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ACCEPTANCE OF FERMENTED ANCHOVY *(ENGRAULIS ANCHOITA)*

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The objective of this study was to evaluate the acceptance of fermented anchovy (*Engraulis anchoita*) by consumers aged 18–67 (n=100) from two experiments, first using preference test and then by acceptance of formulation preference. Anchovy fillets were fermented with added NaCl and glucose with 4 different treatments: A (NaCl 1% and glucose 4%), B (NaCl 1% and glucose 6%), C (NaCl 1.5% and glucose 4%), and D (NaCl 1.5% and glucose 6% glucose). At first, the preference of fermented anchovy fillets with samples prepared in the form of pizza was assessed by applying a preference ranking test to 75 consumers. The results indicated the sample with 1% NaCl and 6% glucose as the preferred (P>0.05). Later in the second stage, the preferred fermented fillet was subjected to acceptance by 100 consumers who have the consumption habit of such product by using a hedonic scale of 9 points. The results indicated an acceptance rate of 79.8%. This work aimed to call attention to the importance of the acceptance of this food.

Keywords: acceptance, food habits, consumer market, fish, fermentation

The anchovy (*Engraulis anchoita*) is a widely available species in Brazilian waters showing significant potential for commercial use without any industrial exploitation (Pastous-Madureira et al., 2009). The anchovy processed by lactic acid fermentation is an alternative to the development of a new product (Dimitroglou et al., 2011).

The lactic acid fermentation is a method of food preservation and transformation by important chemical modifications of raw materials, forming preservative agents. The processes occur through the action of microorganisms interrupting the biochemical processes and oxidative microbial deterioration (Visessanguan et al., 2006; Riebroy et al., 2008).

Logistic regression test hypothesizes about individual coefficients. The significance of each coefficient is the Wald statistic. If the logistic coefficient is statistically significant, its interpretation is in terms of how it impacts the dependent variable. Logistic regression does not depend on multivariate assumption and the presence of homogeneity of variance and covariance matrices. It is a robust technique, which makes its application appropriate in many situations (Hair et al., 2009).

Fish products obtained by lactic fermentation are very common in Southeast Asia (Saithong et al., 2010). In South America, countries like Argentina, Chile, and Peru have developed fermented products with anchoveta (*Engraulis ringens*). In this process the fish is mixed with NaCl in a proportion of 30% and then subjected to fermentation. This product is traditionally known as "matured salted fish" (Czerner et al., 2011). The marinated anchovy fillets are traditionally known as "boquerones" (Pastous-Madureira et al., 2009).

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Brazilians do not have the habit of consuming products such as fermented fish. The introduction of fermented anchovy in the Brazilian market requires a prior study of the consumption habits of fish products. In this sense, the objective was to assess the acceptability of fermented anchovy fillets, aiming insertion of the product in the Brazilian domestic market.

1. Materials and methods

1.1. Raw material

The raw material, anchovy (*Engraulis anchoita*), was captured during the 2011 season. The cruises were conducted by the 'Atlântico Sul' oceanographic ship belonging to the Federal University of Rio Grande (FURG), RS, Brazil. The sampling area extended from the Conceição Lighthouse (32°03'S) to the Albardão Lighthouse (34°16'S). Soon after capture, the fish were placed in polyethylene coolers with ice. The anchovy were fermented under 4 treatments with different NaCl (1–1.5%, w/v) and glucose (4–6%, w/v) values, using 300 g of fish and 10 ml starter culture in 400 ml distilled water. The treatments are described as follows: A: (1% NaCl+4% glucose), B: (1% NaCl+6% glucose), C: (1.5% NaCl+4% glucose), D: (1.5% NaCl+6% glucose). Starter *Lactobacillus plantarum* ATCC 8014, obtained from the University of Santa Catarina/Florianópolis/SC, Brazil, was utilized in the concentration of 8 Log_{10} CFU ml^{-1}. Before use, the starter was reactivated in MRS broth at 30 °C for 18 h (Downes & Ito, 2001). The anchovies were fermented at 20±1 °C for 28 d, centrifuged at 3000 r.p.m. for 2 min, packaged in glass (350 g) with an overlay medium (olive oil), and stored at 4 °C until used.

