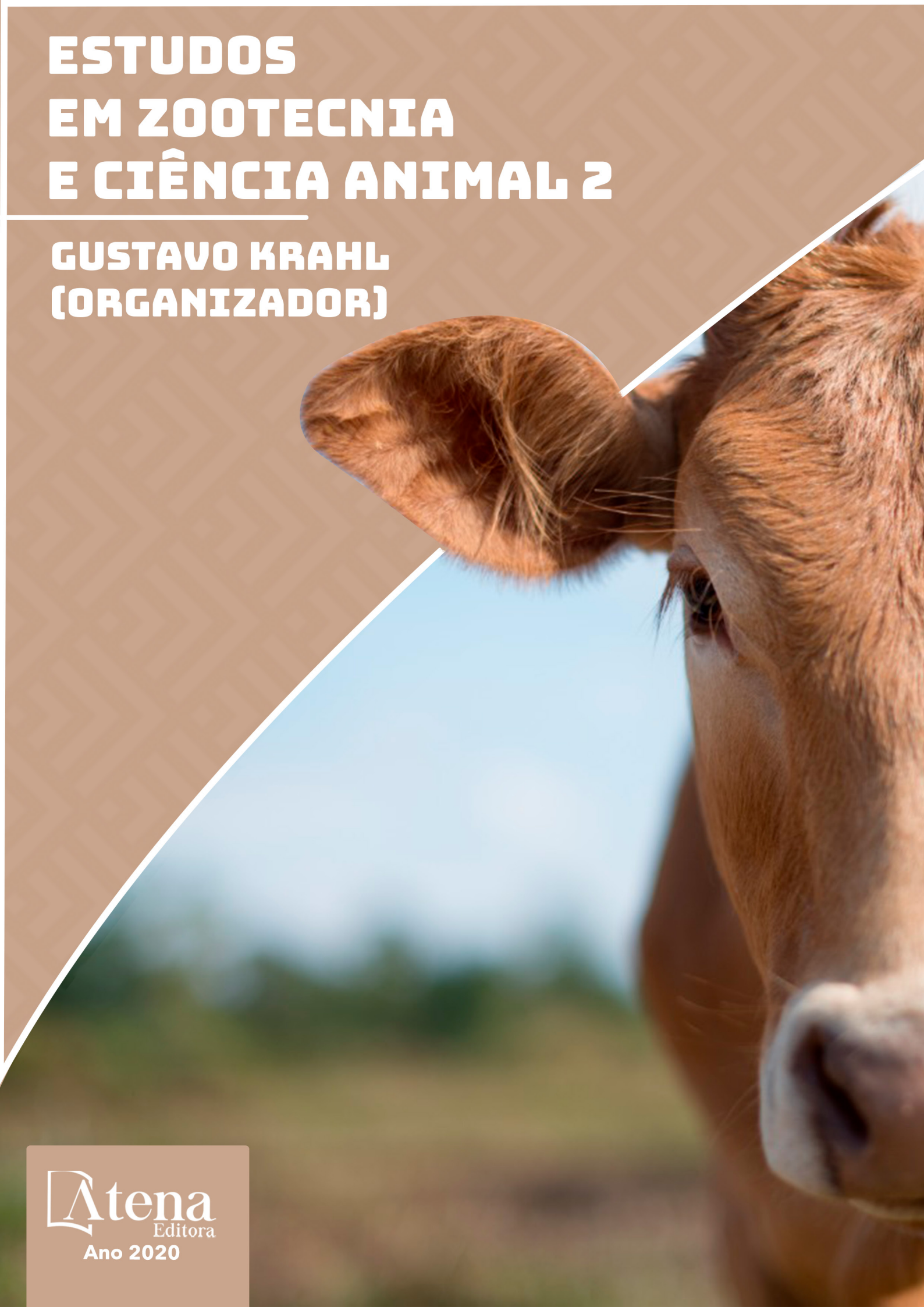
# ESTUDOS EM ZOOTECNIA E CIÊNCIA ANIMAL 2

GUSTAVO KRAHL
(ORGANIZADOR)



