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Effect of Soy Cheese and Trisodium Citrate on Pizza Cheese

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Abstract

The effects of soy cheese (tofu) and trisodium citrate concentration on the organoleptic characteristics of pizza cheese were studied. Flavor, texture, stretchability, appearance, and overall acceptability of pizza cheese samples decreased significantly with increased proportion of soy cheese. Statistically, the color of cheese samples made from different blends of tofu and trisodium citrate was similar to that in the control sample. Stretchability, appearance, and overall acceptability of pizza cheese samples increased but not significantly ($p>0.05$) as concentration of trisodium citrate increased. However, the scores of flavor did not show significant difference.

KEYWORDS: pizza cheese, imitation cheese, soy cheese, soya, organoleptic properties

Introduction

Pizza cheese production and consumption have grown considerably in the last 20 yr due to gains in popularity of pizza topping and related foods (IDF, 2006). Consumption of pizza cheese also has greatly increased in Iran. Considering the ever increasing popularity of pizza among children and teenagers in Iran, pizza cheese consumption is expected to grow (Farahmandfar *et al*. 2010)

Among the ingredients used in pizza cheese analogue, soy bean products have been concerned. Soy bean is a native crop of eastern Asia where it has served as an important part of the diet for centuries. Soy protein is the most inexpensive source of high nutritional quality protein, which the biological value of soy protein is higher than that of casein (Ahmed *et al*., 1995). Thus, soy protein is the predominant commercially available vegetable protein in the world. Food made from soy protein is very popular and traditional in Asian countries. The United States Food and Drug Administration authorized the Soy Protein Health Claim on 26 October 1999 stating that 25 g of soy protein a day may reduce the risk of heart disease. Soybean foods continue to penetrate rapidly into cultures and diets since the market is very responsive to this health claim (Fukushima, 2001; Hermansson, 1978). Tofu is one of the most important traditional soy foods in the eastern world. Studies have been undertaken on the effects of replacing casein in cheese analogue products by various types of vegetable proteins, e.g., soybean, peanut, pea protein or wheat protein (Fox *et al*., 2004). These proteins gave varying results, depending on the ingredient preparation (e.g., soy flour or soy isolate, pH, fat content) and the type and level of other ingredients (e.g., hydrocolloids). However, the use of these protein substitutes has been found to give cheese analogue products which have a quality inferior to that made using casein only. Common defects include lack of elasticity, lower hardness, an adhesive/sticky body, impaired flow and stretchability and/or poor flavor (Fox *et al*., 2004). The flavor was found to be the most important attribute that affected the acceptability of a cheese analogue containing soy protein (Pereira *et al*., 1992). The use of soybean as a human food is limited due to its beany flavor (Singh and Mittal, 1984).

Processed pizza cheese is obtained by mixing natural (based) cheese and other ingredients, along with emulsifying salts, and using heat and agitation to produce a homogeneous product. Trisodium citrate is a common emulsifying salt which is used extensively in the manufacture of processed pizza cheese in Iran. Gupta *et al*. (1984) reported that trisodium citrate gave saltiness intensity scores similar to tripotassium citrate, but each was perceived as significantly less salty than disodium phosphate or dipotassium phosphate in the processed cheese slices.

The objective of this study was to investigate the effect of soy cheese and trisodium citrate concentration on organoleptic characteristics of pizza cheese.

Materials and Methods

The soy flour used in this study was obtained from Toos Soya Company, Iran. One part of flour was mixed with seven parts of water with constant stirring for 10 min at 80 °C. Antifoam spray was used to control foaming. Soy milks were obtained from the slurry after centrifugation (1200 ×g) for 5 min. A single batch of soymilk was used for the preparation of tofu. This was done in order to avoid any changes in the soymilk composition (Farahmandfar *et al*. 2010).

