ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 5, Issue 2, February 2020

Effect of Trisodium citrate on objective properties of spreadable processed Paneer

[1] Ashaq Manzoor, [2] Zahoor Ahmad Dar, [3] Tahir Nazir, [4] Mohammad Ashraf Pal, [5] Sayar Ahmad Beigh
[6] Rayees A. Malik

[1][3][4][5][6] Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-Kashmir, India
[2] Sharda University, Greater Noida, India
[1] ashaqmanzoor3@gmail.com

***Abstract*—The study was conducted to determine the effect of Trisodium Citrate (TSC) on quality of Processed paneer. The pH increased significantly from 5.71 ± 0.06 in control to 6.13 ± 0.01in sample with 1.5 % TSC. Titratable acidity decreased significantly from 0.28 ± 0.01in control to 0.21 ± 0.01 in sample with 1.5 % TSC. Emulsion stability showed a significant decrease with addition of TSC at 1% and 1.5% levels compared to control. The moisture content of all treatments was comparable with control. The fat and protein content decreased numerically but decline was significant at 1.5% TSC level only. The ash content followed a numerical increase with addition of TSC though the increase was significantly higher at 1.5% level compared with control. Based on the inference drawn from the results, sample with 1% TSC level was found to possess most desirable characteristics in terms of physiochemical and proximate characteristics.**

***Keywords*--- Emulsification, Processed Paneer Spread, Proximate Composition**

I. INTRODUCTION

Processed paneer spread is a further processed paneer product envisioned to provide an economically and socially acceptable product acceptable product having the characteristics comparable to its western counterpart, the processed cheese spread. It is expected to constitute a nutritionally desirable product for the breakfast food for almost all classes of consumers particularly the calorie conscious and those suffering from lifestyle disorders.

Process cheese is produced by blending natural cheese of different ages and degrees of maturity in the presence of emulsifying salts and other dairy and nondairy ingredients followed by heating and continuous mixing to form a homogeneous product with an extended shelf life [15]. Combined action of heating, agitation and the action of emulsifiers, results in conversion of insoluble calcium para-casein gel of the natural cheese, to a para casein sol – a homogeneous, flowing mass. This sol is changed again to a gel by the influences of cooling and polymerization forces resulting in processed cheese. As per FSSAI, processed cheese shall contain not more than 47% moisture and the fat content should not be less than 40% expressed on dry matter". While as processed cheese spread shall contain moisture not more than 60% and fat content should not be less than 40%.

Emulsifying salts are of immense importance in processed cheese production where they are used to supplement the emulsifying capability of cheese protein. This is accomplished by removing calcium from the protein system, and peptizing, hydrating, swelling, solubilizing and dispersing the protein. In addition, it emulsifies fat to stabilize the emulsion, controls pH and forms an appropriate structure after cooling. The emulsifying salts most commonly used are citrates, phosphates, polyphosphates, and sodium aluminum phosphates [7]**.** Other potential emulsifying agents include gluconates, lactates, malates, ammonium salts, glucono lactones, and tartarates [16]. Citrates are usually used as sodium salts, although potassium salts have also been used [11].

II. MATERIALS AND METHODS

2.1 Manufacture of Paneer

Paneer was prepared by standard procedure of [14] with slight modifications. Milk was heated to 90 ^{0}C followed by cooling to 70 ^{0}C. Citric acid Solution (2%, 70 ^{0}C) was added to milk at 70 ^{0}C and allowed to stand for 5 minutes. The coagulum was strained through a muslin cloth. The strained mass was pressed in a hoop (@230kg/m2/15min). Pressing was followed by chilling with cold water for 10 minutes. Finally, the freshly prepared paneer samples were chilled in cold water at 4^0 C for 30 minutes.

2.2 Manufacture of Processed Paneer spread

Paneer was sliced and then minced in a cheese mincer with 3.2mm diameter plate. This minced paneer was transferred into blender and ingredients such as emulsifying salts, common salt were added. The whole mixture was hot

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 5, Issue 2, February 2020

blended at 75±2^{0}C. Paneer spread so produced was equilibrated to room temperature.