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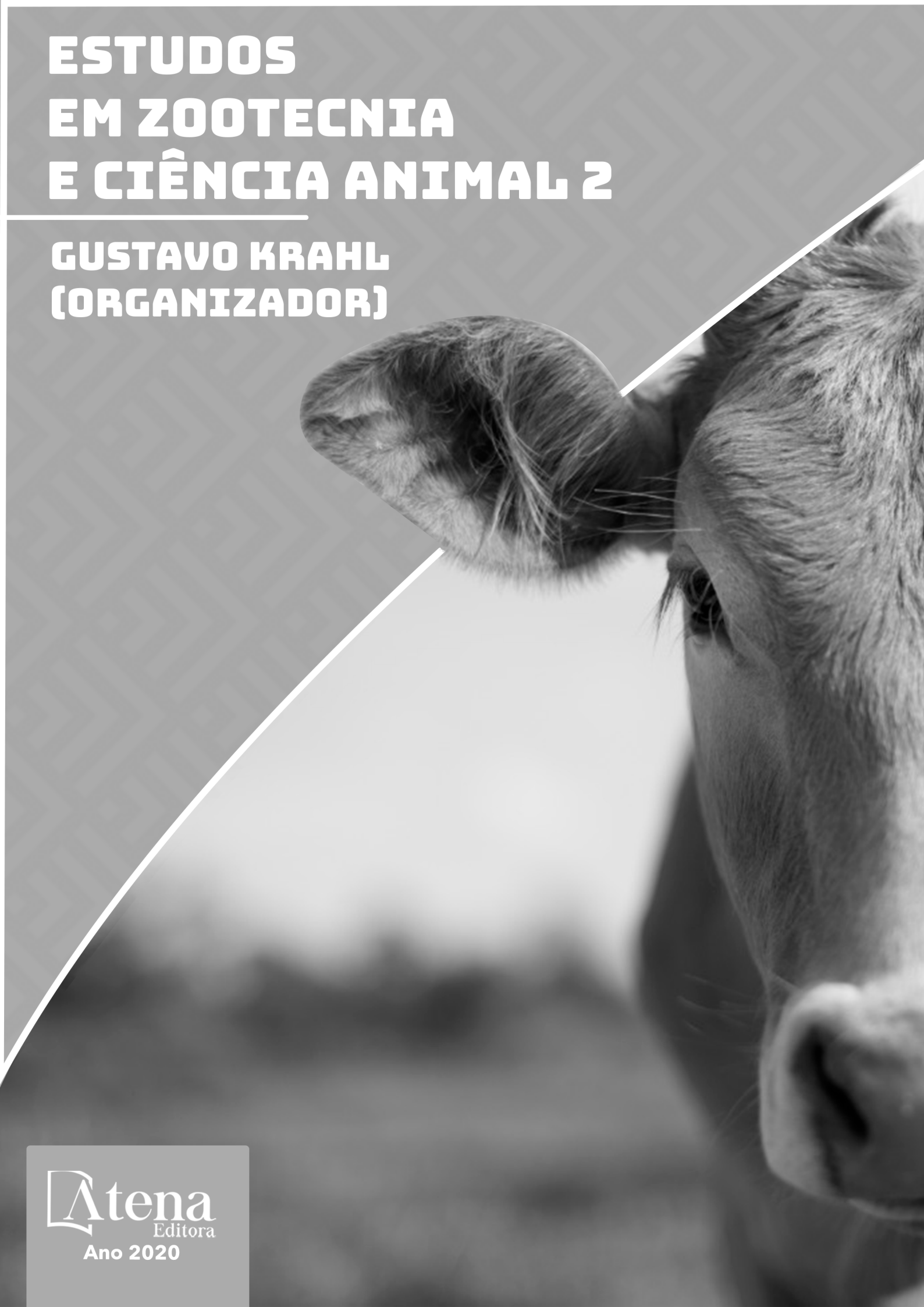

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## APRESENTAÇÃO

As áreas da Zootecnia e Ciência animal englobam o setor agropecuário brasileiro, que por muitas vezes foi o responsável por dar a devida importância ao país na esfera global. Mas também deve-se destacar que este setor é o responsável pela produção de alimentos de origem animal e vegetal, geração de emprego e renda, tecnologias e ainda promove a conservação ambiental.

A diversidade cultural observada no Brasil se estende à produção técnica e científica na área de zootecnia e ciência animal. A editora Atena, através da divulgação de trabalhos desta natureza, dá visualização nacional para pesquisadores que tem o papel fundamental de gerar conhecimento e desenvolver as mais diversas áreas voltadas a criação de animais, produção de alimentos e sustentabilidade. O desenvolvimento econômico, social e ambiental é um dos focos da comunidade científica que trabalha no setor agropecuário.

O e-book "Estudos em Zootecnia e Ciência Animal 2" traz trabalhos desenvolvidos em todo o Brasil, e contempla temas de importância regional e nacional. Os capítulos foram organizados e ordenados de acordo com as áreas predominantes. Os primeiros sete capítulos abordam temas relacionados a produção e conservação de forragem pela ensilagem, com foco na silagem de milho e de culturas alternativas. Os próximos cinco capítulos abordam a reprodução de bovinos machos e fêmeas, equinos e biotecnologias utilizadas. Na sequência, os cinco capítulos contemplam a avicultura de corte e postura, nos sistemas industrial e alternativo. Posteriormente, cinco trabalhos que abordam a bovinocultura leiteira e de corte. Também estão contemplados os com alguns capítulos com temas como a ovinocultura, avaliação sensorial e aceitabilidade de alimentos de origem animal e vegetal, piscicultura, entre outros assuntos com importância regional.

A organização deste e-book agradece a dedicação dos autores e instituições envolvidas pelo desenvolvimento dos trabalhos. Destaca-se que a socialização das informações aos leitores, faz parte do processo de geração de conhecimento e resulta na evolução sistemas produtivos. A troca de experiências materializada em trabalhos científicos, permite entregar ao leitor a informação com qualidade e confiabilidade.

Gustavo Krahl

## SUMÁRIO

# CAPÍTULO 25

## MICROBIOLOGICAL AND SENSORY EVALUATION OF SPICED MOZZARELLA CHEESE

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**ABSTRACT:** In animal production, milk processing is about the use of techniques and technologies to add value to the product. In agribusiness, the milk chain ends with the acceptance of the dairy product by the consumer and, in this sense, the objective of this study was to undertake a sensory and microbiological characterization of 'nozinho' mozzarella cheese containing dried tomato and dried basil. For the analysis of sensory characteristics, acceptance and preference was applied quantitative affective test with the use of hedonic scale for sensorial attributes: color, aroma, taste or flavor, overall aspect, and preference of the cheeses by the consumers, which was evaluated through a questionnaire. We evaluated the product shelf life by determining the count of thermotolerant coliforms, coagulase-positive *Staphylococcus* and *Salmonella* sp. The results showed that the cheese were under adequate conditions of sensory quality and to be microbiologically safe. Cheeses with 4% and 6% dried tomato and basil were preferred. The relationship between age and sex variables and statements means that 'Nozinho' mozzarella cheese containing dried tomato and dried basil is a good for consumption as an appetizer, as it does not have a strong taste and does not taste like medicine. The evaluation of the shelf life (63 days) was satisfactory, as it conforms to the standards defined by the Brazilian law (RDC12), and the use of used condiment proved viable in the formulation of 'nozinho' mozzarella cheese with a distinctive taste.

