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SENSORY EVALUATION OF STANDARD HARD CHEESE MINAS ADDED WITH BRAZIL NUT – A HIGH ANTIOXIDANT DELICACY

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ABSTRACT Increasing consumer interest to enhance their quality of life has encouraged the development of new food products containing high nutritional values. In response, the dairy industry has adapted itself to an increasingly competitive market and has made great efforts to offer consumers alternative food products that possess functional properties but do not affect any of the typical characteristics of the original product in terms of appearance, taste and texture. Standard hard cheese Minas is also known as Minas Curado (“cured Minas”), Minas Prensado (“pressed Minas”) or Minas Padronizado (“Standardized Minas”). Standard hard cheese Minas is probably the oldest and the most original cheese variety in Brazil, which began to be manufactured in the 19th century, particularly in the State of Minas Gerais. The Brazil nut kernel has excellent nutritional and functional properties, particularly due to the quality and amounts of proteins, lipids, dietary fibers, minerals such as selenium, and vitamins (B and E families). The objective of this study was to evaluate the sensory characteristics of appearance, color, taste and texture of Standard hard cheese Minas, manufactured with the addition of Brazil nut. The cheese was manufactured with the addition of a soluble 1:7 dilution of Brazil nut extract and Brazil nut paste (2%) and using the traditional manufacturing process of Traditional standard hard cheese Minas. The results obtained allow to conclude that Standard hard cheese Minas made with the addition of a blend of a soluble Brazil nut extract and kernel paste did not achieve the expected results in terms of consumer acceptance, mainly because of the sandy texture of the finished cheese. The presence of kernel paste made the cheese crumbly. However, as for the attribute aroma, the product was perceived positively by consumers.

Keywords: Functional food, Sensory analysis, Cheese, Brazil nut.

INTRODUCTION The increasing awareness of the importance of enhancing the quality of life has stimulated the development of new functional foods. In response to this trend, the dairy industry has made continuous efforts to adapt itself to the increasingly competitive and demanding market and offer consumers alternative food products that possess functional properties but do not affect the typical characteristics of appearance, taste and texture of the original product (ALVES et al, 2008).

Functional claims are defined as those referring to the metabolic or physiological role of a nutrient or non-nutrient in the growth, development, maintenance and other normal body functions, while health claims state, suggest or imply the existence of a connection between the food or ingredient with diseases or medical conditions (BRASIL, 1999).

Cheese is one of the oldest prepared foods in the recorded history of mankind. It is believed that it was discovered accidentally by storing and transporting milk in a container made from sheep stomach, resulting in the milk being turned to curd and whey by the rennet from the stomach. Its manufacture was of great importance since this significantly improved the keeping quality and increased the keeping time, thereby facilitating its transportation and storage (CENTRO DE PRODUÇÕES TÉCNICAS, 1997).

The manufacture of cheese in Brazil has a very recent history and cheese began to be industrially produced only from the 1920's onwards with the settling of Danish immigrants in the south of Minas Gerais and Dutch settlers in the area of Santos Dumont and Barbacena, also in the State of Minas Gerais (FURTADO, 1991). From a technological standpoint, cheese is a fatty protein concentrate produced by the coagulation of milk. The curdled milk or curd is drained off, which causes a reduction in moisture content. The most important component of cheese is, without any doubt, protein. The fat content may vary depending on the cheese variety; the moisture level also varies greatly and is closely related with the keeping time of the resulting cheese. Cheeses with moisture levels reduced to a greater degree tend to be hard and can be kept or stored for longer periods of time, even under adverse conditions (OLIVEIRA, 1986).

