PHYSICAL-CHEMICAL CHARACTERIZATION OF FRESH SHANKLISH CHEESE WITH KEFIR AND TURMERIC EXTRACT (*Curcuma longa* L.)

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ABSTRACT: Currently, a large number of consumers seek to include functional foods in their diets, aiming beyond the nutritional value prevent health problems, among these foods are probiotic products and vegetables containing bioactive compounds. The objective of this work was to develop and physical-chemically evaluate fresh Shanklish cheeses with the addition of kefir and turmeric extract in order to develop a functional cheese. Shanklish cheese was manufactured and submitted to three different treatments: with the addition of kefir, turmeric extract and both of them. The results obtained for cheese composition were close to the results found in the literature and the cheeses showed stable pH values during the 21 days of storage at 8ºC. It concluded that the addition of kefir and turmeric extract in Shanklish cheese is a way to develop a functional cheese.
KEYWORDS: Functional cheese. Curcumin. Probiotics. Functional foods.

CARACTERIZAÇÃO FÍSICO-QUÍMICA DE QUEIJO CHANCLICHE FRESCO ADICIONADO DE KEFIR E EXTRATO DE AÇAFRÃO (*Curcuma longa* L.)

RESUMO: Atualmente é grande o número de consumidores que buscam incluir alimentos funcionais em suas dietas visando além do valor nutricional a prevenção de problemas de saúde, entre esses alimentos encontram-se os produtos probióticos e os vegetais contendo compostos bioativos. O objetivo deste trabalho foi desenvolver e avaliar físico-quimicamente queijos Chancliche frescos com adição de kefir e extrato de cúrcuma buscando o desenvolvimento de um queijo funcional. Foram fabricados queijos Chancliche e submetidos a três tratamentos diferentes: com adição de kefir, extrato de cúrcuma e ambos. Os resultados obtidos para a composição dos queijos estavam próximos dos resultados encontrados na literatura e os queijos mostraram pH estável durante os 21 dias de armazenamento a 8ºC. Concluiu-se que a adição de kefir e extrato de cúrcuma em queijo Chancliche é uma maneira de desenvolver um queijo funcional.
PALAVRAS-CHAVE: Queijo funcional. Curcumina. Probióticos. Alimentos funcionais

CARACTERIZACIÓN FÍSICA Y QUÍMICA DEL QUESO CHANCLICHE FRESCO AÑADIDO CON EXTRACTO DE KEFIR Y AZAFRÁN (*Curcuma longa* L.)

RESUMEN: Actualmente, una gran cantidad de consumidores buscan incluir alimentos funcionales en sus dietas, apuntando más allá del valor nutricional para prevenir problemas de salud, entre estos alimentos se encuentran los productos probióticos y los vegetales que contienen compuestos bioactivos. El objetivo de este trabajo fue desarrollar y evaluar químicamente quesos Chancliche frescos con la adición de kéfir y extracto de cúrcuma para desarrollar un queso funcional. Los quesos Chancliche fueron elaborados y sometidos a tres tratamientos diferentes: con la adición de kéfir, extracto de cúrcuma y ambos. Los resultados obtenidos para la composición de los quesos estaban cercanos a los resultados encontrados en la literatura y los quesos mostraron pH estable durante los 21 días de almacenamiento a 8ºC. Se concluyó que la adición de kéfir y extracto de cúrcuma en queso Chancliche es una forma de desarrollar un queso funcional.
PALABRAS CLAVE: Queso funcional. Curcumina Probióticos. Alimentos funcionales.

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Introduction

Fresh Shanklish cheese also known as Shinklish, Sorke or Shankleesh is an important component of the gastronomy of Middle Eastern countries, its traditionally production uses whole sheep's milk and whole goat's milk, and it is made with buttermilk and starter culture of yoghurt. However currently looking for a healthier composition it is also produced with skim milk and different starter cultures (MAHA, 2013).