**KEYWORDS:** organoleptic traits, condiment, acceptance test, commercial validity.

## AVALIAÇÃO MICROBIOLÓGICA E SENSORIAL DE QUEIJO TIPO MUSSARELA CONDIMENTADO

**RESUMO:** Na produção animal, o processamento do leite trata-se do emprego de técnicas e tecnologias para agregar valor ao produto. No agronegócio, a cadeia do leite termina com a aceitação do produto lácteo pelo consumidor e, nesse sentido, o objetivo deste estudo foi realizar a caracterização sensorial e microbiológica do queijo Mussarela nozinho contendo tomate seco e manjericão desidratado. Na análise das características sensoriais, de aceitação e preferência foi aplicado teste afetivo quantitativo, com o uso de escala hedônica para os atributos sensoriais: cor, aroma, flavor ou sabor, aparência global e preferência dos queijos pelos consumidores. Foi avaliado o tempo de validade comercial, com a determinação da contagem de coliformes termotolerantes, *Staphylococcus* coagulase positiva e pesquisa de Salmonella sp. Os resultados demonstraram que os queijos se apresentaram em condições adequadas nos atributos sensoriais e microbiologicamente seguros; os queijos com 4% e 6% de tomate seco e manjericão foram os preferidos. A relação entre idade e sexo e as afirmações 1,2,3,4 e 5 indicou que o queijo Mussarela nozinho com tomate seco e manjericão é bom para aperitivo, não tem sabor forte, não é caro e não tem gosto de remédio; A avaliação do prazo de validade comercial (63 dias) dos queijos foi satisfatória, nos padrões estabelecidos na RDC12 e o condimento usado demonstrou ser viável como componente da formulação de queijo Mussarela nozinho, com sabor diferenciado.

**PALAVRAS-CHAVE:** características organolépticas, condimentos, teste de aceitação, validação comercial

### 1 I INTRODUCTION

The food industries are increasingly eager to produce high-quality and safe products, and much research has been undertaken with a view to extend the commercial life of foods, add new flavors, and assist in the development of new products (Tronco, 2010). The mozzarella cheese is constantly studied to have its nutritional, microbiological, and/or sanitary characteristics improved. Though traditionally available in a brick shape, mozzarella cheese can also be found in other forms; e.g., mini-knot (In Portuguese, 'nozinho'), mini-ball, and stick, used mostly in table consumption. It is a mild-tasting, relatively moist, stretched-curd cheese (Silva, 2005).

Cultural differences in Brazil are also reflected in the large variety of cheeses produced in the country. In this regard, there are typically Brazilian cheeses and also those inspired on knowledge brought with Italian, American, British, and other immigrants (Schlosser, 2001). With the increasing purchasing power in the last few years, Brazilians have started to consume higher-quality and practical products

(Biotech Ha-La, 2011).

Sensory and microbiological investigations of the product are extremely important and also a priority, given that they allow for determining sensory attributes that contribute to their increasing acceptance by consumers and microbiological characteristics that ensure the safety and health of this public. In this scenario, we have formulated a 'nozinho' mozzarella-type cheese with dried tomato (*Lycopersicon esculentum* Mill) and dried basil (*Ocimum balicus*) and evaluated its shelf life and the effect of its flavor on consumer acceptance and purchasing preference.

The objective of this study was to develop and evaluate an unprecedented mozzarella cheese aimed at the appetizer market to provide consumers with dairy products with new flavors. This may represent an opportunity for market expansion, broadened production, and a higher number of employees in dairy industries.

## 2 I MATERIAL AND METHODS

The research obtained approval from the Research Ethics Committee on October 20, 2015, under no. 1287401 (Plataforma Brasil, 2015). Tasters were alerted about the risks of the product causing any allergies and received the Statement of Free and Informed Consent Form (ICF), which was signed at the time of evaluation.

### 2.1 Cheese production

The fresh-milk raw material was acquired according quality recommended by Normative Instruction number 62 of the Brazilian Ministry of Agriculture, Livestock, and Supply (Ministério da Agricultura Pecuária e Abastecimento, MAPA) (Brasil, 2011). The milk was pasteurized at 72ºC for 15 seconds. For the processing of cheese were adopted procedures used in dairy processing industry.

The dried tomato was drained and chopped, while the basil was hydrated in the proportion of 1:10 and boiled for two minutes. Condiments were weighed at the ratio of 80% dried tomato and 20% basil, defined using a commercial standard already adopted at the company. The amounts of the dried tomato/dried basil mixture to be added to each experimental treatment were weighed individually (2% [40 g], 4% [80 g], 6% [120 g], and 8% [160 g]). These quantities were incorporated into the packages containing the 'nozinho' cheeses, and all components were mixed manually. Finally, the percentage composition of each component (tomato dried: basil: cheese) of the treatments evaluated were: 2% (1,6: 0,4: 98), 4% (3,2: 0,8: 96), 6% (4,8: 1,2: 94), and 8% (6,4: 1,6: 92).

