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Textural properties of paneer prepared from blends of raw turmeric extract and buffalo milk

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Abstract

In the present investigation the attempt was made to study textural properties of *paneer* made from buffalo milk and raw turmeric extract. The textural properties include hardness, cohesiveness, elasticity, gumminess and chewiness for the raw turmeric extract added *paneer*. The *paneer* was prepared by considering treatment combination of buffalo milk and raw turmeric extract the turmeric extract as 95%, 90% and 85% of buffalo milk and 5%, 10% and 15% of raw turmeric extract in treatments T₂, T₃ and T₄ and treatment T₁ taken as a control prepared from buffalo milk only.

Keywords: Buffalo milk, paneer, channa, turmeric, *Curcuma longa*

Introduction

Paneer is a popular Indian soft cheese variety and indigenous dairy products, which occupy a prominent place among traditional milk products. About 5% of milk produce in India is converted into *paneer* out of 176.35 million tonnes during 2017-2018 (Anonymous 2017-18) [3]. Good quality *paneer* is characterized by a marble white colour, sweetish, mildly acidic taste, nutty flavour, spongy body and closely knit, smooth texture. The ability of *paneer* to be deep fried is one feature that has led to its wider acceptance and a favourite for making snacks, pakoras or fried *paneer* chunks (Aneja, 2007) [1].

Turmeric is a golden spice derived from the rhizome of the plant *curcuma longa*. Turmeric has long been used as a spice, flavoring agent, and colorant. Traditionally, the spice has been used to treat numerous human ailments. Turmeric is a rich source of numerous biologically active constituents such as polyphenols, sesquiterpenes, diterpenes, triterpenoids, sterols, and alkaloids. Modern science has delineated the molecular basis for the pharmacological properties of turmeric against human diseases, and some clinical trials have unequivocally demonstrated the safety and efficacy of turmeric in human subjects. The absence of any significant toxicity associated with this spice has made it superior to other medications (Gupta *et al.* 2013) [8].

The present study was proposed to study effects of raw turmeric extract on textural properties of *paneer* prepared from blends of buffalo milk and raw turmeric extract.

Material and Methods**Buffalo Milk and Raw turmeric**

Already standardized fresh Buffalo milk was procured from local market of Latur city, of Natural Milk Pvt., Ltd., Latur having 6.0 per cent fat and 9 per cent SNF. The pure raw turmeric (Selam variety) required for preparation of paneer was obtained from local market of Latur city. Analytical (AR) or guaranteed grade (GR) reagents were used in the chemical analysis. Polythene bags (200 gauges) was obtained from local market and used for packaging the raw turmeric added *paneer*. Equipments and accessories include stainless steel vessels of requisite capacity, knives, fruit extractor/mixture, muslin cloth, standard weight balance, thermometer, gas shegdi, paneer press machine, etc. used for preparation of *paneer*. Before using this material, it was properly cleaned and washed with detergent solution and all the precautionary measures was considered during the conduct of trials to avoid contamination.

Preparation of raw turmeric extract

The fresh raw turmeric was collected, washed, peeled and cut into small pieces. After cutting raw turmeric pieces were grinded in the mixer for homogenous fine mixture by adding 1:5 ratio of water for extract filtration through muslin cloth.

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Preparation Buffalo milk *Paneer* blended with Raw Turmeric extract

The buffalo milk (6% fat and 9% SNF) was taken in pan then raw turmeric extract was added before heating and mixed properly through glass rod. Milk was heated to 86°C and cooled up to temperature 76 °C. After cooling citric acid were added in milk @ 1-3% at 76°C with stirring. After complete coagulation the stirring was stopped and allow the curd to sink to the bottom. The whey was then drained through a stainless-steel strainer. The curd was collected and filled in stainless steel *paneer* hoope. The hoope used was circular blocks with holes on its side to facilitate the expulsion of whey. *Paneer* was pressed 10-15 minutes @ 3 kg/sq cm. The pressed block of curd was removed from the hoop, cut into pieces and immersed in chilled water (4 °C) for 2 to 3 hours. The chilled *paneer* was then removed from water to drain out and packed in polythene bag and finally storage in refrigerator (5 °C).

Analytical Method

Textural qualities of raw turmeric added *paneer viz.*, hardness, elasticity, gumminess and chewiness were measured by using Instron Universal Testing Machine (Model, 1000).

Procedure

a) Calibration

The instrument was calibrated using 5 kg load transducer and tare weight of Anvil was balanced out.

b) Gage length

Gage length was set to 15 mm by driving the moving cross head up or down using push buttons. On cross head control panel and spacing between Anvil and specimen table was measured using a ruler.

c) Gross head limits

The upper and lower gross head limits were set accurately.

d) Test description type

Multiple bite texture test reserve after compressing to 3 mm thickness.