The Shanklish cheese is formed into small balls and left to dry and age, while its fresh version tastes mild with a soft texture, the ripened Shanklish has a pungent odor and noted for its persisting taste, the fresh Shanklish balls are often covered in za'atar (thyme) mix along with other spices (HAMAD, 2017).

According Hamad (2017) in traditional technology of Shanklish cheese processing the fermented milk with yoghurt culture is poured into a cooking pot and gently heated until complete coagulation takes place, ending thereby with a liquid (whey) at the top and a residual white substance (the clot) settled at the bottom. The salt content in cheese is about 1.5 - 2.0%; the salted cheese is then rolled out into balls similar in both size and shape to those used in tennis. Dehydrated red pepper granules can be incorporated at this stage into the mix, enhancing thereby the taste, flavor and color of the finished product, the prepared balls are placed on top of a piece of an already boiled and dried piece of cloth and left there-by exposed to sunshine for about ten days (HAMAD, 2017).

Kefir grains are a combination of bacteria and yeasts in symbiotic matrix. Most microorganisms present in kefir are non-pathogenic bacteria, especially *Lactobacillus* sp. and yeasts. Kefir contains vitamins, amino acids, carbon dioxide, acetoin, alcohol and essential oils, which have been shown to have health benefits. Recently, the antibacterial, immunologic and antitumor effects of kefir were studied on human beings, its structure is a symbiotic association of yeasts, acid-lactic bacteria, acid-acetic bacteria, and other microorganisms fixed in a polysaccharide matrix called by kefirane (IRIGOYEN et al., 2005; JOHN; DEESEENTHUM, 2015; WESCHENFELDER et al., 2011).

The microorganisms in kefir have beneficial effects on health, such as improved intestinal flora balance and mucosal defense, relief of the symptoms related to lactose intolerance, stimulation of the immune system, relief of constipation, antioxidant potential and antibacterial activity (DIAS et al., 2016; MAGALHÃES et al., 2011; MOREIRA et al., 2008; PLESSAS et al., 2007; SHAH, 2007; WESCHENFELDER; WIEST; CARVALHO, 2009).

One important characteristic about Kefir is its variations in taste and aroma due to the different microorganisms in different kefir grains and in various production areas (TOMAR et al., 2018).

Curcuma longa L. or turmeric (from *Zingiberaceae* family) is highly regarded as a universal panacea in the herbal medicine with a wide spectrum of pharmacological activities, such as antioxidant activity, cardiovascular and anti-diabetic effects, inflammatory and edematic disorders, gastrointestinal effects, anti-cancer effect, antimicrobial activity, hepatoprotective and renoprotective (NASRI et al., 2014; VERMA et al., 2018).

Turmeric contains 69.4% carbohydrates, 6.3% protein, 5.1% fat, 3.5% minerals, and 13.1% moisture. The essential oil (5.8%) obtained by steam distillation possesses Sesquiterpenes (53%), zingiberene (25%), α-phellandrene (1%), sabinene (0.6%), cineol (1%), and borneol (0.5%). Curcumin (3–4%) is responsible for the yellow color, and comprises curcumin I (94%), curcumin II (6%) and curcumin III (0.3%) (NASRI et al, 2014).

Another important possible use of turmeric in food industry is as a substitute for synthetic pigments. Natural alternatives to this have been studying, among them, turmeric has great potential of using and it currently is one of the most used natural dyes by the food industry; turmeric has three main pigments: the curcumin, the majority, and two derivatives, the demethoxycurcumin and the bisdesmethoxycurcumin (FAGUNDES, 2018).

The aim of this work was determine the physical-chemical characteristics of the Shanklish cheese with addition of kefir and alcoholic extract of turmeric and monitor its pH variation during 21 days of storage at 8ºC.