## 2.2 Affective quantitative test

Affective quantitative test was used in accordance with the methodology (164/IV and 166/IV), recommended by the "Instituto Adolfo Lutz-IAL" (2008). It was conducted with 50 untrained evaluators of both genders aged 18 to 56 years, in accordance with Minim (2006), "Instituto Adolfo Lutz-IAL" (2008) and Teixeira (2009), in addition, using the methodology of Hough et al. (2006), it turns out that for all the characteristics evaluated the power of ANOVA was greater than 90%, indicating that 50 tasters were sufficient to detect differences. Each evaluator tested five samples, according to the treatments (C0 - Control 'nozinho' mozzarella cheese, 0% tomato 0% dried basil; C1 - Cheese with 2% dried tomato and dried basil; C2 - Cheese with 4% dried tomato and dried basil; C3 - Cheese with 6% dried tomato and dried basil; C4 - Cheese with 8% dried tomato and dried basil.). Samples of the treatments evaluated were obtained from a single industrial processing of 'nozinho' mozzarella cheese, in accordance with the methodology recommended by "Instituto Adolfo Lutz-IAL" (2008). The acceptability test was based on a five-point ideal scale, in accordance with "Instituto Adolfo Lutz-IAL" - 160/IV Tests with scales (2008) and 166/IV-Affective testing-acceptance testing for optimal range, was anchored on the following scores: 5 = liked very much, 4 = liked, 3 = neither liked nor disliked, 2 = disliked, and 4 = disliked very much, aiming to evaluate appearance, taste or flavor (taste + aroma), aroma, and texture. The color and appearance are part of the visual presentation of the product. For the color associated with tone, intensity and brightness. In appearance, then added to the color, are included the attributes of shapes, movement and space Minim (2006) and "Instituto Adolfo Lutz-IAL" (2008). For the test, approximately five grams of each sample at a temperature between 10 and 12 ºC were offered in disposable plastic plates coded with the letter "C" and sequential one-digit numbers. Samples were evaluated for purchasing preference, using a three-point scale (5 = would certainly buy, 3 = might buy/might not buy, and 1 = would certainly not buy), in accordance with "Instituto Adolfo Lutz-IAL" - 167/IV affective test: – Scale testing of attitude or intention (2008). At the end of the test, consumers expressed how much they agreed, on a three-point scale (5 = totally agree, 3 = neither agree nor disagree, and 1 = totally disagree) in accordance with Minim (2006), with the following statements: a) it is only good for cooking; b) it is good for an appetizer; c) it has a strong taste; d) it is too expensive; and e) it has tastes like medicine. The evaluations were carried out in separate rooms, and one individual (taster) at a time.

## 2.3 Analyses of Commercial Life (Shelf life)

The tested shelf life of the product was 63 days, with microbiological analyzes performed at fortnightly intervals. Microbiological analyses were performed for

low- or medium-moisture cheeses with condiments or herbs or other ingredients, following the trend for a sample indicative of coliforms at 45 ºC/g, coagulase-positive staphylococci, and *Salmonella* sp./25 g, according to treatments evaluated in the parameters mentioned in Board Resolution no. 12 (Brazil, 2001).

The methodology used for the microbiological analyses for thermotolerant coliforms was AFNOR 3M 01/2 – 09/89C (3M, 2009); for coagulase-positive staphylococci, AOAC method 2003.08 (OMA, 2015); and for *Salmonella* sp., AOAC method 020901 (Vidas®, 2011). Results for thermotolerant coliforms and coagulase-positive staphylococci were expressed in cfu/g, while *Salmonella* results were expressed in 25 g.

### 2.4 Experimental Design and Statistical Analysis

*Affective quantitative test*: The scores given by the judges to the different attributes evaluated in the sensory panel were subjected to analysis of variance (ANOVA) in a randomized-block design, and the Scott-Knott test was used for the comparison of means, adopting the 5% error-probability level (Morris,1999). A canonical correlation analysis was employed to check the inter-relationship between sensory traits and types of cheese, (Dijksterhuis, 2008; Hakan & Zubeyde, 2012; Adhikari et al., 2003; Zhang et al., 2011; González-Martín et al., 2016 and King et al., 2013). At the end of the test, the tasters were asked to express how much they agree, on a three-point scale (5 = totally agree, 2 = neither agree nor disagree, and 1 = totally disagree) with statements S1, S2, S3, S4, and S5, present in the questionnaire. Principal component analysis (PCA) was performed to check the relationship between the tasters and the answers (Dijksterhuis, 2008; Hakan & Zubeyde, 2012; Adhikari et al., 2003; Zhang et al., 2011; González-Martín et al., 2016; King et al., 2013). The number of component was determined by the method of the “elbow” (fold) on the chart screen plot (Dijksterhuis, 2008). Statistical Analyses were performed using R Core Team software (R, 2014).

*Analyses of Commercial Life (Shelf life):* Analysis of variance (ANOVA) was performed, and the Scott-Knott test was applied for comparison of means of the different cheeses. Regression analysis was performed for the days (shelf life), adopting a 5% significance level for error probability (Morris, 1999). Statistical analyses were performed using R Core Team Software (R, 2014).