Table1: Formulation of spreadable processed paneer with varying levels of trisodium citrate

Ingriedents	Level of incorporation			
	Control	0.5	1 %	1.5%
Paneer	99.5g	99g	98.5g	98g
Trisodium citrate	0g	0.5g	1g	1.5g
Salt (@0.5%)	0.5g	0.5g	0.5g	0.5g
Total	100g	100g	100g	100g

2.3 Laboratory analysis

a) pH

For determination of pH of paneer spread samples, about 10 g of paneer was blended with 50ml distilled water in a beaker to form slurry. The pH of resultant slurry was recorded using the same procedure

b) Titratable acidity

10 g of sample was triturated with warm distilled water (40°C), Volume was made up to 105 ml. Then it was filtered through Whatman No. 1. Then 25 ml of filtrate was titrated with 0.1N NaOH using phenolphthalein indicator.

Titratable acidity (% lactic acid) = 0.09 X V

Where, V = Volume of 0.1 N NaOH

c) Free fat

The amount of free oil released from functional processed paneer spread sample during melting was measured using fat leakage test as described by [8] with some modifications. Functional Processed paneer spread disks (18-mm in diameter x 7-mm thick) were cut. Filter paper disks (Whatman No 1, 9-mm in diameter) were placed inside glass Petri dishes. Duplicate disks for each sample were placed on the filter papers and kept at room temperature for 30 minutes and then placed in an oven at 110 ºC for 15 min. The Petri dishes were cooled to room temperature. The diameter of each oil ring formed on filter paper was measured to the nearest 0.01 cm at four different angles, and means were calculated

d) Emulsion stability

Emulsion stability of paneer spread was determined by taking 9 grams of paneer spread into centrifugation tubes, the tubes were held in water bath at 70^o C for 15 minutes then centrifuged at 3000rpm for 5 minutes. After centrifugation the tubes were rendered in water bath for 5 minutes and then oil rendered was measured.

e) Proximate composition

Proximate constituents viz. moisture, ether extract, crude protein and ash were determined as per the standard procedures of Association of Analytical Chemists [2].

III. RESULTS AND DISCUSSION

3.1 Proximate composition

The results pertaining to proximate composition revealed that moisture content followed a numerical decline with the increasing level of TSC. However, this increase was insignificant ($p \geq 0.05$). The average moisture content of processed paneer spread was 53.35 ± 0.14 which is lower than observed by [3] but well within the limits prescribed by [4]. Fat and protein content followed a declining trend with increase in concentration of TSC. Thus, highest fat and protein content was found in control sample and lowest in 1.5% TSC incorporated processed paneer sample. This decrease in fat and protein content can be attributed to partial replacement of dry matter with TSC. Contrary to fat and protein, ash content increased significantly with increasing concentration of TSC which seems obvious due to increased amount of salts in the product. The results obtained in our study were in agreement with those reported by [3]. Similar results were found in processed cheese spread incorporated with butter milk chakka by [1]. Similar values of moisture in a blend used were cheddar cheese, mozzarella, paneer and water with added emulsifiers and stabilizers [13]. Contrarily fat values obtained in our study were lower than obtained by [13].

Table 2: Proximate composition of processed paneer spread incorporated with varying concentration of trisodium citrate.

Parameters	Level of trisodium citrate (%)				
	Control	**0.5**	**1**	**1.5**	**Over all mean**
Moisture	53.74 ± 0.27^a	53.49 ± 0.26^a	53.24 ± 0.26^a	52.96 ± 0.26^a	53.35 ± 0.14
Dry matter	46.26 ± 0.27^a	46.51 ± 0.26^a	46.76 ± 0.26^a	47.03± 0.26^a	46.64 ± 0.14
Fat	20.09 ± 0.08^b	19.97±0.07^{ab}	19.78 ±0.07^{ab}	19.64 ± 0.17^a	19.87 ± 0.07
Protein	17.30 ± 0.02^c	17.17 ±0.03^{bc}	17.08±0.05ab	17.00 ± 0.05^a	17.14 ± 0.03s
Ash	1.71 ± 0.03^a	1.79 ± 0.06^{ab}	1.89 ± 0.05b^c	2.00 ± 0.05^c	1.85 ± 0.04

Means ± SE, row wise with different superscripts, differ significantly ($p \leq 0.05$)

