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Organoleptic Qualities of Retort Processed Commercial Paneer Butter Masala vs in-House Prepared Paneer Butter Masala

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Abstract

India, a leading milk producer, faces challenges with milk spoilage due to limited refrigeration. Paneer, a value added product rich in protein and minerals, offers a solution but has short shelf-life due to its higher moisture content (55 -60 % w.b.). Thepresentstudy was attempttodevelop the retort processed paneer butter masala using hot air dried paneer slices and the consumer preference of the in-house prepared paneer butter masala was conducted. The plain gravy for the paneer butter masala was prepared. The paneer was made from buffalo milk and cut to the specified dimensions of (20 mm × 20 mm × 5 mm) and was dried to the moisture content of 16.44 % (d.b.) in tray dryer. The dehydrated paneer slices were added with the plain gravy. The rehydration of paneer slices was done through the retort process. The sensory evaluation was done using the 9-point hedonic scale. The commercial paneer butter masala had overall acceptability (7.0526±0.32) scores that compared favorably with the overall acceptability (7.3158±0.27) scores of in-house preparedpaneer butter masala. The sensory scores were revealed that the in-house paneer butter masala was found superior to the commercially available paneer butter masala with respect to the sensory score of the organoleptic panel. Hence, the inventory cost of in-house retort processed paneer butter masala is minimized due its ambient storage whereasthe fresh paneer demands refrigerated storage. The commercial use of retort processed paneer butter masala will be the promising future to foodindustry.

Keywords: Paneer Butter Masala, Retort, Sensory, 9-Point Hedonic Scale.

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A tasty, healthy, and enticing native dairy product, paneer is made by heating and coagulating milk with acid. Paneer may be defined as the product obtained from the cow or buffalo milk or a combination of these two, by precipitation with sour milk, lactic acidor citric acid. Paneer is popular traditional heat and acid coagulated dairy product, which is mainly used as a base material for the preparation of large number of culinary dishes/snacks in almost all parts of country. Paneer is a highly nutritious and wholesome food as it contains milk fat, protein, minerals, vitamins, and other minor nutrients of milk (Patil 2006).

India is the world's top producer of milk, accounting for 25% of global production. According to the FAO Dairy Market Review (2023), India's milk output is predicted to reach 236.35 million tonnes in 2023-24, up 2.5% from the previous year and faster than the global growth rate (Anonymous, 2024). Indian paneer, or cottage cheese, is usually sold in blocks or slices.

On an annual basis in India, paneer, a value-added product, is made from 7% of milk produced (Kinjal *et al.,* 2015). Thebiologicalvalue(BV) of protein in paneer is in the range of 80 to 86 (Srivastava and Goyal, 2007).

A good paneer should have the characteristic flavor of heated milk mixed with acid; it should be nutty, sweet, and mildly acidic. Its texture and body should be smooth and compact, with just the right amount of firmness to hold its shape while slicing or cutting, and just enough tenderness to allow it to be easily mashed during the mashing process. Its body and texture need to be compact and smooth, with a slight greenish tinge in the case of buffalo milk paneer and light yellow in the

case of cow milk paneer(Kumar *et al.,* 2014). According to Sivaranjani *et al.* (2022) the optimal temperature for the full cream milk with citric acid (88°C at 0.3MPa) produced extremely soft paneer (105.84N).

Due to the presence of high moisture content (55-60 %), it is highly perishable and it makes the environment ideal for the growth of bacteria. The shelf life of paneer was only 6 days at refrigeration temperature (4°) without much deterioration in quality but the product lost its freshness after 3 days; The paneer could not be stored for more than a day at room temperature (Bhattacharya *et al.,* 1971). There have been several attempts made to extend the shelf life of paneer by using various physical and chemical techniques. Dehydration is a major technique used to reduce the moisture content in any perishable food. Microbes can be decreased by lowering moisture of the food products. Consequently,it is possible to prevent deterioration and extend the shelf life of products. Hot air drying at 75°C for 4 h can reduce the moisture into 5-9% and extend the shelf life of dehydrated paneer to 2 months (Vishweshwariah, 1987).