Soymilk was heated to temperature of 80 °C under string. The period of heating, and stirring speed was kept constant for every tofu preparations. Tofu was prepared by coagulating the soymilk using calcium chloride at a concentration of 0.4% based on the amount of soymilk used (Farahmandfar *et al*. 2010). Calcium chloride was dissolved completely in 20 ml of cold water and was used immediately. The hot soymilk and coagulant solution were poured simultaneously into steel container ensuring good mixing without stirring. The soymilk-coagulant suspensions were allowed to stand undisturbed for a period of 25 min to ensure that coagulation occurred. The curds thus formed were broken thoroughly and transformed into a specially designed mould (10 × 10 × 8 cm) lined with cheesecloth. The mould had perforations on sides and bottom (Farahmandfar *et al*. 2010). The whey was drained off naturally for 15 min and the curd was pressed (Fig. 1). Next, tofu was transferred into plastic bag and stored in a refrigerator until further analysis.

Fig. 1. Soy cheese

Natural (based) cheese curd and cream was obtained from Razavi Dairy Company, Iran. The natural cheese was grinded, stored at -10 ˚C, and was transferred to a 5 ˚C refrigerator one day before mixing. A tofu curd for processed pizza production was mixed in different proportions (0:100, 5:95, and 10:90) with

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based cheese. As emulsifying salts, trisodium citrate was dissolved in water (40 ˚C) depending on the treatment and added to the dry ingredient blend followed by cooking. The temperature and time (the time for which the processed cheeses were held after they placed in cooker) of cook water were approximately 80 ˚C and 40 min, respectively. All treatments were manufactured in 1 kg batches using a single screw pilot-scale cooker blender to achieve a homogeneous paste (Fig. 2). The cooked processed cheeses were filled hot in 1 kg boxes and transferred to the cold room (4°C) after 15 min. All the cooked pizza cheeses were wrapped and stored at 4°C until analysis (Farahmandfar *et al*. 2010).

A

B

Fig. 2. Single screw pilot-scale cooker blender (A) homogeneous pizza cheese (B)

Acceptance (consumer) panel consist of 19 members, 12 were female and 7 male, and ranged from 18 to 25 old. Consumer panelist were the students of Department of Food Science and Technology, Ferdowsi University of Mashhad, Iran. Prior to testing, panelists were requested to complete the questionnaire asking gender, age, and frequency of cheese consumption (do not eat cheese, <1/mo, 2 to 4 times/mo, 5 to 6 times/mo, and >6 times/mo). Panelists who

consumed cheese 2 to 4 times/mo or less were eliminated from data analysis. The panelists were asked to evaluate samples of one-week old cheese for flavor, color, texture, stretchability, appearance, and overall acceptability by consumer panel on 5-point hedonic scale (1 = least liked to 5 = most liked). Cheese blocks were cooked, cut into standard, bite-sized pieces; each piece measured 1.3 × 0.9 × 0.9 cm (Madadlou *et al*., 2005). Crackers and water were offered without limit to panelist during testing for cleaning the plates.

An acceptance sensory panel evaluated randomly coded cheese samples. Analysis of variance (ANOVA) was carried out using MSTATC software (version 1.42). Duncan's multiple range test was used as a guide for comparison of the treatment means. The level of significance was determined at $P < 0.05$. Furthermore, the chart was prepared by Microsoft Excel software (2007).