## 3 I RESULTS AND DISCUSSION

### 3.1 Affective quantitative test

There are no differences between the analyzed cheeses as regards their

appearance, this trait displayed the greatest variability, with a coefficient of variation of assigned scores of 67%. In the aroma trait, treatments C2, C3, and C4 obtained the best acceptance of the tasters. For the taste and color traits, cheeses C2 and C3 were those best accepted. In the texture and the overall assessment by the tasters had cheeses C2, C3, and C4 as those with the best scores assigned (Table I). In this way, one can see that the inclusion of dried tomatoes and basil changes the sensory evaluation for the color, texture and overall appearance, because generally the condiments enhance the existing taste or aroma of processed foods (Maia et al., 2004), besides benefiting the texture and overall appearance, leading to greater acceptance of these products by consumers (Figure 1).

| CHEESE | SENSORY TRAIT | | | | | |
|---|---|---|---|---|---|---|
| | Appearance | Aroma | Taste | Color | Texture | Overall aspect |
| C0 | 3.50a | 3.40b | 3.58b | 3.48b | 3.80b | 3.26b |
| C1 | 4.28a | 3.52b | 3.68b | 3.50b | 3.82b | 3.48b |
| C2 | 4.00a | 3.98a | 4.06a | 4.16a | 4.14a | 3.96a |
| C3 | 4.14a | 4.16a | 4.26a | 3.98a | 4.20a | 4.20a |
| C4 | 3.80a | 4.06a | 3.86b | 3.72b | 4.06a | 3.84a |
| CV | 67.35% | 19.56% | 22.84% | 22.85% | 16.43% | 24.53% |

Tabela 1: Mean values and coefficient of variation for scores assigned to sensory traits of the cheeses.

Means followed by common letters do not differ at the 5% significance level by the Scott-Knott test. C0 - Control 'nozinho' mozzarella cheese, 0% tomato 0% basil; C1 - Cheese with 2% dried tomato and dried basil; C2 - Cheese with 4% dried tomato and dried basil; C3 - Cheese with 6% dried tomato and dried basil; C4 - Cheese with 8% dried tomato and dried basil.

Figure 1 presents the relationship between sensory variables and cheese types, in which the vectors represent the cheese types (blue) and the points represent the sensory variables (black). Note that, through the use of canonical variables, the five cheese types were divided into three region groups by their similarities, due to the small angles between their vectors. In this way, chesses C0 and C2 are very similar, and so are C3 and C4. As regards the sensory variables, a similarity is noted between the scores attributed to overall aspect and aroma. A strong correlation is present between the scores for the taste, texture, and color sensory attributes. Scores for appearance were not correlated with the others. The relationship between sensory variables and cheese types can be observed through the proximity of the vector with the variable. Thus, C0 apparently has a high correlation with texture. Cheese C1 has a high correlation with appearance, and C2 with taste. Cheeses C3 and C4, however, have a high correlation with aroma and overall aspect.

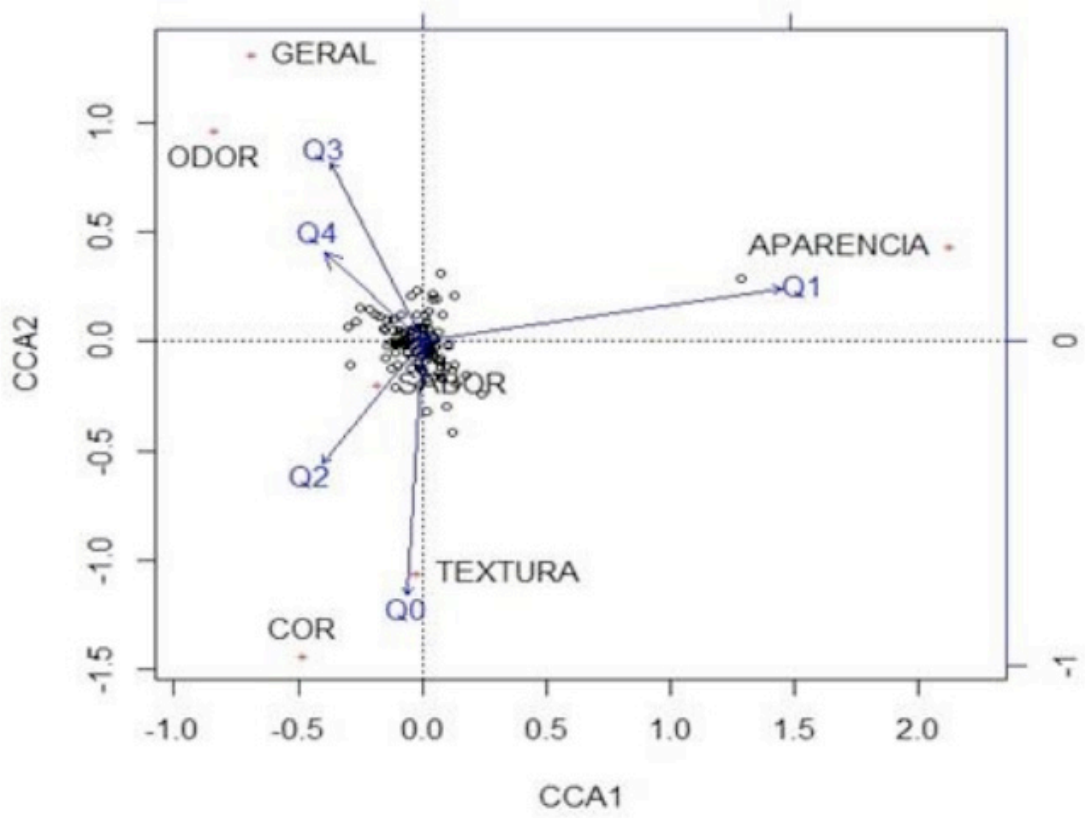


Figure 1: Graphic distribution of the different cheese types (C0 - Control 'nozinho' mozzarella cheese, 0% dried tomato 0% dried basil; C1 - Cheese with 2% dried tomato and dried basil; C2 - Cheese with 4% dried tomato and dried basil; C3 - Cheese with 6% dried tomato and dried basil; C4 - Cheese with 8% dried tomato and dried basil) and their sensory traits (overall aspect, aroma, taste, appearance, texture).