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 5, Issue 2, February 2020

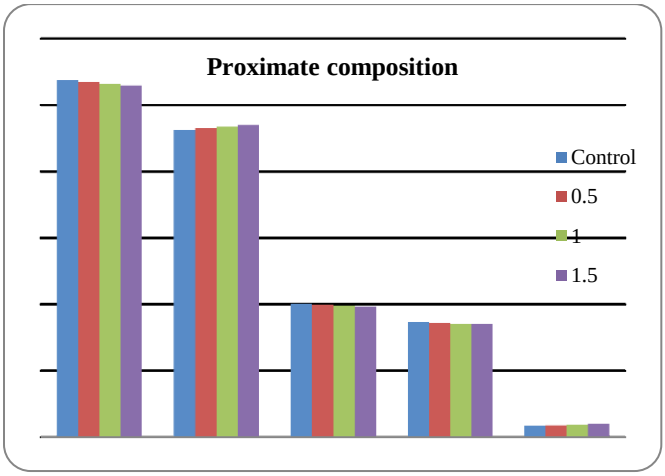

Fig 1: Effect of TSC on proximate composition of processed paneer spread

3.2 pH and titratable acidity

The pH value followed a general increasing trend with increasing levels of trisodium citrate. When pH values of TSC treated samples were compared with the control sample, a significant (P≤0.05) increase in pH was observed, however pH of processed paneer spread emulsified with 1% and 1.5% TSC were comparable. The results obtained were in agreement with [6]. The final pH of a processed cheese has been found to have a significant effect on the quality, microstructure and the type of protein interactions in the resulting processed cheese emulsion [5, 12]. Generally, increasing pH increases the calcium-sequestering ability of the emulsifying salts, resulting in greater disintegration of the calcium para-casein network [10]. This can be attributed to two reasons: First, the increase of pH causes an increase of the negative charge of the protein molecules and a more open para-casein conformation is formed that facilitates the access of emulsifying salts; Second, the better dissociation of the sodium emulsifying salts at high pH values leads to the formation of more reactive emulsifying anions.

Titratable acidity (% lactic acid) value decreased with increased concentration of TSC in processed paneer spread. A significant variation (p≤0.05) was observed between control and TSC treated samples, however, the titratable acidity of samples containing 0.5% and 1% TSC were comparable.

Table 3: Effect of trisodium citrate on pH and Titratable acidity of spreadable processed paneer

Parameters	Level of trisodium citrate (%)				
	Control	0.5	1	1.5	Overall mean
pH	5.71 ± 0.06^{a}	5.9 ±0.04^{b}	6.04 ±0.04^{c}	6.13 ± 0.01^{c}	5.95±0.05
Titratable acidity (%lactic acid)	0.28 ± 0.01^{c}	0.25 ± 0.003^{b}	0.24 ±0.01^{b}	0.21 ± 0.01^{a}	0.24 ± 0.01

Means ± SE, row wise with different superscripts, differ significantly (p ≤0.05)

3.3 Free fat & emulsion stability

The emulsion stabilizing ability of TSC was studied by fat leakage test (oiling off) and centrifugation method. The results revealed that with increasing concentration of TSC the emulsion stability of processed paneer spread increased. The trend observed in this study was in agreement with [9]. Similarly a decreasing trend in fat leakage with addition of butter milk Chakka was found [1].

Table 4: Effect of trisodium citrate on emulsion stability and free fat of spreadable processed paneer

Parameters	Level of trisodium citrate (%)				
	Control	0.5	1	1.5	Overall mean
Free fat (Cms)	1.98 ±0.09^{b}	1.89 ±0.02^{ab}	1.83±0.01^{ab}	1.75 ±0.01^{a}	1.86 ± 0.03
Emulsion stability (ml/100g)	14.70±0.69^{b}	13.14 ±0.18^{b}	10.55±1.15^{a}	10.18±0.37^{a}	12.14 ± 0.63

Means ± SE, row wise with different superscripts, differ significantly (p ≤0.05)

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 5, Issue 2, February 2020

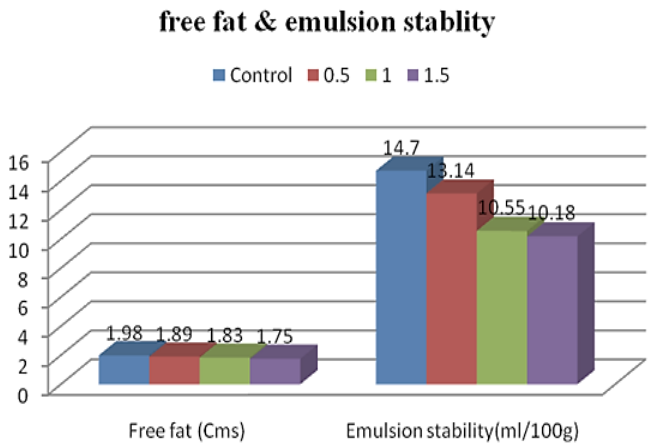

Fig. 3: Effect of TSC on free fat and emulsion stability of processed paneer spread

