



ORIGINAL ARTICLE

Influence of Mono-Diglyceride on protein, fat and elasticity of Mozzarella cheese

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ABSTRACT

Mozzarella cheese is one of the most Italian soft unripened cheeses and from the family of Pastafilata that has a higher nutritional value than the Pizza cheese consumed in Iran due to differences in its production process and in recent years, taking it as a healthier replacement in preparing the pizza is rising. Growing enhancement of consumers' awareness to promote the health rate and regulate the fat content with healthy diets has prompted the food industry to produce a variety of low-fat food. Extensive research has performed to evaluate the effects of partial and total reduction of fat and the results obtained about Mozzarella cheese indicate that as much as the reduction of fat content in diet is optimal, it has a negative influence on the textural and cooking properties of Mozzarella. Hence, many ways such as modifying the production processes, adding fat replacements and using emulsifiers including mono Diglyceride, has been proposed to improve the textural and cooking properties of low-fat cheeses. Since the mono diglycerides works at the common surface of water and fat and have a good lipophilic properties, as a result, it stores higher fat content in tissues and exerts its effect on low levels and therefore helps to maintain products healthy. The purpose of this study is to investigate the effect of adding emulsifier of Mono diglycerides on the amount of protein, fat and elasticity of Mozzarella cheese. Mono diglyceride at ratios of 0/1, 0/3 and 0/5 percent was added to Cheese in the phase of cooking and the results after performing chemical testing and evaluation of elasticity with texture analyzer machine were as follows: increase of samples' protein in parallel with increasing emulsifier and higher levels of fat in sample containing 0/1 percent emulsifier was significant at confidence level of 99% and the recent sample had the best elasticity.

Keywords: Semi-fat cheese, Mozzarella, emulsifiers, monodiglycerides, chemical properties, elasticity.

Received 01.05.2014

Revised 19.05.2014

Accepted 15.09.2014

INTRODUCTION

Mozzarella cheese is of the most important Italian soft unripened cheeses and from Pastafilata cheese groups or stretched-curd that traditionally it is obtained from cow's full and fat milk with frictional Operation and plasticizing of fresh curd in hot water and it has a special fibrous structure as well as particular melting and stretch.

Recently this cheese is produced using the starter-enzyme technique and in a less amount compared to processed cheese (pizza) in Iran [1,3].

Increasing selling rate of Mozzarella cheese is a result of growing enhancement of consuming pizza and its related products and since Mozzarella cheese is usually used in a melted mode in pizza, as a result, melt and textural properties of Mozzarella after melting are of important factors that influence the general acceptance of Mozzarella [10].

Hence, a greater consideration on improving the cooking and textural properties of Mozzarella is focused through various methods including homogenization of milk in cheese making, modifying the production process, adding fat replacements and using emulsifiers such as mono diglycerides [9]. The emulsifiers are widely used in the food industry, for example, they have been used extensively in the production of emulsified fats and they increase the shelf life of the bread. Considering that both are hydrophilic and lipophilic, they relatively are soluble in water and oil and are found on surface of water / oil contact with polar groups of molecule in the aqueous phase and its non-polar groups in the fat phase compared with other emulsifiers. , thereby acting on the stability of emulsions and reducing the surface tension [11].

In the study of Vial et al., by investigating the impact of adding mono diglyceride in the production of fresh cheese with light-textured foamed, the result indicates that the use of monodiglyceride has a positive effect only less than 0/025 percent on the texture and in higher values cause the reduction of foamability and thus stiffening textures. [12]

The purpose of this study is to investigate the effect of mono-diglyceride emulsifier on the properties of Mozzarella.

MATERIALS AND METHODS

Raw materials

Raw materials used to produce the product are including:

Skimmed milk-Starter -Rennet-cream-butter, white cheese, mono and diglyceride Mono and diglycerides produced by the Beldem were added to cheese with desired concentrations during the cooking process.

Machine

Machinery and equipment used to produce supplies include:

- Laboratory cheese cooking pot
- mechanical crusher
- Steel tanks

Production steps

The supply production, took a few steps that include:

Starter inoculum, inoculation, coagulation, cutting, dewatering, curd making, grinding, tension testing, baking Cheese that details of which are as follows:

chopped raw cheese is poured in cooking pot and the steam valve will be opened until cheese is hot due to circulating the steam in the pot's jacket and texture is uniform, It should be noted that the vapor pressure is 0/25-0/75 Bar and the temperature in cooking pot is 70-75 ° C. Then the white cheese, cream, butter are added to the pot according to the formula respectively. The cheese texture will be elastic due to continuous stirring and temperature and salt. (by a mixing paddle with two arms and rotational speed of 20 rpm).(7)

Chemical tests

Chemicals

Chemicals used in chemical tests were mainly made of Merck company.

Devices

Devices, laboratory equipment used to it include:

- pH meter EYELA model 2000 – pH M made in Japan
- Heraeus oven, model 2000 - Fs
- Centrifuge made in Iran
- Milk Analyzer, made in Bulgaria, Model: Milk Ana KAM 2000-982 2BULTEH 2000 Ltd

Test method

Fat

The technique for determining the fat content of the cheese and the melted cheese was conducted according to International Standard 760 in 1978 with the reference method [5].

Protein

The "Measurement of the protein content of melted cheeses" was performed according to Iran national standard 1811 in 1977 [6].

Elasticity

Devices

The texture analyzer machine QTS25 made in England

The Texture analyzer machine was used to measure the elasticity of Cheese. So that 30 g of cheese sample was shaped at temperature of 50 °C in proper template and then it was evaluated in the device.

