



Short Communications

## Influence of sanitary inspection on the physicochemical quality of coalho cheese

Influência da inspeção sanitária na qualidade físico-química do queijo de coalho

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### ABSTRACT

This study aimed to evaluate the influence of sanitary inspection on the physicochemical characteristics, colour and texture of coalho cheese commercialised in the semiarid region of Brazil. One hundred and thirty-eight coalho cheese samples from commercial establishments in 46 Brazilian cities were evaluated, and physicochemical analyses (acidity, moisture, fat content, pH and ashes), as well as colour and texture tests were performed. The averages for the parameters in cheeses without the official sanitary inspection seal were 4.31, 0.34%, 50.34%, 55.9 and 4.83, for ash, relative acidity, moisture, fat content and pH and in samples with the official sanitary inspection seals we found values of 4.41, 0.32%, 51.51%, 55.37 and 4.92, for the same parameters, respectively. There was no difference in the colour and texture parameters, which for the samples with the official seal were 71.15, 1.43, 13.52 and 1.65; and for the ones without the official seal were 69.58, 1.50, 13.15 and 1.71 for L\*, a\*, b\* and texture, respectively. The fact that the coalho cheese was commercialised with an official inspection seal did not influence the physicochemical, texture or colour analyses.

### RESUMO

Com o objetivo de avaliar a influência da inspeção sanitária nas características físico-químicas, cor e textura do queijo de coalho comercializado no semiárido do Brasil, 138 amostras de queijo de coalho de estabelecimentos comerciais de 46 cidades foram avaliadas quanto as análises físico-químicas (acidez, umidade, teor de gordura, pH e cinzas), além de testes de cor e textura. As médias dos parâmetros de queijos sem selo de inspeção sanitária oficial foram 4,31, 0,34%, 50,34%, 55,9 e 4,83, para cinzas, acidez relativa, umidade, teor de gordura e pH e nas amostras com selos sanitários oficiais encontraram valores de 4,41, 0,32%, 51,51%, 55,37 e 4,92, para os mesmos parâmetros, respectivamente. Não houve diferença nos parâmetros de cor e textura, as amostras com selo oficial apresentaram 71,15, 1,43, 13,52 e 1,65; e as amostras sem o selo oficial foram 69,58, 1,50, 13,15 e 1,71 para L\*, a\*, b\* e textura, respectivamente. Tanto os queijos com selo de inspeção quanto os sem inspeção apresentam grande variabilidade quanto aos caracteres físico-químicos, de cor e textura, não havendo diferença entre os dois grupos, comprovando uma falta de padronização na produção do queijo de coalho, evidenciando assim uma diferenciação individual que pode influenciar na escolha do consumidor no momento da compra.

#### Palavras-chave:

Fabricação de queijo

Características físico-químicas

Serviço de inspeção

### INTRODUCTION

Cheese is a source of protein, vitamins and minerals, especially calcium and phosphorus which are essential

components in highly consumed food. It is important to assess the standard characteristics of cheese in order to contribute to the quality of this food (EL-BAKRY; SHEEHAN, 2015).

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Cheese was traditionally produced on small scale and manually, while currently most of the cheese production worldwide happens on a commercial scale in large dairies (SABIKHI; BHONGLE; SATHISH KUMAR, 2015). Although the basic process to manufacture cheese is the same for both production types, variations in the milk origin, processing technique and maturation time create a huge variety of characteristics (PERRY, 2004).

In many countries, traditional products have been increasingly valued and, more often than not, chosen by consumers. The production of traditional food is generally done and marketed informally, and this is mainly due to the close relationship between producers and consumers, which generally allows an exchange of information on the origin and quality of these products (CRUZ; MENASCHE, 2014).

Cheese characterisation is also important to protect traditional production and to contribute to quality control. Physicochemical parameters (MAGENIS et al., 2014), texture (LTEIF et al., 2014) and colour (YASIN; SHALABY, 2013) are used to assess the quality of the cheese.

Many traditional cheeses are produced in small dairies (GRIGOLI et al., 2015), coalho cheese is an example, typically in northeast Brazil. This cheese stands out as one of the main artisanally-produced cheeses and is commonly produced with raw milk (QUEIROGA et al., 2013). Similar to other varieties of cheese, coalho can be manufactured with raw or pasteurised milk. Technological variations during production and lack of standardisation can change the characteristics of the cheese, which therefore interferes with consumer preference. Thus, the aim of this study was to evaluate the influence of sanitary inspection on the physicochemical characteristics, colour and texture of the coalho cheese marketed in the semiarid region of Brazil.