The paneer cubes were dehydrated in microwave oven in 700W at 80% and 90% power level for 2 and 3 min., respectively. With 90% power level at 700W of treatment, shelf life of paneer was improved and can be stored for 39 days in refrigeration temperature (Barman and Roy, 2018). The drying experiments on paneer using superheated steam at 62, 72, and 82°C and 10, 14, and 18 k Pa absolute pressures were studied by (Srivastava and Kumbhar 2010). The textural quality of paneer that had been dried using low pressure superheated steam was similar infreshly prepared paneer. To enhance the drying kinetics without sacrificing product quality, pre-treatment is a viable strategy before drying.

Sharma *et al.* (2018) evaluated the comparison of the two pre-treatments, which were blanching for 1 min, 2 min and dipping in $CaCl_2$ for 10 min. In conclusion, blanching pre-treated paneer cubes were removed more amount of water during drying. Furthermore, the dried sample that had been blanched showed the least amount of colour loss. Additionally, the combination of air drying along with lyophilisation could save time and energy consumption. Top of FormBottom of FormDehydrated paneer can be repositioned as multi-faceted value added cuisines like Paneer butter masala and Kadai paneer.

Paneer butter masala is a very popular convenience food in India and among Indians living in abroad. The acceptability of paneer butter masala depends not only on taste but also on the textural quality (firm, slightly chewy and not too soft) of paneer portion. It is an excellent substitute for meat in Indian cuisine (Kumar *et al., loc cit.*).

Paneer butter masala is among the most well-liked dishes crafted with paneer. After chicken gravy, paneer butter masala is the most popular dish (Market Research, 2024). The current study aimed to increase the shelf life of paneer butter masala made from dehydrated paneer slices through retort processing and it was compared with commercially available paneer butter masala.

Materials and Methods

Manufacturing of Paneer: Using a manual paneer hooper (200 mm × 200 mm × 200 mm) and a batch pasteurizer (100 L), paneer was made from buffalo milk. Using an electric pasteurizer, 10 L of milk was heated to 90°C

Table I. List of ingredients used for preparing paneer butter masala in the laboratory

S.No	Ingredients	Quantity (g)	(%)
1.	Oil	33	2.4
2.	Onion	203	14.8
3.	Tomato	365	26.7
4.	Red chili	3	0.2
5.	Cashew	33	2.4
6.	Water	655	47.8
7.	Butter	29	2.12
8.	Sugar	6.5	0.57
9.	Gingergarlic paste	20	1.5
10.	SpiceMix	19	1.4
11.	Salt	According to taste	
12.	Bayleaves	0.4	0.03
13.	Cardamom	0.3	0.02
14.	Cinnamon	0.3	0.02
15.	Kasurimethi	0.5	0.04
	Total	**1369**	**100**

without being held, then cooled to 70°C. Coagulation was achieved by adding water and vinegar to the milk in a 1:2 ratio and stirring continuously until the whey visibly separated. To settle the curd mass, coagulation was continued for an additional 5 minutes. Whey was drained using a muslin cloth. The resulting curd mass, known as 'chhana,' was compressed by a hooper. To facilitate better fusion of the curd, paneer was submerged in 4°C cold water. The paneer was sliced into 20 mm × 20 mm × 5 mm slices.

Drying of paneer slices: The sliced paneer were placed in a tray and dried at 50°C for 43 h using tray dryer as recommended by Arulkumar *et al*., (2023).

Preparation of plain paneer butter masala: The paneer butter masala was prepared using the ingredients mentioned in (Table I and II). The preparation flowchart of the in-house prepared paneer butter masala from dehydrated paneer slices was given in Fig 4. The pre-prepared plain masala showed in Fig 1.