Results and Discussion

Samples made with different proportion of soy cheese and trisodium citrates are shown in Fig. 3, 4, 5, 6, 7 and 8. The values are the means of ten observations of pizza cheese samples presented to the panelists for evaluation of flavor, color, texture, stretchability, appearance, and overall acceptability. The experimental values of flavor, color, texture, stretchability, appearance, and overall acceptability of pizza cheeses was ranging from 2.5 to 4, 3.2 to 3.5, 1.9 to 3.8, 1.4 to 3.8, 1.9 to 3.8, and 1.9 to 3.7, respectively. Flavor, texture, stretchability, appearance, and overall acceptability of pizza cheese samples showed notable difference with increase in proportion of soy cheese, which the greatest values were for control cheeses (CC1C and CC2C), followed by pizza cheese with 5% and 10% soy cheese. The decrease in stretchability could be due to less percentage of casein available for conversion to mono-calcium-paracaseinate by the addition of soy solids (Kumar and Jha, 1997). The most difficult problem limiting the expanded use of soy protein products is the strong off-flavors associated with these products. There are two types of off-flavors. One is grassy and beany flavors and the other is bitter, astringent, and chalky flavors (Yada, 2004). Statistically, the color of cheese samples made from different of blends of tofu and trisodium citrate was similar to that in the control sample. Kumar and Jha (1997) showed that flavor, color, texture, and stretchability of mozzarella cheese decreased, as proportion of soya milk in the buffalo milk increased. Rani & Verma (1995) reported that the color score increased with increase in proportion of soya milk in the cows milk increased. Atia *et al*. (2004) reported that scores of texture and appearance were higher in control cheeses compared to cheeses with 5% to 7% soy protein isolate after 30 days. On the other hand, stretchability, appearance, and overall acceptability of pizza cheese samples increased but not significantly ($p>0.05$) as concentration of trisodium citrate increased. However,

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the scores of flavor did not show significant difference. Neither the age of the panelists nor their sex resulted in different preference. Farahmandfar *et al*. (2010) showed that fat and FDM contents of pizza cheese increased significantly with increased TSC. On the other hand, fat reduction effect on sensory properties of Iranian cheese. Thus, probably fat content is one of important factors effecting on appearance and overall acceptability of pizza cheese. By the way, Gupta *et al*. (1984) reported that trisodium citrate gave saltiness intensity scores in experimental processed cheese.

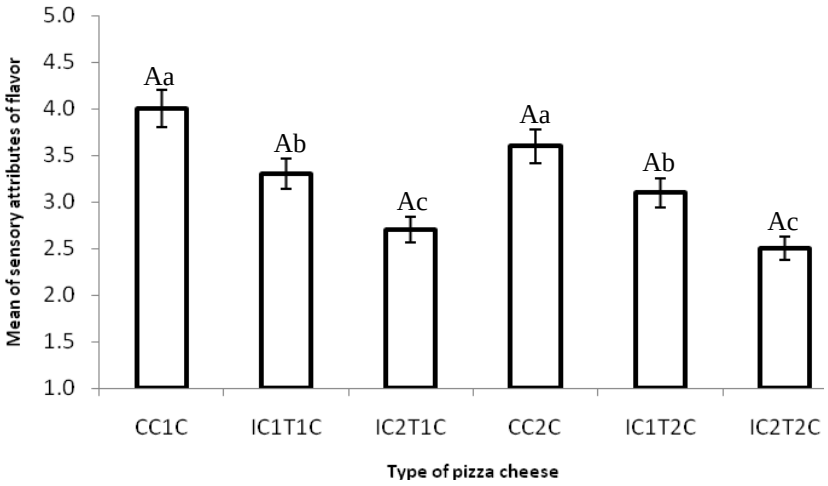

Fig. 3. Effect of soy cheese and trisodium citrate on flavor of pizza cheese.