## MATERIALS AND METHODS

In total, 138 coalho cheese samples were randomly collected from commercial establishments (supermarkets, public markets and open-air markets) located in 46 cities and towns of the semiarid region of Brazil. Of these, 51 (fifty one) had the official sanitary inspection seal and 87 (eighty seven) did not have the official sanitary inspection seal. The cheeses that were sold in bulk quantities were packed at the commercial establishment and placed in sterile bags together with their original packaging. The bags were coded and identified with specific data about the presence or absence of an official inspection seal, best before date, conservation method used during commercialisation, etc. Next samples were transported under refrigeration to the laboratory where the analyses took place.

### *Physicochemical analysis*

For the physicochemical analyses of acidity and ash we followed the recommendations of the Analytical Standards of the Adolfo Lutz Institute (IAL, 1985). To measure fat content in the dry extract, we used the recommendations of the Normative Instruction n°. 68 (BRASIL, 2006). Moisture content and pH were measured as well.

Acidity analysis was done through the titrimetric method, where acidity based on lactic acid was calculated. We weighed approximately 10 g of the sample and transferred that to a 100 mL volumetric flask with neutral 95% alcohol, for six hours. Next, the contents were filtered and titrated with a 0.1 M sodium hydroxide solution after the addition of five drops of phenolphthalein solution until pink colouration was achieved.

To determine the ash content, the sample was incinerated at 550 °C in a muffle furnace until white. Heating and cooling was repeated until the weight of the sample became constant.

For the analysis of fat content, 3 g of the sample were added to 5 mL of water, 10 mL of sulphuric acid solution and 1 mL of isoamyl alcohol, directly in the cup of the butyrometer and homogenised in water bath at 65 °C. The next step was to centrifuge the mixture for 10 minutes at 1200 rpm to determine the percentage of fat directly from the marks on the butyrometer. The value of the fat content in the dry extract was calculated with the results found in the analyses of moisture and total fat content, according to the guidelines of Lanagro (2014).

To assess the pH value we used a PHTEK pHmeter (model HI 99161) and moisture determination was done through the moisture-determining scale, model MOC 63, according to manufacturer's specifications.

Instrumental colour determination was performed with a KONICA MINOLTA CM-700d/600d colorimeter, using the CIELAB system (CIE, 1986). We performed measurements of the parameters L\* (brightness), a\* and b\*, which refer to green(-)/red(+) and blue(-)/yellow(+) chromaticity coordinates, respectively. Measurements were performed in triplicate and the equipment was calibrated prior to use.

Texture was recorded, instrumentally, in a texturometer (TEXTURE ANALYZER TA-XT-125), coupled to an aluminium cylinder of 25 mm diameter (P/1s). Data were collected on the "Texture Expert for Windows 1.20" program (Stable Micro Systems).

### *Statistical analysis*

Data for the physicochemical, colour and texture analyses based on the influence of the sanitary inspection were studied by comparing means using Tukey's test at 5% probability and analysis of variance.

## RESULTS AND DISCUSSION

Results for the physicochemical parameters (acidity, moisture, fat content, pH and ash), colour and texture of

the coalho cheese samples are shown in Table 1.

Table 1 – Results, means and Standard Deviations of the physicochemical analyses performed on coalho cheese samples commercialised in the semi-arid region of Brazil.

Analyses	With the sanitary inspection seal	Without the sanitary inspection seal	Total	Total		Standard	
	M±SD	M±SD	M±SD	Min.	Max.		
Acidity (%)	0,34±0,12 <sup>a</sup>	0,32±0,10 <sup>a</sup>	0,33±0,11	0,16	0,63	-	
Moisture (%)							
Fat content							
pH	50,34±12,41 <sup>a</sup>	51,51±12,37 <sup>a</sup>	50,26±12,40	29,05	74,15	36 a 54,9%	
Ash (g/100g)							
	55,9±16,82 <sup>a</sup>	55,37±16,85 <sup>a</sup>	55,19±16,77	29,74	82,63	35 a 60%	
	4,83±0,42 <sup>a</sup>	4,92±0,48 <sup>a</sup>	4,90±0,44	3,82	5,90	-	
	4,31±0,57 <sup>a</sup>	4,41±0,59 <sup>a</sup>	4,20±0,54	2,80	5,68	-	
Instrumental colour	L*	71,51±8,16 <sup>a</sup>	69,58±10,33 <sup>a</sup>	70,49±9,43	43,39	83,74	-
	a*	1,43±0,60 <sup>a</sup>	1,50±0,68 <sup>a</sup>	1,46±0,66	0,33	3,6	-
	b*	13,52±2,40 <sup>a</sup>	13,15±3,04 <sup>a</sup>	13,37±2,66	2,58	17,59	-
Texture	1,65±0,52 <sup>a</sup>	1,71±0,72 <sup>a</sup>	1,70±0,61	0,4	3,76	-	

Lowercase letters in different columns mean statistical difference ( $p < 0.05$ )

L\*- Brightness, a\*- Green/Red, b\*- Blue/Yellow, Min.- Minimum, Max.- Maximum

Regarding the physicochemical parameters, samples presented average of 4.9 for the potential of hydrogen (pH), ranging from 3.82 to 5.90. As to moisture, values ranged from 29.05 to 74.15%, averaging 50.26%, which characterises the samples as highly moist cheese (46.0 and 54.9%) (BRASIL, 2001). The percentage of acidity expressed in lactic acid, ranged between 0.16 and 0.63%, and had an average of 0.33%. Ash percentage had values between 2.8 and 5.68, averaging 4.20, and finally, fat content in the dry extract had values from 29.74 to 82.63 and an average of 55.19.

