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STUDY OF THE USE OF MORE AFFORDABLE YEAST FOR THE PRODUCTION OF MOSSARELLA CHEESE

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Abstract: A very important factor in the production of mozzarella is the yeast added to the milk at the time of production. Specific bacteria are used by the industry to ferment the dough in a short time and obtain a product of excellent quality. For the production of this cheese on an academic scale, alternatives are considered when purchasing inputs, in order to serve more quickly, in a smaller volume and with less investment. Therefore, the use of natural yogurt in association with yeast for the production of bread can be an alternative to meet these purchasing specificities. The objective of this project was to evaluate the physical-chemical and sensorial characteristics of mozzarella produced with the bacteria present in natural yogurt and the yeast found in the yeast used to make bread. As a result, it was seen that the yeast treatment obtained excellent sensorial acceptance, mainly in relation to texture, which is one of the most demanded attributes in mozzarella cheese, together with the ease of acquiring this input and an excellent fermentation time, around 3 to 4 hours, compared to 18 hours for natural yogurt and 2 hours for dairy culture, making it a great fermenting agent for making mozzarella cheese. With the results obtained, it is concluded that mozzarella can be made with yeast: *Saccharomyces cerevisiae*, making it easier to plan and execute practical mozzarella classes in the animal products processing discipline of the Food Technician course at IFG; Campus: Aparecida de Goiânia.
Keywords: fermentation, cheese, lactic acid.

INTRODUCTION

The Federal Inspection Service (SIF) registered around 2000 dairies in Brazil in 2020. In addition to those registered, it is known that a significant number of artisanal or informal dairy products exist across the country, with the state of Minas Gerais representing 25% of cheese production in Brazil (ANUÁRIODOLEITE, 2021). According to the same authors, mozzarella cheese is preferred by Brazilian consumers due to its widespread use at home and in fast-food chains.

The definition found in the legislation for mozzarella cheese is "a fresh or matured product obtained by partial separation of whey or reconstituted milk, or whey coagulated by the physical action of rennet, specific enzymes, specific bacteria, organic acids, isolated or combined, all of acceptable quality for food use, with or without the addition of food substances, condiments or additives" (BRAZIL, 1996).

One of the final stages of mozzarella cheese is filamentation, which consists of kneading the cheese dough so that it acquires an elongated texture, at temperatures ranging from 80 to 85°C. But for the temperature to promote elasticity, the dough must have a pH between 5.1 and 5.4 (SILVA, 2005). Fermentation, which promotes the acidification of the dough, through the production of lactic acid causes the calcium that binds the proteins to be removed, promoting the demineralization of the dough, which makes it more flexible (FURTADO, 2016). Considering what was said above, it appears that the production of acid to lower the pH is a very important step in the production of mozzarella.

At industrial levels, the faster the mass demineralization pH is reached, the greater the productivity of the manufacturing process and this fact means that thermophilic crops (produced based on *Streptococcus thermophilus*) are more widely used, as they produce acid more quickly (CRH. HANSEN, 2012).

Due to low resources and the bureaucracy involved in purchasing inputs for practical classes, several alternatives are being considered to replace the ingredients used in the manufacture of dairy products. While the freeze-dried culture, sold specifically for the production of mozzarella cheese is

sold in specific locations, is more expensive and has a short shelf life, the use of natural yogurt, which also has bacteria in an ideal proportion, to promote the fermentation of milk, it happens in a homemade way, being used for fermentation in the order of 2% and has the characteristic of being a much cheaper raw material when compared to freeze-dried culture (SILVA, 2016, FAO, 2017).

The only problem associated with using natural yogurt is the fermentation time, which goes from 2 to 3 hours (freeze-dried culture) to around 18 hours. According to SCHEPERS et al. (2006) yeast extract is excellent for rapid lactic acid production and lactic acid bacteria growth rates. Therefore, the use of yeast, *Saccharomyces cerevisiae*, yeast used in the fermentation of bread dough, easily found in local and low-cost stores, can be tested together with natural yogurt to promote the fermentation of mozzarella dough, in order to obtain a yeast that is easily accessible in practical processing classes of milk from the Food Technician course at IFG; Campus: Aparecida de Goiânia.

MATERIAL AND METHODS

Obtaining raw materials and inputs

Obtaining milk: Raw milk was obtained from small producers in the Aparecida de Goiânia Campus region. The yeast, natural yogurt and dairy culture were obtained from local markets.

MOZZARELLA PRODUCTION

Cheese production was carried out according to SILVA (2005). After obtaining it, the milk was filtered to retain physical impurities. The next step was pasteurization, heating at 65°C for 30 minutes in order to eliminate pathogenic bacteria. At the end of 30 minutes, the milk was cooled to 40°C to receive the culture that will ferment the milk, together with the calcium chloride and the coagulant (chymosin enzyme). The treatments in this project varied according to the fermentative culture added to the milk. Which were the following:

1 - With freeze-dried lactic acid culture: The freeze-dried culture purchased from a specialized company is diluted according to the manufacturer's instructions. One sachet was diluted in 1L of milk, at 36°C, half an hour before being added to pasteurized milk to make mozzarella. This step is called yeast activation.

2 – With natural yoghurt: The natural yoghurt was purchased at a local store, using around a tablespoon for each liter of milk to be fermented. The dilution was made in 1L of milk before being added to the milk to be fermented.

3 – With natural yogurt and yeast: *Saccharomyces cerevisiae*: The use of natural yogurt followed as described in the previous item. As for the yeast, also purchased from local stores, one tablespoon was used for 10L of milk. The yeast with yogurt remained in this solution at room temperature for 30 minutes, before being added to the milk. When the milk to be fermented reached 40°C, natural yogurt and yeast extract was added.