Sample: *Paneer*

Fixture: Compression Anvils.

e) Test parameters

- By compression: Up to 80%
Sample size: 15 mm cube
Compressed to: 12 mm cube

- Crosshead speed: 100 mm/min
- Drive chart speed: 50 mm/min
- Force range: 20 kg

Raw turmeric extract added *paneer* samples were compressed successively to stimulate chewing. The cubes of 15 mm. raw turmeric extract added *paneer* were compressed to 12 mm i.e. 80 per cent compression. A typical curve is given below. From the above curve different texture qualities were defined and calculated (Bourne, 1966)^[5] as follows,

1. Hardness

It is the amount of maximum force i.e. exerted on the sample. Height (H) of the first bite corresponds to the hardness and its unit is in kg / N (Newton).

2. Cohesiveness

Cohesiveness is the ratio of areas under the first and second bite i.e. A2/ A1; being ratio-it is unit less. Cohesiveness= A2/ A1.

3. Elasticity

The total movement of cross speed to the start of second bites (D-D'). Its unit is cm.

4. Gumminess

It is the product of hardness and cohesiveness which is measured in kg / Newton.

$$\text{Gumminess} = \text{Hardness} \times \text{Cohesiveness} = H \times A_2 / A_1$$

5. Chewiness

Chewiness is defined as the product of hardness, Cohesiveness and elasticity. Its unit in kg-cm/kg-mm

$$\text{Chewiness} = \text{Hardness} \times \text{Cohesiveness} \times \text{Elasticity}$$

$$= H \times A_2 / A_1 \times D-D'$$

Result and Discussion

Textural qualities of raw turmeric extract added *paneer*

The textural qualities in respect of hardness, cohesiveness, elasticity, gumminess and chewiness for the raw turmeric extract added *paneer* were tested by Instron Universal Testing Machine, in the laboratory of College of Food Technology, V.N.M.K.U., Parbhani. Four samples for each parameter were tested and average value of the same is presented in table no. 1

Table 1: Effects of different levels of raw turmeric extract on textural qualities of raw turmeric extract added *paneer*.

Treatments	Hardness (Kg)	Cohesiveness	Elasticity (cm)	Gumminess (Kg/N)	Chewiness (Kg-cm)
T ₁	6.97 ^a	0.15 ^a	1.02 ^a	1.04 ^a	1.06 ^a
T ₂	6.75 ^b	0.16 ^b	1.13 ^b	1.08 ^{ab}	1.22 ^b
T ₃	6.65 ^c	0.17 ^c	1.27 ^c	1.13 ^{bc}	1.43 ^c
T ₄	6.59 ^d	0.18 ^d	1.35 ^d	1.18 ^c	1.53 ^d
SE ±	0.011	0.003	0.006	0.015	0.011
CD at 5%	0.036	0.009	0.019	0.05	0.036

The values with different small letters superscripts row wise differ significantly at 5% level of significance.

In all the textural parameters i.e. hardness, cohesiveness, elasticity, gumminess and chewiness these values were found to be significantly differed over control and between each other also excluding gumminess. It is also noted that addition of increased proportion of raw turmeric extract from 5%, 10%, and 15% per cent in *paneer* had decreasing values of all

the textural parameters. In other words, it can be stated that the addition of 5% percent raw turmeric extract in preparation *paneer* was found to be an optimum level as far as the textural qualities *viz.*, hardness, elasticity, gumminess and chewiness, respectively. It indicates that turmeric has an effect on the textural parameters of *panner*, it may be due to the impact of

raw turmeric extract on coagulation of *chhana* by affecting pH, acidity, electrostatic forces and Micro heterogeneity of the caseins molecules. There is need to further study of the structure and properties of the casein micelle, to solve textural problems faced due to the addition of non-dairy ingredients in milk for the preparation of milk products. The casein micelle presents an interesting and complex problem in protein quaternary structure (Fox and McSweeney, 1998) [7]. The textural parameters of following workers also found in changed due to the use of turmeric for the development of different milk products.

Panchbhai (1994) [11] studied on the effect of hydrocolloids on the yield and quality of *chhana* and stated that increased the proportion of sago starch decrease the values of gumminess and chewiness i.e. from 0.748 to 0.231 kg/N and 2.695 to 0.819 kg-cm, respectively. The present findings are quite agreeable with the findings of above research workers as for as all the textural parameter studied are concern.

Bhadekar (2003) [4] prepared *paneer* from buffalo milk added with sago powder and observed that in all the textural parameters i.e. hardness, cohesiveness, elasticity, gumminess and chewiness had maximum values for T₁ combination of the sago *paneer*. These values were found to be significantly differed over control.