Principal component analysis (PCA) yielded two variables (dimensions 1 and 2), which are combinations of the answers of the evaluators (Figure 2). Dimensions 1 and 2 explain, respectively, 43 and 18% of the variation in the assigned scores. Thus, the first two components explain approximately 61% of results. The two components are considered sufficient to represent the identification of samples, because they explain most of the variation in the data; so, it has a two-dimensional representation. As shown in Figure 2, in the relationship between the variables "Age", "Sex", and Statements 1, 2, 3, 4, and 5, there is a negative correlation between the statements and age. The 50 tasters (evaluators) were grouped into five groups of Statements, in consequence of the ACP analysis according to Dijksterhuis (2008).

This behavior reflects the relevance of how to form a team of evaluators. A sensory effective team to be formed from specific criteria that can influence the perception of the individual who evaluates a product, such as factors related to the physiology (sensory receptors, nervous system), psychology (stimulus-response) and sociology (age, sex, ethnicity, eating habits, level of education). In addition, the recommended age is between 18 to 50 years because, after this age the individual may reveal certain desensitization of sensors ("Instituto Adolfo Lutz-IAL", 2008).

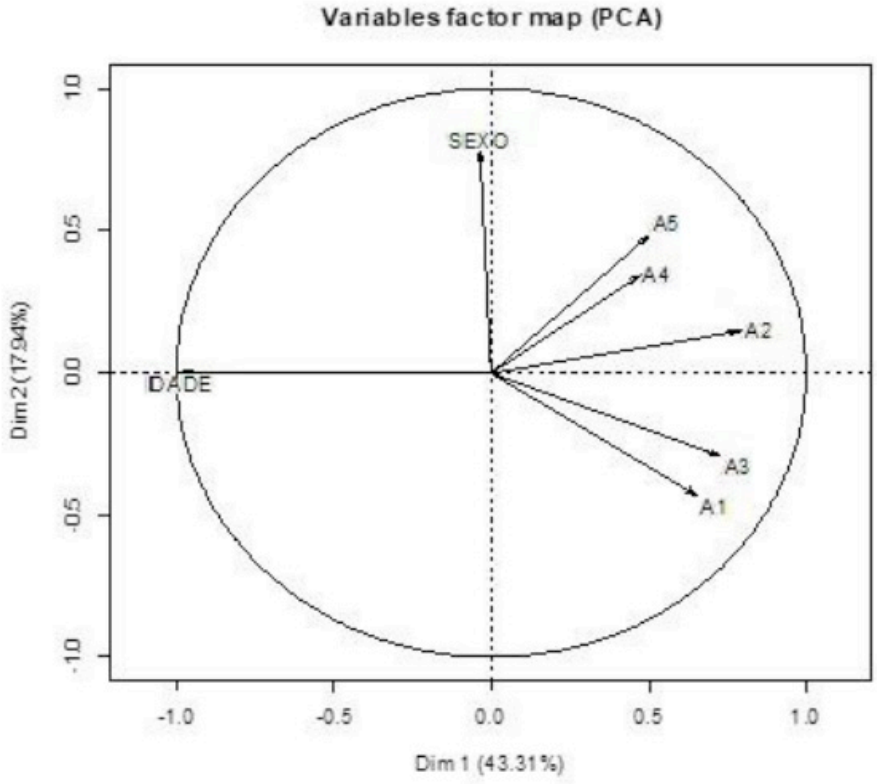


Figure 2: Principal component analysis of tasters and relationship among between variables "Age" and "Sex", and Statements S1, S2, S3, S4, and S5

Figure 3 shows the cluster analysis, which demonstrates the formation of two groups contrasting with respect to the "Age" variable, in which the statements of the younger interviewees are opposed to those of the older ones. A similarity is also noted between statements 4 and 5 and statements 1 and 2 (Table 2). Cluster 1 is composed of 32 individuals, mostly woman (63), on average 35 years old, with the following facts: -Statement 1, "Nozinho' mozzarella cheese with dried tomato and dried basil (NTB) is only good for cooking", had most respondents assigning score 1; in other words, most disagree with this statement; -Statement 2, "NTB is good for an appetizer", had most respondents assigning score 5; in other words, most totally agree with this statement; -Statement 3, "NTB has a strong taste", had most respondents assigning score 1; in other words, most disagree with this statement; -Statement 4, "NTB is too expensive", had most respondents assigning score 1; in other words, most disagree with this statement; -Statement 5, "NTB tastes like medicine", had all respondents assigning score 1; in other words, of the women aged 35 years on average, which are the majority in this cluster, none agrees that the product tastes like medicine.

Group 2 (Cluster 2) is composed of 18 younger individuals, 44% men and 56% women, at an average age of 21 years old, with the following facts: -For statement 1, "NTB is only good for cooking", most respondents assigned score 1; in other words, most disagree with this statement; -For statement 2, "NTB is good for an appetizer", all respondents assigned score 5; in other words, all totally agree with this statement;

-For statement 3, “NTB has a strong taste”, only one person totally agrees, whereas the rest totally disagrees or has no formed opinion about this statement; -For statement 4, “NTB is too expensive”, most respondents assigned score 1; in other words, most disagree with this statement; -For statement 5, “NTB tastes like medicine”, most respondents assigned score 1; in other words, the younger public also disagrees that the product tastes like medicine.