4 – With yeast: *Saccharomyces cerevisiae*: The preparation of the yeast extract was carried out as described previously. As soon as 30 minutes of preparation was reached, it was added to the milk to be fermented.

After adding the yeast, the coagulant was added, according to the manufacturers' information. Then, stirring, and then resting for 40 minutes. After the coagulation time, the dough was tested and when it was ready, horizontal and vertical cuts were made.

The grains were first stirred for approximately 20 minutes, with the aim of releasing the whey from the dough. It started slowly and

then intensified. After this time, the dough together with the whey was heated to 42°C, increasing the temperature by 1°C every 2 minutes, until the formation of a firm dough, which clumps together and does not have a brittle characteristic. After detecting the mass point, the serum was removed, transferring the filtrate to a container that maintained its temperature. After 2 hours of fermentation, the pH of the dough was monitored to check the moment of filamentation.

When the dough reached a pH between 5.1 and 5.4, the filament test was carried out. At this stage, the dough was cut into small slices and placed in water at a temperature of 80 – 85°C and kneaded. When they acquired an elastic texture, without becoming brittle, the filament point was reached. The purpose of the filament is to make the dough elastic and give it shape, which in the case of this project, was mozzarella nuts. After receiving formatting, the nuts were left in 20% brine for 30 minutes and then vacuum packed until analysis.

TOTAL SOLIDS, FAT AND PROTEIN ANALYZES

The methodologies for these analyze were taken from BRAZIL (2006) and carried out outsourced.

SENSORY ANALYSIS

For the sensorial analysis of the manufactured samples, an acceptance test was used, with 60 untrained tasters. The test was carried out using a nine-point hedonic scale according to (CHAVES and SPROESSER, 2002) and the samples were analyzed monodically. The attributes evaluated were color, appearance, texture, aroma and flavor. The project was approved by the IFG Ethics Committee, according to CAAE 66894723.9.0000.8082.

RESULTS AND DISCUSSION

The pH, total solids, protein and lipid results, in percentage, of the mozzarella cheeses were organized in Table 1.

Mozzarella	pH	Total solids (%)	Protein (%)	Fat (%)
CL	6,03a	49,75a*	20,29a	26,45a
LS	5,26ab	49,58a	20,47a	20,06b
IN	5,70a	49,98a	19,33a	25,2a
IN+LS	5,08b	49,43a	19,04a	26,41a

Table 1: Results of total solids, protein and lipids, in percentage (%), of mozzarella fermented from dairy culture (CL), natural yogurt (IN), yeast (LS) and natural yogurt + yeast (IN+LS).

* Different letters in the same column indicate a significant difference at 5% probability (P0.05) for the values of total solids and proteins in samples from the four types of treatment.

The pH results indicate that the differences found between the results ($P<0.05$) occur with the use of yeast, which had lower values, indicating greater fermentation. The results for total solids and proteins did not differ between mozzarella treatments ($P>0.05$). For total solids, the lack of difference between the results may indicate that all mozzarella was made in a standardized way, respecting the processing, fermentation time, formatting and salting of the walnut-shaped cheeses. As for proteins, it can be seen that the amount of yeast did not interfere with the increase in protein, probably due to the short fermentation time of this cheese.

The lowest result for fat analysis was found in the yeast treatment. The production of lipases may be an explanation for the lower fat content in the LS treatment, since the *Saccaromyces Cerevisae* can produce this enzyme (HADEBALL, 1991). Lipases are enzymes that produce free fatty acids and glycerol by catalyzing triglycerides, that is, they break down fat (MESSIAS et al., 2011). Once the fat was broken down, it was not

possible to retain the same amount as other treatments in the cheese.

Regarding the acceptance of mozzarella, the attributes of appearance, aroma, flavor and texture were analyzed by 60 tasters, including students and employees at the IFG Campus: Aparecida de Goiânia. The results of the sensory analysis are found in Table 2.

Mozzarella	Appearance	Smell	Savor	Texture
CL	7,70a	7,10a	7,87a	7,11bc
LS	7,52a	6,96a	7,85a	7,94a
IN	7,54a	7,26a	7,72a	7,56ab
IN+LS	7,85b	7,13a	7,51a	6,65c

Table 2: Results of the acceptance analysis of standard Minas cheeses fermented from dairy culture (CL) and yeast (LS).

The aroma and flavor attributes did not show a significant difference (P>0.05) between treatments. For appearance, the treatment with natural yogurt and yeast (IN+LS) obtained the highest score (P<0.05) in relation to the other treatments, with a score close to moderately liked. Regarding texture, the highest scores were obtained by treatments with yeast (LS) and natural yogurt (IN).

With the above, we see that the yeast treatment achieved excellent sensorial acceptance, mainly in relation to texture, which is one of the most demanded attributes in mozzarella cheese, together with the ease of acquiring this input and an excellent fermentation time, around 3 to 4 hours, compared to 18 hours for natural yogurt and 2 hours for dairy culture, making it a great fermenting agent for making mozzarella cheese.

CONCLUSION

With the results obtained, it is concluded that mozzarella can be made with yeast: *Saccharomyces cerevisiae*, since it obtained an excellent texture, good appearance and flavor attributes and physical-chemical characteristics close to industrially prepared mozzarella. Therefore, easy access to this type of yeast will make it easier to plan and execute practical mozzarella classes in the animal products processing discipline of the Food Technician course at IFG: Campus: Aparecida de Goiânia.

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