Fig 1. In-housepaneer butter masala made using dehydrated paneer slices under laboratory conditions

Packaging: The quantity of 70 g pre-prepared plain masala was poured into retort pouch and 20 g dehydrated paneer slices were added to pouch together with 3 fold of water to the mass of the dehydrated paneer, for the purpose of rehydration of dried paneer. There tort pouches were sealed using a band sealer. The temperature was fixed at 200 °C. The Sealed retort pouch of paneer butter masala with dehydrated paneer slices was showed in Fig 2.

Retort Processing: Retorting was performed using a pilot- scale horizontal stationary water spray retorting system (Lakshmi Engineering Works, Chennai, India.) available at Department of Food Plant Operations, College of Food and Dairy Technology, Koduvelli. The filled and sealed retort pouches were laid flat on the tray. Steam was fed directly into the vessel in order to complete the retort processing in the retort unit showed in the Fig 3. Retorting was done at 121°C for 15 min at 200000 N/m^2 pressure (Didik *et al.,* 2020). The dehydrated paneer was rehydrated during the retort process.

Sensory evaluation: Sensory evaluation based on characterization and differentiation of the various sensory character such as body and texture, taste, flavor, color, appearance and overall acceptability of the in-house and commercial paneer butter masala were evaluated by a panel of 20 semi-trained judges on a 9-point hedonic scale. The composition of the commercial paneer butter masala was given in Table III.

Table II. Composition of spice mix

S. No	Ingredients	Quantity (g)
1	Red chili powder	4
2	Garam powder	2
3	Coriander powder	1
4	Turmeric powder	0.11
5	Kashmiri chili powder	10.5
	Total	**19**

Physico-chemicalanalysis

Acidity: A sample size of 2 g crushed paneer was added with 5 ml of distilled water and made into a paste using mortar and pestle.

Table III. List of ingredients and their quantification in a commercially available Paneer butter masala

S.No	Ingredients	(%)
1.	Butter	3
2.	Tomato	15
3.	Paneer	15
4.	Onion	7
5.	CashewNuts	1.4
6.	RefinedSunflowerOil,Water,Cream, Garlic Paste, Mixed Spices, Sugar, Ginger Paste, Iodized Salt, Green Chilli, Dried fenugreek Leaves	58.6
	Total	**100**

Fig 2. Sealed retort pouch of paneer butter masala containing dehydrated paneer slices

Fig 3. Retort unit used for the processing of in-house paneer butter masala

Then, 15ml of water was added to make it up to 20ml. To this 10 ml of 0.1 N NaOH and 2-4 drops of phenolphthalein indicator were added and titrated against 0.1NHCl till the pink color disappeared and then stirred vigorously. The titratable acidity as lactic acid equivalent was calculated by using the given formula (i) as mentioned by (IS: 10484, BIS 1983).

$$\text{Titratable acidity (\%)} = \frac{10\text{-V}}{\text{M}} \text{x } 0.9$$

Where,

V=Volume of the 0.1 NHCL required for titration and 0.9 is aconstant.

Moisture Content : The paneer slices were weighed using a weighing balance and moisture content of the sliced paneer was determined using the given equation (ii) as reported by Parveen and Pandian (2020).

Where,

$$\text{(ii)MC (\%)} = \frac{W_w}{W_d} \text{x } 100$$

MC= Moisture content in % (d.b.)

W_W =the weight of water evaporated to make the paneer-dry condition in *g*

W_d= Weight of dry matter content present in the paneer, g.

Dry ingrate: The dry ingrate for paneer was determined using equation (iii) as mentioned by Parveen and Pandian (*loc cit.*):

Where,

$$\text{(iii)K} = \frac{W_w}{T}$$

K = dryingrate, g/h

W_W = quantity of moisture evaporated, g

T = time taken (for drying) to remove water W_w g of moisture, h

Rehydration Ratio: The rehydration ratio of retort processed paneer was estimated. The rehydration ratio of the paneer slices was determined using Equation (iv) as mentioned by Sharma *et al*., (2018).