Material and Methods

The turmeric used in this work was cultivated and donated from Botanical Garden of Unipar - Umuarama, whose rhizomes were obtained from the Saffron producers Cooperative located at Mara Rosa, State of Goiás, Brazil. Rhizomes after harvest were washed, peeled and dried naturally in the sun, after drying they were processed in a knife mill. Kefir grains were obtained from Department of Food Science and Technology of Londrina State University - UEL.

Production of turmeric extract

The turmeric extract was prepared as described by Licón et al. (2012), ground turmeric was added in whole pasteurized milk at the concentration of 0.10% (w/v), the mixture was kept at 50° C/3h under constant stirring and after that time the solid residue was removed by using a filter paper .

Shanklish cheese production

For production of the Shanklish cheese was used pasteurized whole cow milk heated at 42 °C added by commercial yogurt (2% v/v) and fermented for 12 hours in the same temperature. After the fermentation process, the curd was heated at 85ºC and cooled to room temperature, and drained in a sterilized cotton bag. The curd was separated into three groups: added of 10.0% of fermented skim milk by kefir (T_1); added of 2.5% of Turmeric extract (T_2) and added of 10.0% of fermented skim milk by kefir and 2.5% of Turmeric extract (T_3). Cheeses were packed in plastic film and kept at 8ºC. The results presented in this work are the average of two productions of cheese.

Chemical analysis

Total solids (TS), proteins, fat, titratable acidity and

pH were analyzed according to BRASIL (2003). The pH of the cheeses were determined on the day of manufacture and after seven, 14 and 21 days under refrigeration temperature storage (8ºC). All analysis were realized in triplicate.

The fat content in the total solids (FTS) and solids-not-fat (SNF) were obtained by calculating the percentage considering the butterfat contents and the total solids obtained in the cheeses.

The yield of cheese processing was calculated by the ratio between the mass of cheese obtained by the volume of milk used in processing and expressed in kg/L.

Statistical Analysis

Samples characterization was expressed by mean ± standard deviation and the t-student test was used to compare the statistically significant differences between the means of the samples, with the significance level of 5%. The software BioEstat was used to statistical analysis (AYRES et al., 2007).

Results and Discussion

The milk used in the manufacture of the Shanklish cheese had a high content of fat; it occurred due to the utilization of whole milk in cheese processing instead standardized milk (Table 1). The quality of milk is related to its physical-chemical composition as well, so it is important to identify animals that produce better quality milk, the parameters most researched and that reflect the quality of milk are: fat, protein, lactose and somatic cells. The average composition of milk can be influenced and vary according to the level of production, birth order, lactation stage, race, feeding, age, environmental temperature, season, physiological and pathological factors, milking portion and interval among milking (CABRAL et al., 2016; GONZÁLES et al., 2001).

The average of cheese yield found in this manufacturing process was about 5.62L/kg. The manufacturing process of Shanklish cheese is similar to the Quark cheese but there is no heating of the curd in this last one. Melo et al. (2018) found cheese yield of 5.30 L/kg in Quark cheese fermented using Kefir as starter culture.

Table 1: Physical-chemical composition of milk used in manufacture of the cheeses.

Component	
Proteins	2.60 g/100 g
Fat	3.80 g/100 g
Proteins/fat ratio	0.68
Titrable acidity (lactic acid)	0.16 g/100g

According Abd El-Gawad and Ahmed (2011) there are different aspects related to cheese yield: characteristics of the milk (contents of protein and fat, genetic variants of proteins, somatic cells), cheese making conditions (incorporation of whey proteins in the curd, homogenization of the fat, type of coagulant, use of different starters, curd firmness, type of vat, treatment of the curd). Different predictive formulas may be used to determine cheese yield and strategies in order to minimize cheese making losses.

The physical-chemical composition of the cheeses manufactured in this work is shown in Table 2, there were no significant differences among the treatments for all analyzed and calculated compounds.