Hardiness is most commonly evaluated characteristic of *paneer*. It may be described as force necessary to attain given deformation. The maximum force during the first cycle of compression, it also known as "firmness". Factors such as moisture and fat content, type of protein, processing treatment, etc. affect the hardness of *paneer*.

It is observed from the table no. 1 that the hardness of the raw turmeric extract added *paneer* ranged between 6.59 to 6.97 kg i.e. for T₄ to T₁. Hardiness of raw turmeric extract added *paneer* showing decreased in samples. Similar observation with little-bit changed observed by: Chitra (2009) [6] prepared alovera *paneer*, mint *paneer* and clove *paneer* @ 2% level of alovera, mint and clove extract. The hardness of control, alovera *paneer*, mint *paneer* and clove *paneer* was 6.524, 4.229, 4.418 and 4.472 N. Lokhande (2013) [10] studied storage studies on textural aspects of selected Indian dairy products. Hardiness of *paneer* after 2 hr after preparation of product was 18.9341 ± 426 N and was increased 28.7832 ± 860 N on the next day. Singh *et al.* (2014) [14] studied impact of turmeric addition on the properties of *paneer*, prepared from different types of milk. They used cow milk, buffalo milk and mixed milk. In research found that hardness of *paneer* decreases with addition of turmeric powder in cow milk, buffalo milk and mixed milk *paneer* from 10.6 (control) and 7.92 (0.6%) in cow milk, 12.2 g (control) to 10.2 (0.6%) in buffalo milk, 11.33 (control) and 8.94(0.6%) in mixed milk. Khodke *et al.* (2014) [9] studied characteristic evaluation of soy-groundnut *panner*. They studied that textural properties of soy-groundnut *paneer* ranges from 666.7g, 659.1g, 612.6g, 435.7g, 211.6g and 93.2g for the treatments 100:00, 90:10, 80:20, 70:30, 60:40 and 50:50. In soy-groundnut *paneer* sample hardness value decreased. Prasad (2017) [13] studied anti-oxidative, physico-chemical and sensory attributes of burfi affected by incorporation of different herbs and its comparison with synthetic anti-oxidant (BHA). They used six different herbs, *viz.*, turmeric, ginger, clove, curry leaves, basil leaves and small cardamom, were incorporated (@1% of khoa) into burfi. Hardiness of developed burfi found that 40.96 (control), 42.33 (turmeric), 43.35 (cardamom), 42.38 (ginger), 41.22 (curry leaf), 43.67(clove) and 41.58 (basil).

Cohesiveness is the ratio of areas under the first and second bite. It is defined as the extent to which a material can be deformed before its rupture and it mainly depends upon the strength of internal bonds. The cohesiveness parameter ranged in between 0.15 to 0.18 for T₁ to T₄. The values of cohesiveness increased due to the increased level of raw turmeric extract respectively Supported by: Chitra (2009) [6] prepared alovera *paneer*, mint *paneer* and clove *paneer* @ 2% level of alovera, mint and clove extract. The cohesiveness of control, alovera *paneer*, mint *paneer* and clove *paneer* was 0.640, 0.452, 0.461 and 0.468. Lokhande (2013) [10] studied storage studies on textural aspects of selected Indian dairy products. Cohesiveness of *paneer* 2 hr after preparation of product was 10.4710 ± 0.42 which remained 0.449 ± 0.041 16th day of storage. Singh *et al.* (2014) [14] studied impact of turmeric addition on the properties of *paneer*, prepared from different types of milk. They used cow milk, buffalo milk and mixed milk. In research found that cohesiveness of *paneer* decreases with addition of turmeric powder in cow milk buffalo milk and mixed milk *paneer* from 0.23 (control) and 0.36 (0.6%) cow milk, 0.32 g (control) to 0.35 (0.6%) buffalo milk, 0.67 (control) and 0.68(0.6%) mixed milk. Prasad (2017) [13] prepared anti-oxidative, physico-chemical and sensory attributes of burfi affected by incorporation of different herbs and its comparison with synthetic anti-oxidant (BHA). They used six different herbs, *viz.*, turmeric, ginger, clove, curry leaves, basil leaves and small cardamom, were incorporated (@1% of khoa) into burfi. Cohesiveness of developed burfi found that 0.12 (control), 0.13 (turmeric), 0.14 (cardamom), 0.12 (ginger), 0.12 (curry leaf), 0.14 (clove) and 0.12 (basil).

Elasticity of raw turmeric extract added *paneer* ranged from 1.02 to 1.35 cm. Elasticity of product increases from T₁ to T₄. The elasticity observed in all treatments vary significantly between each other itself a proof that the following researchers were different values for elasticity in their product developed by using different ingredients and prepared different products. Examples of Babje (1989) [3] prepared *paneer* from soy milk and buffalo milk blend and stated that increase in proportion of soymilk increase the values of elasticity in *paneer* from 2.64 to 2.79. And Panchbhai (1994) [11] studied on the effect of hydrocolloids on the yield and quality of *chhana* and stated that the increased in proportion of sago starch in *chhana* increases the values of elasticity of *chhana* from 3.6 cm to 4.2 cm.