Minas Padrão cheese is also known as *Minas Curado* ("cured *Minas*"), *Minas Prensado* ("pressed *Minas*") or *Minas Padronizado* ("Standardized *Minas*"). Standard hard cheese *Minas* is probably the oldest and the most original cheese variety in Brazil, which began to be manufactured in the 19th century, particularly in the State of Minas Gerais. There are other varieties with similar characteristics, such as *Serro* cheese, *Canastra* cheese, *Catiara* cheese and *Coalho* cheese, all of which are manufactured from raw milk on small scale in farmstead dairies. Standard hard cheese *Minas o* differs from *Minas Frescal* cheese in that it is dryer, firmer and has a fine, yellowish rind, a white creamish color and some irregular, small eyeholes and a pungent, slightly acidic taste. It is a cylindrical cheese weighing between 0,8 to 1,2 kg. It is much consumed at breakfast or as dessert, together with sweets. The average manufacturing yield is about 8,0 to 8,5 liters milk/kg cheese (FURTADO & LOURENCO NETO, 1994).

The Amazon region is home to one of the richest and most valuable oilseeds - Brazil nut, the seed of a tropical evergreen tree - *Bertholletia excelsa* - belonging to the Lecythidaceae family. Although common in Amazonian cooking, its use as an ingredient is still limited in the other regions of the country. Consumption in the home of Brazil nut is very low and most of the production is exported to Europe and North America where it is highly esteemed as a healthy and tasty snack delicacy. It is estimated that only 1 % of the total production is consumed on the domestic market (REGITANO-D'ARCE et al, 1995; RIBEIRO et al, 1993).

The Brazil nut kernel has excellent nutritional and functional properties, particularly due to the quality and amounts of proteins, lipids, dietary fibers, minerals such as selenium, and vitamins (B and E families) (PACHECO e SCUSSEL, 2006, 2007). With their composition rich in these nutrients, Brazil nuts have a powerful antioxidant effect in human metabolism, in addition to improving food efficiency by increasing the absorption by the body of essential compounds that play an important role in the prevention of osteoporosis and non-transmissible chronic diseases. The nutrients and compounds contained in Brazil nuts have been found to be effective not only in the modulation of diarrheas caused by antibiotics, chemotherapy, radiotherapy and stress situations, but also help in the prevention, treatment and regulation of intestinal obstruction in the

elderly and improve intestinal flora, in addition to enhancing the resistance of the immune system.

Due to its pleasant taste and recognized high nutritional value, Brazil nut has a good potential to be consumed in significant quantities and to be incorporated into the daily diet of the Brazilian population. The development of processed Brazil nut-based food products and ingredients has been an object of study for some time now (SANT'ANNA, 1985).

The objective of this study is to develop a Standard hard cheese *Minas*-type cheese manufactured with the addition of Brazil nut and functional properties as an alternative for consumers who seek foods that are at the same time good tasting and healthy, in a way so as to use a locally produced raw material of high nutritional quality and offer an alternative food product with characteristics of a fine gourmet delicacy.

METHODOLOGY:

Traditional standard hard cheese *Minas* (Figure 1) and Standard hard cheese *Minas* added with Brazil nut extract (Figure 2) and Brazil nut kernel paste (Figure 3) was manufactured at the Laboratory of the Paraná Federal Technological University – Medianeira Campus. The cheese was manufactured with the addition of a soluble 1:7 dilution of Brazil nut extract and a 2% Brazil nut paste (2%). It should be emphasized no other change was applied to the traditional Standard hard cheese *Minas* making process and that all the cheeses were made from pasteurized skim milk. Sensory analyses were conducted at the sensory analysis laboratory of the Paraná Federal Technological University – Medianeira Campus. A sufficient number of samples at room temperature were evaluated at two different times of day, in the morning and in the afternoon. Testing took place in individual booths under white lighting by 130 untrained panelists, regular consumers of Traditional standard hard cheese *Minas*, both male and female between the ages of 18 and 50. The panelists were provided with printed instructions and each received a sample score sheet onto which they were asked to assign a liking score on a 9-point hedonic scale (Figure 4) for the attributes taste, texture, appearance, color and overall evaluation, using the procedures for consumer sensory evaluation described by Minim, (2006).