Addas (2013) studied the traditional Shanklish production in Hama Province at West of Syria, in this region cheese producers use whole sheep milk in cheese manufacturing. The fat contents in analyzed cheeses varied between 6.83 to 12.73 g/100g; for proteins and 30.67 to 42.26 g/100g, and for total solids between 50.20 to 57.27 g/100g; it is important to observe that sheep milk has a different composition when compared to cow milk. Total protein content in sheep milk ranges from 4.79 to 6.10 g/100g, and the casein content from 3.93 to 4.93 g/100g and fat content is about 7.50 g/100g (HILALI; EL-MAYDA; RISCHKOWSKY, 2011).

Table 2: Physical-chemical composition of Shanklish cheeses produced.

	Treatments		
Components (g/100g)	T_1	T_2	T_3
Proteins (g/100g)	15.03±2.035	16.36±3.140	14.68±1.315
Fat (g/100g)	14.50±0.983	14.00±2.234	14.50±0.674
TS (g/100g)	32.72±0.699	33.29±0.951	31.68±0.340
SNF (g/100g)	18.22	19.29	17.18
FTS (g/100g)	44.31	42.05	45.77
Ashes (g/100g)	1.20±0.256	1.31±2.930	1.24±1.315
Carbohydrates (g/100g)*	1.99	1.62	1.26

TS – Total solids; SNF – Solids non fat; FTS – Fat in total solids. *Calculated by difference of 100g. T_1: added of 10.0% of fermented skim milk by kefir; T_2 - added of 2.5% of turmeric extract. T_3 - added of 10.0% of fermented skim milk by kefir and 2.5% of turmeric extract. There were no significant differences among the treatments.

Santana (2018) produced Shanklish cheese with goat milk and found the following average composition: protein 14.00 g/100g; fat 15.00g/100g; total solids 28.00 g/100g, and ash 2.00g/100g, these results are close of the ones found in this present work.

According to the Brazilian legislation, the obtained cheese can be classified as fresh (not ripening), semi-fat (25.0 – 44.9 g/100g of FTS) and very high water content (not less than 55.00 g/100 of water) cheese (BRASIL, 1996).

The Shanklish cheese processing does not use

rennet in its technology and the curd formation is the result of lactic fermentation produced by yoghurt starter culture then the final product has a low pH value according seen in table 3. There are not found significative differences among the treatments and the days of storage at 8ºC.

The Shanklish cheese is an acid-curd cheese produced by lowering the pH of milk by adding lactic acid starter cultures. The low pH solubilizes the calcium and phosphate salts of the casein micelles for the whey and demineralizes caseins micelles that is total at pH 4.6. They lose their polarity and no longer interacts with water forming aggregates, it is the curd and the whey obtained from this coagulation is called acid whey (ORDÓÑEZ, 2005).

Table 3: Variation of pH of the Shanklish cheese during 21 days at 8ºC.

	Treatments		
Days of storage at 8ºC	T_1	T_2	T_3
1	4.56	4.67	4.63
7	4.53	4.62	4.61
14	4.39	4.46	4.44
21	4.41	4.49	4.46

T_1: added of 10.0% of fermented skim milk by kefir; T_2 - added of 2.5% of turmeric extract. T_3 - added of 10.0% of fermented skim milk by kefir and 2.5% of turmeric extract. There were no significant differences among the treatments neither among the days of storage.

The few change in pH during the storage time must be the effect of the action of the starter culture used in the manufacture of the cheese that produced lactic acid from the degradation of residual lactose. Furthermore, it is important to be aware that in the cheese manufacturing the curd formed was heated and consequently the most part of the lactic bacteria was inactivated.

Santana (2018) found results close of this work; the values were 4.35 in the day of manufacturing and 4.16 after 20 days of storage at 5ºC for fresh Shanklish cheese.

Conclusion

According to the results obtained, it was possible to determine that there were no significant differences in the physical-chemical composition of Shanklish cheeses, regardless of the addition of kefir, turmeric alone or in combination. The pH values were expected due to the type of coagulation used. Although a few numbers of studies were found about this type of cheese, it can be verified that the results were close to those of the literature.

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