Where,

$$\text{(iv)RR} = \frac{M_r}{M_d}$$

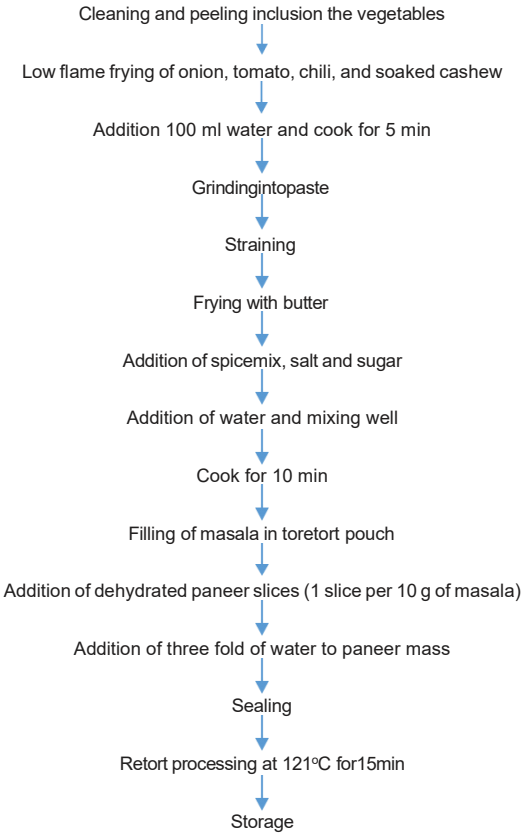
RR	=	Rehydration Ratio
Mr	=	Weight of paneer slices after rehydration (g)ie., after retort processing
Md	=	Weight of paneer slices after drying (g)

Results and Discussion

Drying rate: The Drying characteristics of paneer slice was analyzed at 50°C and observed for initial and equilibrium moisture content. The average value of drying time was found to be 43 h.

At the initial period of drying, the drying rate of dehydrated paneer was found increased with respect to time. This may be due to the evaporation of free moisture water

Fig 4. Process flow chart for the preparation of retort processed paneer butter masala



present in the dehydrated paneer slices. Then the drying rate decreased significantly and it became plateau with increasing drying time as showed in Fig 5. These drying characteristic results were found in agreement with Arulkumar *et al.,* (*loc cit.*).

Physico-chemical characteristics:

The average acidity value of thepaneer was found to be 0.318 % of lactic acid. The initial moisture content was determined as 106.92 % (d.b.) and the final moisture content was determined as 16.44 % (d.b). The rehydration ratio in the present study was found to be1.6891 which was in agreement with earlier observations (Arulkumar *et al.,loc cit*). The mean values of physio-chemical and drying properties of sliced paneer were illustrated in Table IV.

Sensory Analysis

The sensory scores of commercial and in-house paneer butter masala were furnished in (Table V). The result showed that the in-house preparedpaneer butter masala was found to be superior over the commercially available paneer butter masala.

The Fig. 6 represented the sensory scores of the in-house prepared paneer butter masala to the commercially available paneer butter masala. The overall acceptability was found to be 7.3158±0.27 where the commercial paneer butter masala secured a score of 7.0526±0.32.

Summary and Conclusion:

The study on consumer preferences recorded the highest score for the in-house prepared paneer butter masala made from dehydrated paneer slices over commercially available sample. The application of thermal treatments at 121° for 15 min enhances the sensory characteristics of the in-house prepared paneer butter masala. Retort processed paneer butter