The gumminess of raw turmeric added *paneer* ranged from 1.04 to 1.18 kg/N for T₁ to T₄. The values of gumminess of the raw turmeric extract added *paneer* increases due to the increased level of raw turmeric extract. Lokhande (2013) [10] studied storage studies on textural aspects of selected Indian dairy products. Gumminess of *paneer* 2 hr after preparation of product was 8.917 ± 100 which remained 9.0711 ± 196 16th day of storage.

Chewiness is one of the most important textural properties of *paneer*. It is the energy required to masticate a solid food product to make it ready to swallowing. The chewiness was in the range of 1.06 to 1.53 kg-cm for T₁ to T₄ treatment combinations. The present result for chewiness compared with following researchers and found variation may be due to the different in products, raw material and preparation techniques.

Lokhande (2013) [10] studied storage studies on textural aspects of selected Indian dairy products. Chewiness of *paneer* 2 hr after preparation of product was 5.9750 ± 769 which remained 6.5770 ± 434 16th day of storage.

Poojitha (2017) ^[12] prepared safflower milk blended *paneer* used different coagulants C1 (citric acid), C2 (lactic acid), C3 (acetic acid). Chewiness of safflower blended *paneer* recorded as 0.70 (control), 0.63 (C1), 0.89 (C2) and 0.96 (3).

Chitra (2019) prepared alovera *paneer*, mint *paneer* and clove *paneer* @ 2% level of alovera, mint and clove extract. The chewiness of control, alovera *paneer*, mint *paneer* and clove *paneer* was 3.319, 1.989, 2.095 and 2.139 N.

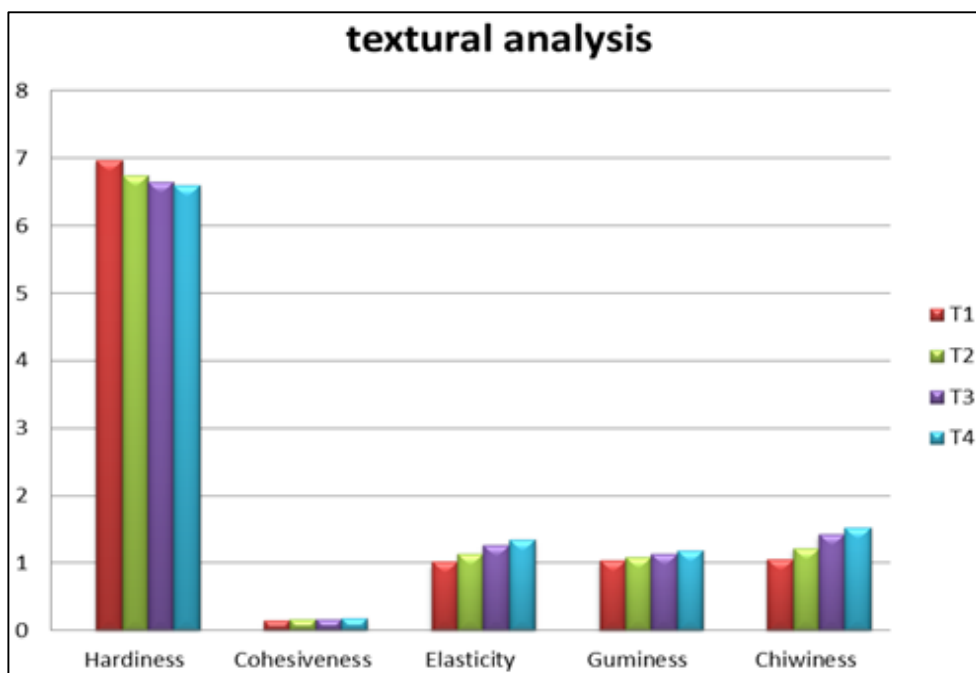


Fig 1: Geographical Representation for Textural analysis of Raw Turmeric Extract Added *paneer*

Conclusion

All the textural parameters i.e. hardness, cohesiveness, elasticity, guminess and chewiness these values were found to be significantly differed over control and between each other also excluding guminess. It is also noted that addition of increased proportion of raw turmeric extract from 5%, 10%, and 15% per cent in *paneer* had decreasing values of all the textural parameters. In other words, it can be stated that the addition of 5% percent raw turmeric extract in preparation *paneer* was found to be an optimum level as far as the textural qualities viz., hardness, elasticity, guminess and chewiness, respectively.

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