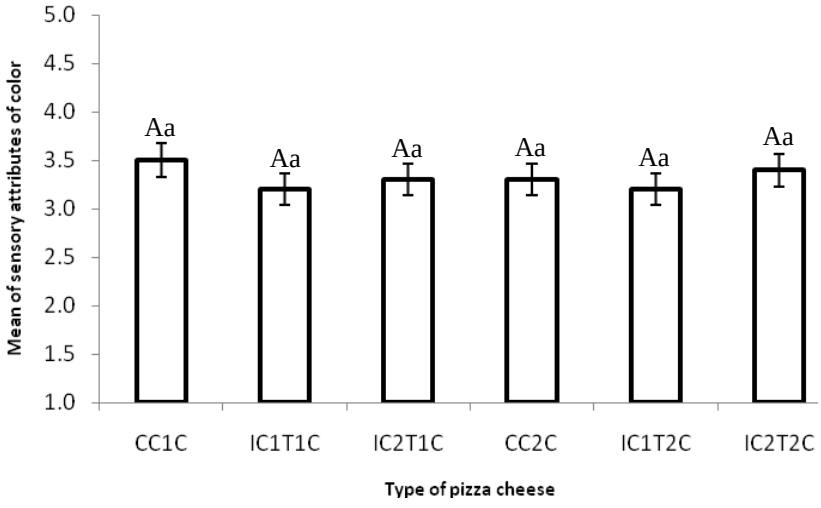

Fig. 4. Effect of soy cheese and trisodium citrate on color of pizza cheese.

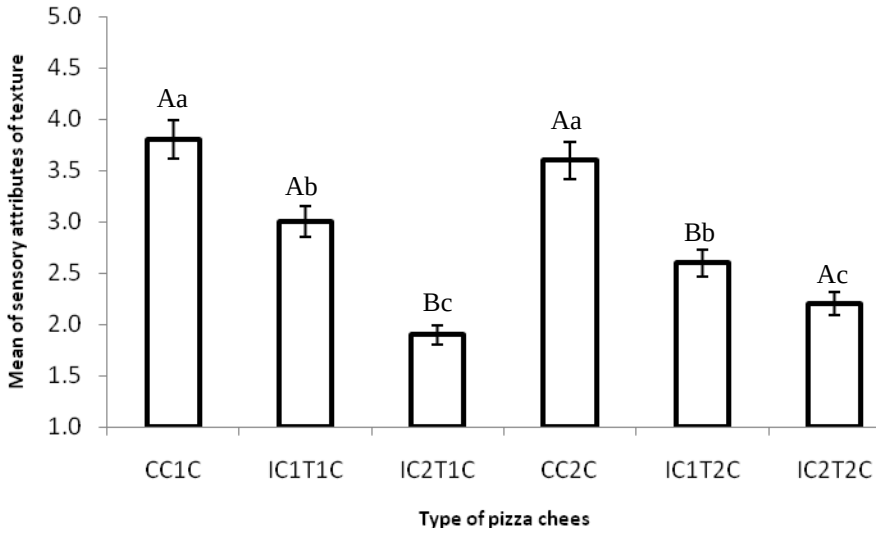

Fig. 5. Effect of soy cheese and trisodium citrate on texture of pizza cheese.

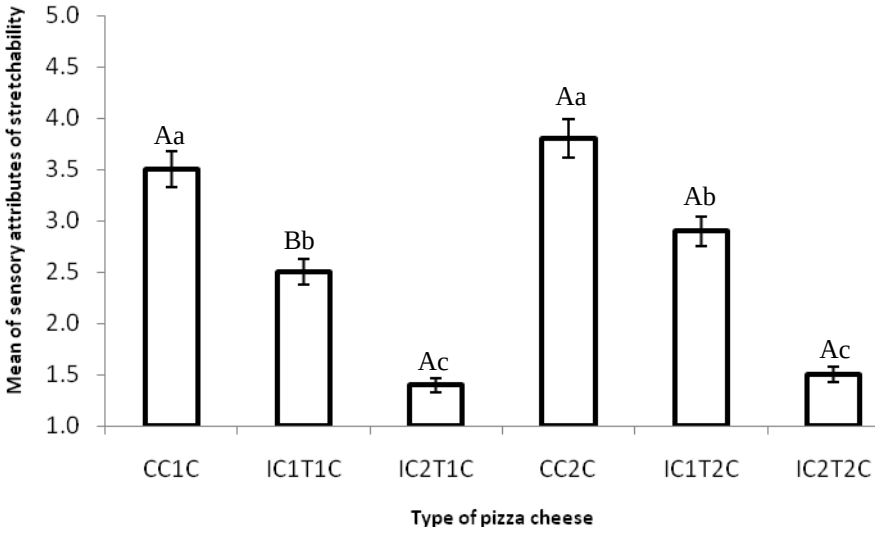

Fig. 6. Effect of soy cheese and trisodium citrate on stretchability of pizza cheese.