All samples were served in uncovered 50 mL disposable white plastic cups identified by a random 3-digit code, along with a 200 mL cup containing distilled water to remove any aftertaste. The test was set up as a randomized block design and the data were statistically analyzed by analysis of variance (at the 5 % level of significance).



Figure 1. Traditional standard hard cheese *Minas*



Figure 2. Standard hard cheese *Minas* added with soluble Brazil nut extract and Brazil nut paste.



Figure 3. Soluble Brazil nut extract and Brazil nut kernel paste

FICHA PARA AVALIAÇÃO HEDÔNICA DOS QUEIJOS

Nome: _____ idade _____ Sexo _____

Você está recebendo amostras de Queijo Minas Padrão, avalie os 02 tipos de Queijo Minas Padrão de acordo com a sua preferência e com base nos atributos solicitados na tabela e na escala hedônica abaixo:

- 1 – Desgostei muitíssimo
- 2 – Desgostei muito
- 3 – Desgostei regularmente
- 4 – Desgostei ligeiramente
- 5 – Indiferente
- 6 - Gostei ligeiramente
- 7 - Gostei regularmente
- 8 - Gostei muito
- 9 - Gostei muitíssimo

Código dos queijos	Código da avaliação de acordo com a escala hedônica apresentada e os atributos descritos					
	Sabor	Aparência	Textura	Cor	Aroma	Avaliação global
587						
382						

OBS.

Obrigado pela sua colaboração.

Figura 4. Sample core sheet for hedonic evaluation of the cheeses

SAMPLE SCORE SHEET FOR HEDONIC EVALUATION OF THE CHEESES

Name:

Age:

Gender:

You are receiving samples of Standard hard *Minas* cheese. Please evaluate the 02 types based on your personal preference. Please assign a liking score to each of the attributes listed using the hedonic scale below:

1. Dislike extremely
2. Dislike very much
3. Dislike moderately
4. Dislike slightly
5. Neither like nor dislike
6. Like slightly
7. Like moderately
8. Like very much
9. Like extremely

Code of cheeses	Evaluation code in accordance with the hedonic scale presented and the attributes listed					
	Taste	Appearance	Texture	Color	Aroma	Overall evaluation
587						
382						

Observations:

Thank you very much for your collaboration

RESULTS AND DISCUSSION:

The results for the attributes appearance, color, taste and texture of Standard hard cheese *Minas* added with soluble Brazil nut extract and Brazil nut paste are presented below. The comparison between the means and acceptability percentages of the six sensory attributes evaluated by the 130 untrained panelists for the two products - Traditional and Standard hard cheese *Minas* added with soluble Brazil nut extract and Brazil nut paste - are shown in Table 1.

Table 1 – Average scores achieved after evaluation by 130 untrained panelists of Traditional standard hard *Minas* cheese control cheese and Standard hard *Minas* cheese manufactured with the addition of a soluble Brazil nut extract (50 %) and Brazil nut kernel paste (2 %), assigned onto a 9-point hedonic scale (1 = dislike extremely, 9 = like extremely) and the acceptance percentage obtained by each product.

Attributes	Traditional standard hard <i>Minas</i> cheese		Cheese with soluble Brazil nut extract and Brazil nut kernel paste	
	Mean*	Acceptance % **	Mean*	Acceptance % **
Taste	7,2 ^a	91	5,0 ^b	47
Appearance	7,5 ^a	91	4,6 ^b	34
Texture	7,3 ^a	91	4,4 ^b	33
Color	7,3 ^a	85	5,2 ^b	45
Aroma	7,0 ^a	82	5,7 ^b	53
Overall evaluation	7,4 ^a	94	5,1 ^b	46

* Means followed by different characters in the same row differ significantly (analysis of variance F-Test $p < 0,05$).

** Percentage of scores above 5.

It was observed that, for all the attributes evaluated, analysis of variance revealed a significant difference ($p < 0,05$). It is important to stress that, as explained by Lanzillotti and Lanzillotti (1999), sensory evaluation of entirely new products is very difficult since there are no known standards against which they can be compared; and human decisions tend to be based on expectations generated by previous experiences and subjective observation. Since this product had not been previously consumed by the panelists, their responses and evaluation were based on their perception of the sensory attributes of a similar product, which, in the specific case of this study, was the product used as control.