There was no significant difference between the mean values found for pH in the cheese samples, which were 4.38 and 4.92, respectively for cheeses without inspection seal and with inspection seal. According to Hayaloglu et al. (2008), the high variation in pH found in this study may be due to microbial action and the presence of acidifying bacteria in the raw material or acquired during processing. According to Sousa, Ardo and Mcsweeney (2001); Lee and Anema (2009), the pH parameter is important to cheese, because with a pH below 5.7, the cheese melts and deforms under heat. For Silva et al. (2010), heat resistance is an important feature for this cheese, since it favours the preparation of the popular dish "Roasted Cheese".

The coalho cheese samples analysed were classified as highly moist cheeses, however, there was a large variation of values in the results. The high values found

for moisture content may be associated to several factors involved in the process of cheese production. Coalho cheese is made from the coagulation of milk, followed by cutting and stirring the curd, sieving the whey, heating, adding chloride, pressing, drying, packing and storing (BRASIL, 2001). The lack of a standard time frame for each step can modify the characteristics of the cheese. For example, pressing is characterised as an important factor for the moisture content of a cheese, as depending on how it is done, the cheese either retains water or dries out. In addition, moisture is also correlated with the length of storage time, and the more dehydrated cheeses have harder texture (FREITAS; MALCATA, 2000).

The marked difference between minimum and maximum values found for acidity in this study, was also noted in the studies of studies the Ballesteros et al. (2006), that evaluated artisanal and industrial cheeses and observed higher acidification activity in artisanal cheeses. Despite this fact, in this study, we did not observe significant difference in the values of acidity between samples.

Milk and dairy products are an abundant source of minerals, which perform a variety of functions in the human body (ALJEWICZ; CICHOSZ, 2015). Ash content in cheeses is associated with type of production and raw material. The average value for this parameter was similar between all samples analysed.

The average value found for fat content in dry extract was 55.19%, this means that the coalho cheeses samples we analysed were within the standards established by legislation, which are 35 to 60% (BRASIL, 2001). The range of values for fat content in dry extract was from 29.74 to 82.63% and these were superior to those found by Silva et al. (2010), who found values ranging between 36.59 and 48.16%. Such as for moisture, the difference in fat content is likely due to the processing of the cheese and to the variations of the raw material. The handling of the curd influences how much moisture and fat the cheese holds and, therefore, the centesimal composition of the final product (SALES et al., 2016).

As for the determination of colour, the samples presented average value of 70.49 for brightness ( $L^*$ ) and 1.46 and 13.37 for  $a^*$  and  $b^*$  parameters, respectively. Regarding texture, we found the average value of 1.70 for the samples.

Colour is an important parameter in product development, because appearance of food is usually the first impression to register in the minds of consumers (YASIN; SHALABY, 2013). Consumers seek quality products, and appearance is one of the required attributes (GRUNERT; AACHMANN, 2016), especially for those who already know the product. Coalho cheese must present, amongst other sensory characteristics, a compact and soft texture and uniform yellowish white colour (BRAZIL, 2001).

Cheese colour is closely linked to the fat content in the milk used to produce such cheese and, therefore, is subject to seasonal variations, which are corrected by the addition of dyes (RAMÓREZ-NAVAS; RODRÓGUEZ DE STOUVENEL, 2012). In determining the colour, the  $L^*$  parameter indicates the brightness and refers the ability of the object to reflect light, ranging in a scale from zero to 100. Based on the average  $L^*$  parameter in this study (70.49), samples were considered bright. All samples presented low and positive values for  $a^*$ , which represents the colour red; while for the  $b^*$  value we found positive average, representing the intensity of the colour yellow. Thus, the cheeses tended to be a yellowish white colour, which is similar to the characteristic, predominantly yellow colour of the cheese (MAGENIS et al., 2015).

The instrumental texture parameter varied between samples (ranging from 0.4 to 3.76), and we did not observe standardisation nor difference between the presence or absence of the official inspection seal. The texture is influenced by the proteolysis process and variations in pH (FERRANDINI et al., 2011).

## CONCLUSIONS

The results obtained indicate that the influence of sanitary inspection did not influence the physicochemical, texture or colour results.

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