegar in the preparation are recommended, using F4 from this research as a control formulation, to verify the influence of the gradation of the acidifying agent on consumer preference. Additionally, more in-depth economic studies are needed, which contain a greater number of production factors/indicators, which investigate the economic viability for artisanal (or industrial) production and/or indicate advertising strategies for this product, aiming for its success in the market.

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