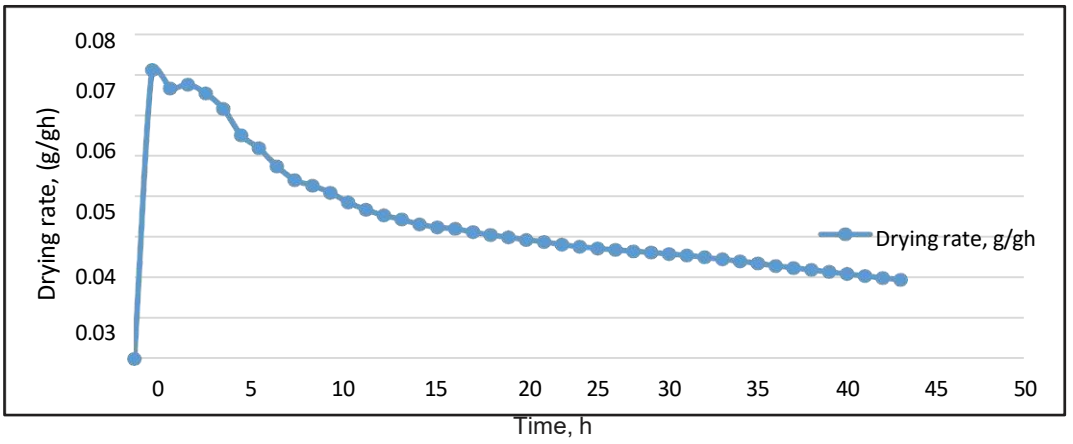


Fig 5. Drying rate characteristics of paneer slices at 50℃

Table IV. Mean values@ of physico-chemical and drying properties of sliced paneer

S.No	Sample	Average value of physico-chemical Properties
1.	Acidity,(%LA)	0.318
2.	Initial Moisture, (% d.b)	106.92
3.	Final Moisture, (% d.b)	16.44
4.	Drying Time, (h)	43
5.	Temperature, (°C)	50
6.	Rehydration Ratio	1.6891

@Average of three trials

masala made from dehydrated paneer slices have a number of benefits, such as maintaining food quality without requiring refrigeration and providing a convenient, shelf-stable, ready-to-eat meal that can be kept for a long time.This research highlighted the potential for improving the sensory and quality of dried paneer product through advanced processing methods, catering to the evolving preferences of consumers for high-quality, convenient and flavourful dairy products.

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Table V. Sensory evaluation (Mean±SD) scores of the commercial and in-house prepared paneer butter masala

Sample	Bodyand Texture	Taste	Flavour	Colour	Appearance	Overall acceptability
Control	6.9474±0.27	6.6842±0.37	6.7895±0.36	7.3158±0.24	7.3158±0.27	7.0526±0.32
T1	7.0000±0.33	7.4211±0.27	7.1053±0.26	7.2632±0.18	7.2105±0.29	7.3158±0.27

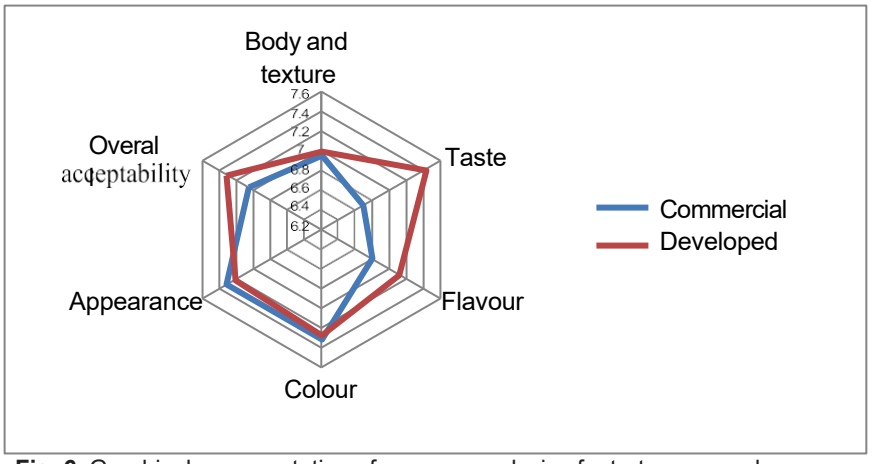

Fig. 6. Graphical representation of sensory analysis of retort processed paneer butter masala.

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