1.2. Preference test

The preference evaluation of the prepared formulations was performed by applying a ranking test according to Lawless and Heymann (1999). In this test, the samples are ranked from least preferred (1) to most preferred (9). A total of 75 potential consumers were asked to indicate their preference from the submitted samples. The group of evaluators with age between 15–45 years was composed of undergraduate students, graduate students, and employees of a local fish processing industry. Four formulations of pizza using fermented anchovy were presented A: (1% NaCl and 4% glucose), B: (1% NaCl and 6% glucose), C: (1.5% NaCl and 4% glucose), and D: (1.5% NaCl and 6% glucose). The samples were served in standard quantities (30 g), coded with a random three-digit code. The results were evaluated by the Newell & MacFarlane table (ABNT, 1994).

1.2.1 Sample preparation. The pizza samples were prepared with four sauce toppings based on the fermented anchovy fillets. The sauce toppings were prepared with 70% tomato paste and 30% fermented anchovy fillets for each formulation and heated at 100 °C for 10 min and spread over the dough with 1 cm thickness. The samples were heated at 250 °C for 20 min and then offered to consumers.

1.3. Acceptance testing

The preferred formulation was subjected to an acceptance test with 100 consumers in the city of Mar del Plata, possible habitual anchovy consumers. A hedonic scale of 9 points was used. In addition, a questionnaire was presented to 100 consumers based on socio-demographic

factors (sex, age, education) and consumption habits (fish consumption frequency and anchovy consumption habits). The analysis was performed by using the multivariate statistical analysis of multinomial logistic regression in order to assess the acceptance of fermented anchovy fillet.

2. Results and discussion

2.1. Evaluation of formulations of fermented anchovy as the preference

Table 1 presents the order sum and the differences in magnitude between the sums, corresponding to the ranking of samples on the preference of the formulations of fermented anchovy pizzas.

The results were analysed by using the Newel and MacFarlane (ABNT, 1994) table, which relates the number of judges with the number of samples to different levels of probability. Comparing the magnitudes of the differences obtained for the samples evaluated with the critical value (41), provided by Newel and MacFarlane table at 5% probability, it is apparent that formulation B: (1% NaCl and 6% glucose) differed significantly in preference from the formulations A: (1% NaCl and 4% glucose), C: (1.5% NaCl and 4% glucose), and D: (1.5% NaCl and 6% glucose).

Table 1. Sum of orders for the different formulations

Formulation		A	B	C	D
	Total	199	156	202	199
A	199	–	43 (s)	3 (ns)	4 (ns)
B	156		–	46 (s)	39 (s)
C	202			–	7 (ns)
D	195				–

A: (1% NaCl and 4% glucose); B: (1% NaCl and 6% glucose); C: (1.5% NaCl and 4% glucose), and D: (1.5% NaCl and 6% glucose). Critical value for 4 samples and 75 consumers: 41 (ABNT, 1994); s: significant; ns: not significant

The literature reports that the attribute acidity and low concentrations of NaCl are the factors that contribute to the acceptability of fish products (Riebroy et al., 2008). This fact may be associated with the hydrolysis of muscle proteins, which gives the product acidic taste masking or eliminating fish flavour (Saithong et al., 2010).

2.2. Acceptance of preferred formulation

Evaluating the data in Table 2 revealed that 57% of the panelists who participated in the acceptance test independently rated at the upper end of the scale (8–9), which correspond to the hedonic terms “really liked” and “I liked very much”. Only 6% of the results were located in the rejection region of the scale (<5). This behaviour expresses an index of acceptability of 79.8%.

The acceptance of fermented fish products using starter culture has been evaluated by several authors (Visessanguan et al., 2006, Riebroy et al., 2008), revealing higher acceptance rate for the fish processed with starter culture when compared to the traditional process.

Visessanguan and co-workers (2006) reported an acceptance rate close to that recorded in this study, when assessing the effect of *Lactobacillus curvatus* in Nham fermentation, registering acceptance rate for flavour and texture of 71% and 75%, respectively.

Table 2. Distribution of grades awarded for fermented anchovy by Argentine consumers and acceptance rate

Scale	Judgements	Score	Average	Acceptance index*
1	3	3	0.03	0.33
2	0	0	0	0
3	3	9	0.09	1.00
4	0	0	0	0
5	16	80	0.80	8.89
6	4	24	0.24	2.67
7	17	119	1.19	13.22
8	30	240	2.40	26.67
9	27	243	2.43	27.00
Total	100	718	7.18	79.78

*: Acceptance index: calculated based on the highest grade given (9) taken as 100%, and the average value (7.18) of the distribution of grades recorded

From Table 3, sociodemographic characteristics and habits of consumption of the participants in the acceptance testing of the product under consideration can be assessed. It can be seen that the panellists are predominantly male, that 56% consume fish at least once a week, and that 67% have the habit of consuming anchovy.