The sensory characteristics developed for the target-product of this test are described below and some of them are very different from those of the control-product used for this study. This may possibly have influenced certain psychological factors and pre-existing expectations.

Both the comments written on the score sheets by panelists and the results of the means and percentages of acceptance (Table 1) clearly indicate that the main sensory problems of the test product were a texture and appearance that were quite different from the texture and appearance of the traditional product (Standard hard *Minas* cheese control cheese) and which resulted in a reduction of the acceptability of the nut cheese developed.

The Brazil nut paste gave the product a visual appearance strikingly different from that of a typical cheese. The nut paste brought about a drastic change in color and texture which gave the

Standard hard *Minas* cheese made with the addition of Brazil nut extract and Brazil nut paste (Figure 5) sensory characteristics (appearance, color and texture) similar to those of an ice cream with chocolate crumbs.



Figure 5. Standard hard *Minas* cheese with added Brazil nut extract and Brazil nut kernel paste

According to Treptow et al. (1998), visual characteristics are important determinants of sensory acceptability of food products and decisively influence the purchase decision of consumers in retail stores. When selecting a product from the supermarket shelf, the consumer will guide him or herself by the visual appeal of a product and will customarily express his discontent whenever the product does not live up to his/her expectations. The same happens during in-laboratory sensory evaluation tests and the consumer expresses his/her dissatisfaction in a sometimes even more explicit way when the characteristics of appearance are compromised; this effect occurs as a result of the natural reaction of the predisposed brain that expects that the product will be unpleasant even before the person consumes it.

Amerine et al. (1965) explain that after tasting a food, appearance and color become secondary to texture and taste. However, in the case of the product investigated, texture was the attribute that obtained the lowest mean score, as well as the lowest percentage of acceptability. This was due to the fact that the texture of the product was much like that of ricotta. The presence of Brazil nut paste made the test cheese crumbly and much different from a traditional Standard hard *Minas* cheese. For that reason, when the panelists compared the test cheese to the traditional Standard hard *Minas* cheese control cheese, this attribute led to an even greater reduction in the sensory acceptance of the test cheese. This, in turn, was a factor with significant potential to impair the final acceptance of the test product since the consumer panelists tried to identify similarities among the attributes evaluated.

Of all the sensory attributes evaluated, aroma was the most well accepted. Summing up the value of acceptance with the “neither like nor dislike” value (indifference), this would be the only attribute of the test cheese that would achieve 70 %, with less than 25 % of rejection and a percentage of acceptance of 53 % (Figure 6), thereby demonstrating that the presence of Brazil nut aroma in dairy products tends to be well accepted. However, the addition of Brazil nut kernel paste to the cheese developed in this study caused a differentiation in taste, appearance, color and mainly texture – mainly caused by the crunchy nut bits – that was not well accepted by consumers.

The consumption of cheese containing crunchy inclusions is certainly not common as is the case of ice creams. The addition of Brazil nut kernel paste to ice cream would probably have more chances to achieve high sensory acceptance ratings. A series of additional tests should be

conducted to evaluate the use of only Brazil nut extract in Standard hard *Minas* cheese and that of Brazil nut kernel paste to ice creams.

The addition of both ingredients to cheese at the same time did not achieve satisfactory acceptance ratings that would justify the launching of the test cheese into the market. According to Minin (2006); a minimum consumer acceptance percentage of 70 % is required to be able to presume, with a good margin of probability, that a product will be well-accepted by consumers and, consequently, may be launched into the market. In the case of this enriched cheese variety, that threshold value was not achieved for any of the attributes evaluated (Figure 7).

On the other hand, the Traditional standard hard *Minas* cheese (Figure 6), manufactured under the same conditions and from only skim milk yielded acceptance percentages for all the attributes evaluated greater than 80 % and very low rejection percentages, as can be seen in Figure 7.