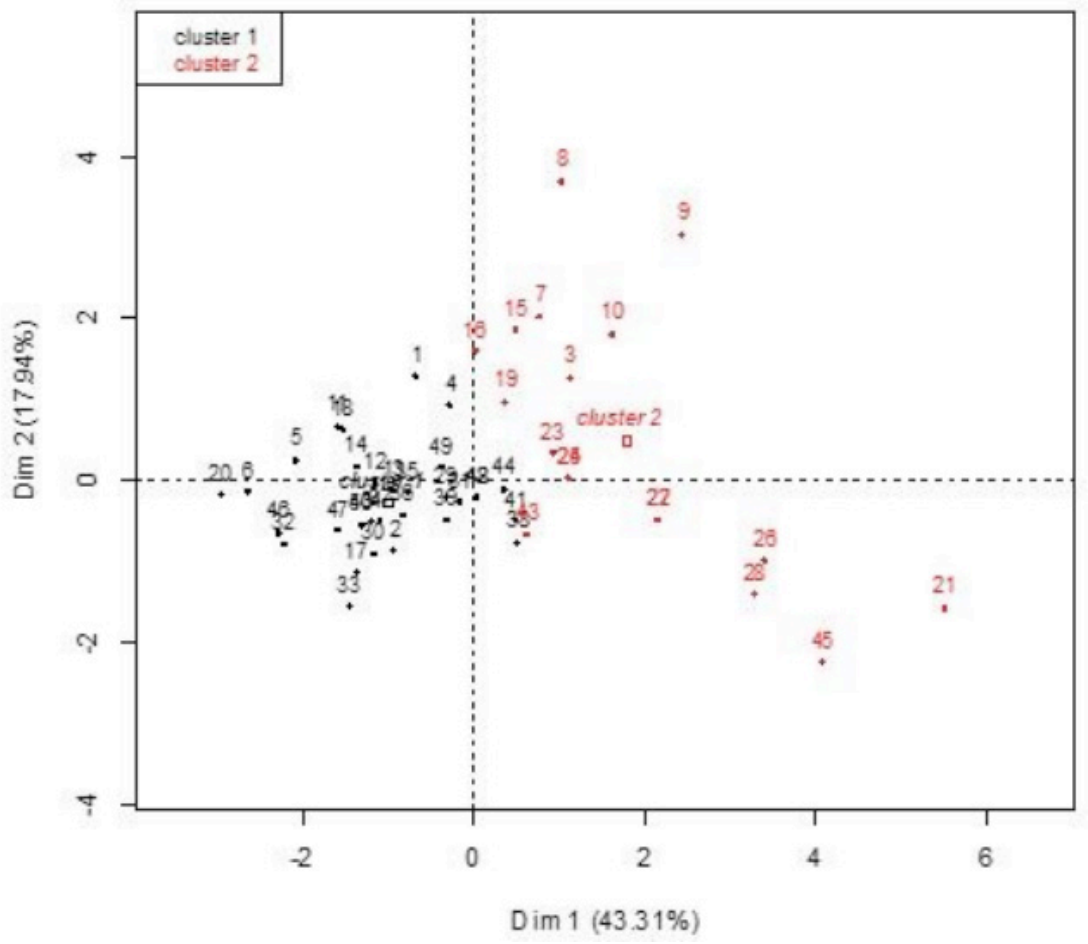


Figure 3: Graphic distribution of tasters (numbers) divided into Cluster 1, composed of 32 individuals, and Cluster 2, with 18 individuals.

| CLUSTER | AFIRMATIONS (NTB) | | | | |
|---|---|---|---|---|---|
| | **S1** | **S2** | **S3** | **S4** | **S5** |
| **Cluster 1**<br>32 individuals;<br>Most women (63%); Men (37%); Average 35 years old | Most disagree | Most totally agree | Most disagree | Most disagree | Most disagree |
| **Cluster 2**<br>18 individuals;<br>Most men (44%); Women (56%); Average 21 years old | Most disagree | All totally agree | One person totally agrees while others disagree or have no formed opinion | Most disagree | Most disagree |

Table 2: Answers from Clusters 1 and 2 regarding statements about the cheese.

In the profile analysis for the “Age” and “Sex” variables and statements 1, 2, 3,

4, and 5 (Figure 2; Table 2), a negative correlation was observed. In this regard, the older the respondant was, the more he/she agreed with the statements, which means that for the older public, the “NTB is good for an appetizer, does not have a strong taste, and does not taste like medicine. While the cheeses with most condiment (C2, C3, and C4) were the most correlated with taste, aroma, and overall aspect, the least condiment-filled ones (C0 and C1) were correlated with texture and appearance. Cheese C2, with 4% dried tomato and basil, and C3 and C4, with 6% and 8% dried tomato and basil, respectively, were the best in all evaluated traits.

According to the Principal Component and Cluster analyses, for the older public, the NTB is good for an appetizer, does not have a strong taste, is not expensive, and does not taste like medicine. According to the results arising from the use of principal components analysis, it becomes clear that your importance in obtaining information about or sensory profile or preference of consumers. Examples of these results were obtained also by Hakan & Zubeyde (2012) that conducted a study of consumer preferences regarding traditional cheeses with a sample of ‘tulum’, a Turkey traditional cheese. Cluster analysis identified two groups of consumers; the first assigned greater importance to the type of milk used, texture, and flavor, while consumers from Group 2 put more emphasis on the price, salt level, content, fat, and origin of the ‘tulum’ cheese.

In acordance with it, Zhang et al. (2011) evaluated sensory traits that determined the consumer preference among seven imported cheeses. Cluster analysis identified five major groups of consumers and substantially improved the understanding of consumer evaluation. Cheeses with specific sensory profiles could be sold for specific target markets.