IV. CONCLUSION

The present study was contemplated to be undertaken to optimize technological parameters for the manufacture of processed paneer spread so as to provide an alternative to western counter product, processed cheese spread. At present, mainly two types of spread are available in the Indian markets, namely, butter and cheese spread, which are used along with bread in the breakfast. Butter spread is not desirable for calorie conscious persons or those suffering from obesity, diabetes mellitus and coronary heart disease. Of late the cheese spread has gained some popularity but is still confronted with several issues with regard to its acceptance as the consumers are suspicious about its ingredients. Contrarily the paneer spread is surmised to offer a comparatively economical and equally nutritious alternative with no taboos.

ACKNOWLEDGEMENT:

Authors are highly thankful to Dean faculty of Veterinary science.

REFERENCES

1. A.J, Gokhale, J, Mallik, A. M. Patel, and A. J. Pandya. Influence of incorporation of butter milk chakka on the quality of processed cheese spread. International Journal of Science, Environment and Technology, 5(4), 2275–2285, 2016.
2. AOAC. Official Method of Analysis, Association of official analytical chemists, 20th edition. Washington, USA, 2000.
3. R. Dwivedi, H. Singh, and M. P. Gupta. Standardization of methods for manufacture of paneer spread. The Journal of Rural and Agricultural Research, 10(2), 17-19, 2010.
4. FSSA. Food safety and standards act. Legislative department, ministry of law and justice. Revised standards for milk and milk products, August. 2017.
5. H. J, Palmer, and W. H. Sly. Oil separation in processed cheese. Dairy India, 8, 427¬-30, 1943.
6. L. Chen, and H. Liu. Effect of emulsifying salts on the physicochemical properties of processed cheese made from Mozzarella. Journal of Dairy Science, 95(9), 4823–4830, 2012.
7. M. Caric and M. Kalab. Processed cheese products, in, Cheese: Chemistry, Physics and Microbiology, Vol. 2, Major Cheese Groups, RE Fox, ed., Elsevier Applied Science Publishers Ltd., London. pp. 339-383, 1987.
8. N. C. Bertola, A. Califano, & N. E. Zaritzky. Effect of Freezing Conditions on Functional Properties of Low Moisture Mozzarella Cheese. Journal of dairy sciences, 79(2), 185-190, 1996.
9. P. S. Klndstedt, and J. K. Rippe. Rapid Quantitative Test for Free Oil (Oiling Off) in Melted Mozzarella Cheese. Journal of Dairy Science, 73, 867–873, 1990.
10. R. E. Fox, T. P. Guinee, T. M. Cogan, and P. L. H. McSweeney. Fundamentals of Cheese Science. Aspen Publishers, Inc., Gaithersburg, MD, 2000.
11. S. K, Gupta, C. Karahadian, and R. C. Lindsay. Effect of emulsifier salts on textural and flavour properties of processed cheeses. Journal of Dairy Science, 67, 764-778, 1984.
12. S. Marchesseau, E, Gastaldi, A, Lagaude, and J. L. Cuq. Influence of pH on protein interactions and microstructure of process cheese. Journal of Dairy Science, 80, 1483-1489, 1997.
13. S. S Shanker, and C. Ramesh. Development and quality assessment of cheese spread prepared by using: Paneer, mozzarella and cheddar cheese. Indian Dairyman, 6(4), 1–6, 2017
14. S. Sachdeva, S. Singh, and S. K. Kanawjia, Recent developments in paneer technology. Indian Dairyman, 37, 501,1985.
15. T. P. Guinee. Salting and the role of salt in cheese. International Journal of Dairy Technology, 57, 99–109, 2004.
16. W. V. Price, and M. G. Bush, The process cheese industry: a review. II. Research and development. The Journal of Food and Dairy Technology, 37, 179-198, 1974.