Figure 6. Traditional Standard hard *Minas* cheese

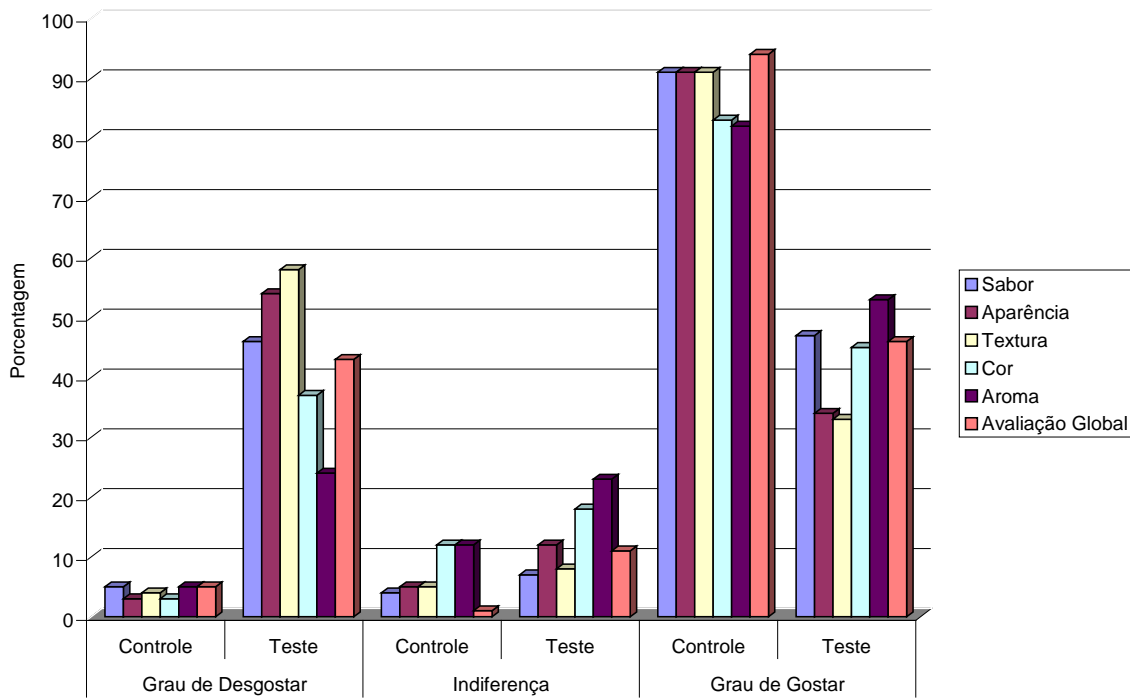


Figure 7. Percentage of Acceptance (degree of liking = percentage of scores above 5), Indifference i.e. neither like nor dislike (percentage of scores equal to 5) and Rejection (degree of disliking = percentage of scores below 5) obtained after evaluation by 130 untrained panelists of Traditional standard hard *Minas* cheese control cheese and Standard hard *Minas* cheese manufactured with the addition of soluble Brazil nut extract (50 %) and Brazil nut kernel paste (2 %) who attributed a liking score to 6 sensory attributes onto an hedonic 9-point scale (1 = dislike extremely, 9 = like extremely).

CONCLUSION:

Standard hard *Minas* cheese manufactured with the addition of soluble Brazil nut extract and Brazil nut kernel paste did not achieve good sensory acceptance rates due to the sandy and differentiated texture of the cheese. The product received good acceptability rates for the attribute aroma, which can be considered an encouraging result for an innovative product that was little known by the consumer panelists. It was concluded that this cheese should be recommended as an alternative option for the consumption of Brazil nuts, not only because Brazil nut is a locally produced raw material that so far has been little used in industrial food processing in Brazil, but mainly because of the functional properties Brazil nut can contribute to an array of processed foods.

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