### 3.2 Analysis of Commercial Life (Shelf life)

All cheeses showed negative values for thermotolerant coliforms (cfu/g) and presence of Salmonella sp. (25 g), at all days. Variance analysis revealed, for log (cfu+1) of Staphylococcus, that there is no interaction between cheeses and days ($p>0.05$), suggesting that the response of Staphylococcus coagulase testing over the days is independent of the cheese type.

Table 3 presents the mean log values (cfu+1) of Staphylococcus coagulase testing in the cheeses. The coefficient of variation of this trait was 19%. The Scott-Knott test was performed and indicated differences between the mean log values (cfu+1) of Staphylococcus, with C2, C3, and C4 showing the highest means, followed by C1 and C0.

| CHEESE | MEAN |
|---|---|

| | |
|---|---|
| C0 | 1.13c |
| C1 | 1.86b |
| C2 | 2.27a |
| C3 | 2.28a |
| C4 | 2.28a |

Table 3: Mean log values for Staphylococcus coagulase testing.

Means followed by common letters do not differ at the 5% significance level.

C1 - Control 'nozinho' mozzarella cheese, 0% tomato 0% basil; C2 - Cheese with 2% dried tomato and dried basil; C3 - Cheese with 4% dried tomato and dried basil; C3 - Cheese with 6% dried tomato and dried basil; C4 - Cheese with 8% dried tomato and dried basil.

Figure 4 displays the log regression analysis (cfu+1) of Staphylococcus coagulase testing as a function of the days. The regression model showed an increase in number of cfu until around day six, after which it declined until the 45th day and then rose again.

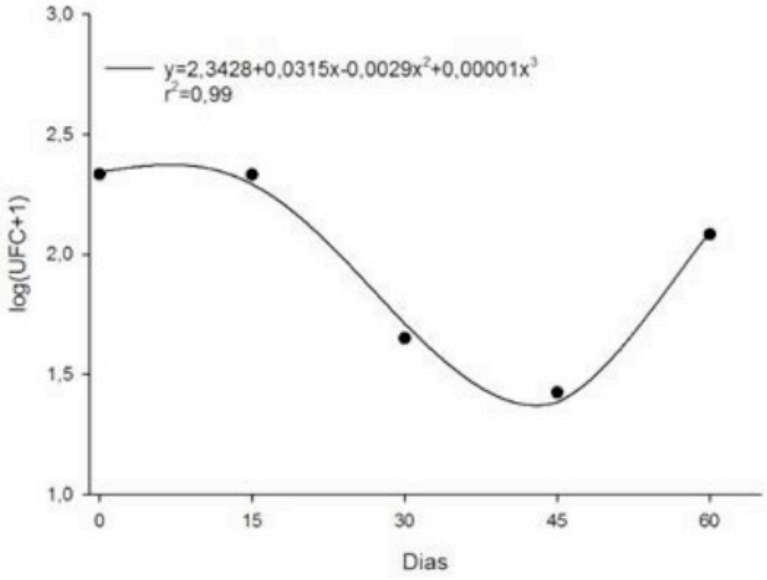


Figure 4: Mean (dots) and estimated (line) log values for Staphylococcus coagulase testing according to days of storage.

The 'nozinho' cheese with dried tomato and dried basil in all evaluated tests (C0, C1, C2, C3, and C4) for commercial life at times 0, 14, 28, 49, 63 days, for count of thermotolerant coliforms (cfu/g) and presence of Salmonella sp. (25 g), had negative results, indicating that they conformed to the standards established in RDC 12 (Brasil, 2001).

The 'nozinho' mozzarella cheese with dried tomato and dried basil in the count of coagulase-positive Staphylococcus, at all days of assessment, showed results within the maximum established standards of 1.0 × 103 cfu/g, ranging from 1.0 × 100 to 9.6 × 102 cfu/g on days 0 and 14, dropping to 1.6 × 102 cfu/g on days 28 and 49, and

increasing to up to 6.8 × 102 cfu/g on day 63. Throughout the days, this downward followed by an upward response in number of coagulase-positive Staphylococci was similar in all cheeses, but microorganism counts were different, with C2, C3, and C4 displaying the highest means, followed by C1 and C0.

The basil used in the experiment with 'nozinho' mozzarella cheese with dried tomato underwent heat treatment, ratifying the study of Azevedo et al. (2016), who mentioned that the condiments used received a heat treatment before being added to the ricotta cheese, indicating that the heat treatment of condiments is of fundamental importance for the maintenance of the hygienic-sanitary quality of the product, preventing the presence of an undesirable microbiota that may alter the quality as well as reduce its shelf life. The ricottas remained with a satisfactory microbiological quality for 30 days of cold storage, and addition of heat-treated condiments did not change the hygienic-sanitary quality of the ricotta cheese.

## 4 I CONCLUSIONS

The developed and evaluated product and the manufacture technology utilized here showed adequate conditions of quality and is microbiologically safe to the health of consumers. Sensory and acceptance analysis of the different attributes revealed that cheese with 4% and 6% dried tomato and dried basil are preferred by the evaluators. The choice for producing cheese in its condition may be made by the dairy company, since both had the same acceptability by the tasters. The commercial life of 63 days of the 'nozinho' mozzarella cheese with varying percentages of dried tomato and dried basil is satisfactory. The use of dried tomato and dried basil demonstrated to be viable for inclusion in the formulation of 'nozinho' mozzarella cheese with a distinct flavor.

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## ÍNDICE REMISSIVO

### A



### B



### C



### E

## F



## G



## I



## M



## N



## O



## P



## R

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## T



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