Table 3. Socio-demographic characteristics and Argentine consumer habits

Variables		Code*	n=100
Sex	Female	0	43
	Male	1	57
Age group	18–30		42
	31–48		24
	49–67		34
Primary and secondary education			77
Higher education			23
Consumption of fish (monthly frequency)	Never		0
	Once		26
	Two		18
	Four		37
	Eight		19
Habit of consuming anchovy	No	0	33
	Yes	1	67

* Representation of non-metric variables (0 and 1).

The results are best explained by the analysis of Tables 4 and 5. The data indicate the formation of three groups based on the acceptance of fermented anchovy fillet as well as statistical significance of each variable. Group 3 stands out, it consists of consumers who accepted the product in the maximum hedonic levels (regular like to extremely like) and represent 73% of the target population. This group consists mostly of men with an average age of 41 years. The group is characterized by higher frequency of fish consumption, as well as the usual consumption of anchovy, demonstrating the importance of the habit in food acceptance. According to Nu and co-workers (1996), the preference and eating habits are notably affected by the age factor. However, appeals for healthy foods have been shown to be decisive factors in choosing food (Verbeke & Vackier, 2005), this appeal being inserted into the regular intake of fish.

Data analysis also revealed that the frequency of consumption proves to be strongly associated with the habit. It is observed that the lowest frequencies recorded (Groups 1 and 2) are connected with low anchovy consumption habit. This can be confirmed by analysis of the statistical significance of each variable expressed by Wald statistics.

Table 4. Groups formed on the basis of acceptance

Variable	Formed groups		
	Group 1	Group 2	Group 3
Sex	0.4	0.6	0.6
Age	48	35	41
Education	9	10	10
Consumption frequency monthly	2.6	2.2	4
Habit of consuming anchovy	0.3	0.3	0.7
N	7	20	73

Group 1: answers on the hedonic scale from extreme dislike to regular dislike; group 2: answers on the hedonic scale from slight dislike to slight like; group 3: answers on the hedonic scale from regular like to like very much

The data analysis revealed that the variables "habit of consuming anchovy", "age", and "monthly consumption frequency" are those that best explain the acceptance of fermented anchovy fillets, while the variables "gender" and "education" showed no good impact on acceptance.

In general, research addressing consumer behaviour with fish products reports that it is women who have higher consumption habit when compared to men (Verbeke & Vackier, 2005). Although the gender variable did not present a good impact on acceptance, results reported in Table 5 do not suggest the same behaviour. Considering Groups 2 and 3, a predominance of males is shown, and it is verified that the highest frequency of fish consumption is in these groups.

Verbeke and Vackier (2005) studied the individual determinants that influence the intention and frequency of fish consumption with data collected in Belgium. It was found that the habit has emerged as a strong determinant, indicating that the consumption of fish is a matter of habit, suggesting the importance of the media in the challenge of habit changes through healthy awareness campaigns.

Table 5. Statistical significance of each variable

Effect	Wald	P
Habit of consuming anchovy	5.93	0.0482
Consumption frequency monthly	2.39	0.3014
Sex	0.003	0.9984
Age	3.84	0.1463
Education	0.65	0.7199

The importance of frequency and consumption habit in the present work is shown as variables of large impact in the attitude of like or dislike of the product under analysis. This is reflected in Group 3, which was characterized by having higher consumption frequency and anchovy consumption habit. The influence of anchovy consumption habit in the acceptance of the product under examination is evident, since the group that expresses greater acceptance was the one characterized by having a habit of consuming anchovy in the form of salty matured or boquerone. This is evidenced in the data reported in Table 3, where it is found that 67% of respondents report having the habit of consumption of salty matured anchovy (Czerner et al., 2011).

3. Conclusion

The fermented product was accepted by the consumers with an index of 79.8%. The consumers were characterized mostly as men having a frequency of fish consumption of at least once a month and have the habit of consuming salty matured anchovy.

The successful insertion of the fermented anchovy product in the Brazilian market can occur due to behavioural changes in eating habits, through an appeal for healthy foods consumption under which fish is classified. For this to occur, behavioural changes must be consolidated so that this becomes a habit.

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