Method of statistical analysis of Data

The results were analyzed in the form of completely randomized scheme with four treatments (control of 0/1, 0/3, 0/5 percent monodiglycerides) with three replicates. Statistical analysis of data was performed using the software SAS and comparisons on the average of each significant level trait was conducted ($\alpha=0/01$, $\alpha=0/05$) and the statistical software of Excel was used to Figure.

RESULTS

Cheese Fat: Adding mono and diglyceride emulsifier has made a significant difference in cheese fat content at confidence level of 99 ($\alpha = 1\%$) and as seen in previous Figure, emulsifier content and percentage of samples' fat are inversely related, thus the maximum value is related to

thesamplecontaining0/1% mono and diglycerides and the lowest is in the samples containing0/5 % mono and diglycerides.

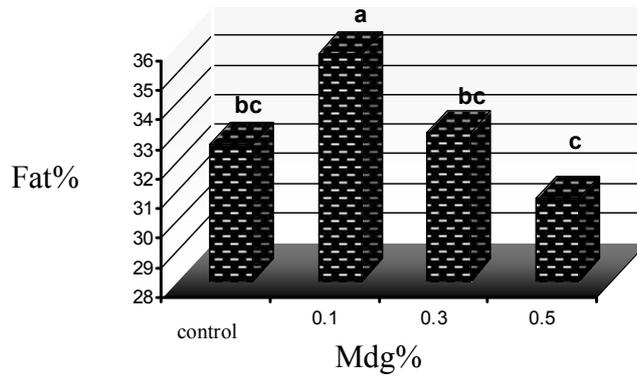


Figure 1. The impact of adding mono and diglycerides on cheese fat content
Cheese Protein: in parallel to increasing the mono and diglyceridecontent, the samples' protein content has been significantly increased at the confidence level of 99% and the sample containing 0/5 % reached the highest level i.e. 33% and the lowest value was related to control sample that's 20%.

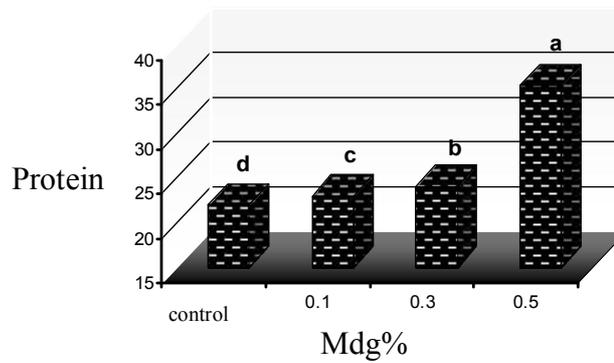


Figure 2. The impact of adding Mono and diglyceride on Mozzarella cheese 's protein

Cheese Elasticity: adding emulsifier creates a significant difference in samples at the confidence level of 99 % (a=1%) and the lowest and highest elasticity are respectively related to the control sample and the sample containing 0/1 % mono and diglycerides.

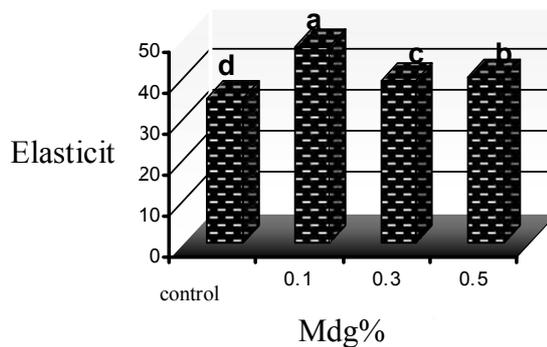


Figure 3. The impact of adding mono and diglyceride on cheese elasticity.

RESULTS AND DISCUSSION

Undesirable properties which is intensified by removing fat from Mozzarella cheese during cooking includes insufficient melting, hard and rubber texture, rapid formation of crust that the causes of these changes can be described by the fat cells. In this way that fat cells act in filling role among protein stands

that are formed during cooking curd and then lead to reduction of interaction of proteins inside the cheese's network.

Hence, we observe a more rigid texture and less elasticity in fat-free cheese due to increase of protein density and their interaction that after adding remarkably mono-diglyceride, these defects have been improved. Based on previous findings, by studying the microstructure of cheese during the mixing and stretching in cooking step, the performance of mono diglyceride can be described as follows:

Considering the fact that in usual conditions, without the presence of mono-diglyceride during cheese cooking, fat cells to resist the pressure exerted by the protein matrix are pressed together and after cooling the cheese, they are settled in channels of serum-fat between the strands of protein. In sample containing 0/1 % of emulsifier, mono diglyceride by creating the connection between fat and protein helped remarkably to keep fatter and thus improving texture elasticity of cheese. But by increasing the amount of mono-diglycerides, since this emulsifier has a greater impact on surfaces in high concentrations so that it links with hydrophilic factors in the outer surface of proteins on hydrophobic surfaces and helps the combining of proteins together. As a result, by increasing the protein density in cheese texture it prevents the presence of fat and leads to the reduction of elasticity.

Accordingly, using mono diglyceride emulsifier of 0/1 % in the process of producing the low fat Mozzarella in line with improving the texture properties and reducing the complications arising from the use of skimmed milk had the best results and according to the results of this research, this is suggested as an appropriate solution [8,11].

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CITATION OF THIS ARTICLE

Bahare S and Shabnam I S Influence of Mono-Diglyceride on protein, fat and elasticity of Mozzarella cheese. Bull. Env. Pharmacol. Life Sci., Vol 3 [11] October 2014: 05-08