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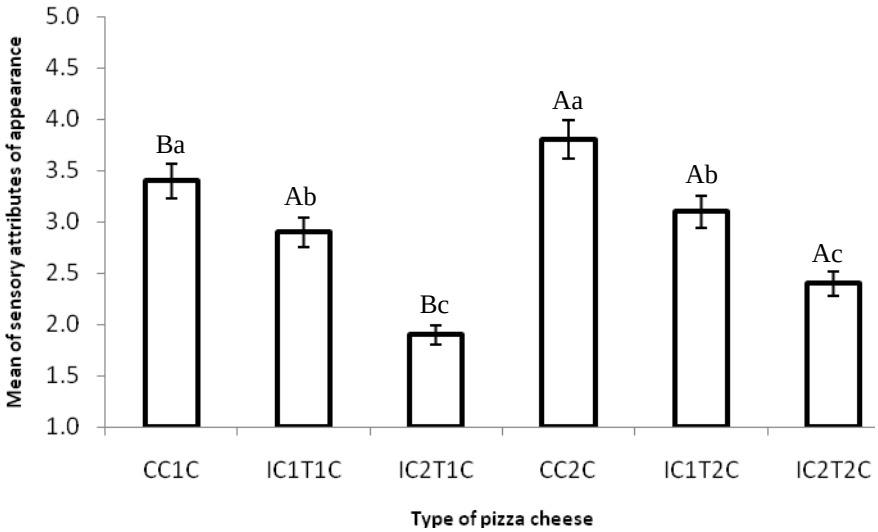

Fig. 7. Effect of soy cheese and trisodium citrate on appearance of pizza cheese.

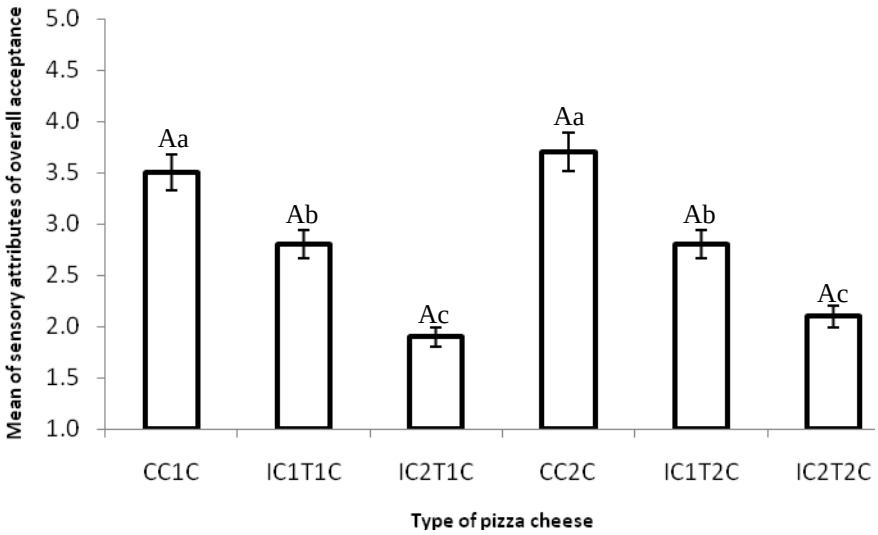

Fig. 8. Effect of soy cheese and trisodium citrate on overall acceptance of pizza cheese.

Abbreviations:

C1C = cheese with 0.5% trisodium citrate
C2C = cheese with 1% trisodium citrate
CC1C = control cheese with 0.5% trisodium citrate
CC2C = control cheese with 1% trisodium citrate
IC1T1C = imitation cheese with 5% tofu and 0.5% trisodium citrate
IC2T1C = imitation cheese with 10% tofu and 0.5% trisodium citrate
IC1T2C = imitation cheese with 5% tofu and 1% trisodium citrate
IC2T2C = imitation cheese with 10% tofu and 1% trisodium citrate

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