

Development, Evaluation and Storage Studies of Flavour Enriched Herbs-Based Paneer

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Abstract

Paneer represents a South Asian variety of soft cheese prepared by acid and heat coagulation of milk. It is a rich source of animal protein and fat. Paneer used commercially are without flavours and is bland in taste. Potherbs are, Green leafy vegetables (GLV) are rich in micronutrients and functional components. Therefore, in the present study an attempt was made to develop Paneer, by addition of different herbs such as Kasuri methi, Curry leaves and Spinach. All paneer samples were prepared with 5% fat and 8.5% Solid not fat of milk using citric acid as coagulant. All herb based paneer samples were prepared by addition of 2% herbs. All paneer samples were analyzed for nutrient, quality, sensory and microbial parameters. Sensory analysis of paneer samples were carried out by preparing Paneer butter masala. The samples were studied for its storage stability by keeping at refrigerated condition (0-4°C) for 30 days and analysed for quality, sensory and microbial analysis. Control paneer, kasuri methi and spinach added paneer samples had good keeping quality till 30 days and curry leaves added paneer sample could be stored till 25 days under the refrigerated condition.

Key words: Kasuri methi; Curry leaves; Spinach; Storage stability; Flavour

Introduction

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 highly nutritious and wholesome food as it contains milk fat, protein, minerals, vitamins and other minor nutrients of milk (Patil, 2006).

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 acid or ascorbic acid. About 5% of milk produced in India is converted into "Paneer" (Torres et al., 2007). Paneer

must be uniform and have a pleasing white appearance with a greenish tinge when prepared from buffalo milk and light yellow when prepared from cow milk. Paneer is characterized by a mild acidic flavour with slightly sweet taste, a soft, cohesive and compact texture. It is an excellent substitute for meat in Indian cuisine (Sunil, 2014). In comparison to other dairy products paneer has many advantages. The technology of manufacturing and handling of paneer is relatively simple. The equipment required are relatively less sophisticated and less costly.

Curry leaves, Spinach and Kasuri methi belongs to herb family, which have been used in many different ways. Since the ancient times, culinary herbs have been added to food to enhance flavour and improve their organoleptic properties. Herbs have also been widely used as preservatives and medicine. Herbs have been extensively studied in different countries because of the high antioxidant activity and their beneficial effects on human health (Yashin, 2017).

Fenugreek (*Trigonella foenum-graecum* L.) commonly known as methi. It belongs to the family Leguminosae, genus *Trigonella*. Cultivated Fenugreek (*Trigonella corniculata* L.), also known as Kasuri methi (Pasricha and Gupta, 2014). Methi leaves are being consumed almost all around the world owing to its several uses. Major medicinal uses of methi include its anti-diabetic, lowering cholesterol level, anti-cancer, anti-microbial activities. The biological and pharmacological properties of methi are accredited to the diversity of its components such as poly-phenolic substances, volatile components, amino acids, etc. (Mehrafarin et al., 2010).

Murraya koenigii commonly known as curry plant belongs to the family Rutaceae (Harish et al., 2012). Curry leaves are used for flavouring and spicing of food. The curry leaf is believed to have various curative properties like anti-diabetic, anti-oxidant, antimicrobial, anti-inflammatory, anticarcinogenic and hepato-protective properties (Kirupa et al., 2015).

Spinach (*Spinach oleracea*) is an wholesome flowering plant in the family of Amaranthaceae. Spinach has a high nutritional contents and is exceptionally rich in antioxidants, especially when fresh, steamed, or quickly boiled (Kavitha and Ramadas, 2013). Spinach contains different carotenoids and high concentration of vitamins like A, E, C, and K. and in addition folic acid, oxalic acid, various minerals (Guha and Das, 2008). Apart from having nutritional value, it has been also credited with various biological activities like virus inhibitor (Adam et al., 2008), anthelmintic (Patil et al., 2009), and antioxidant (Verma et al., 2003), hepatoprotective (Gupta and Singh, 2006) and reducing risk of breast cancer (Longnecker et al., 1997).

Paneer used commercially are without flavors and is bland in taste. Therefore, in the present study, an attempt was made to develop flavor enriched paneer with increased nutrients and shelf life by using natural ingredients like potherbs leafy vegetables viz., kasuri methi, spinach and curry leaves, and evaluate the nutritional and quality parameters.

Materials and Methods

Materials

Collection of milk and other ingredients

Fresh cow's milk, other ingredients such as kasuri methi, curry leaves, spinach and lemon (citric acid) were procured from the local market of Mysuru.

Chemicals

All chemicals and media used in the study were of analytical grade and were purchased from S D fine chemicals limited, Mumbai -30 and nice chemicals (P) Ltd., Kerala, India.

Packaging and Storage of Paneer

Prepared control paneer and different herbs-based paneer were packed in low density polyethylene pouches (LDPE) and stored at refrigerated condition (4°C) for shelf life evaluation.

Methods

Preparation of Control Paneer

Paneer was prepared as per the procedure led down by Bhat-tahacharya et al., (1971). Milk standardized to 5% fat and 8.5% SNF was heated upto 85°C (the desired temperature for coagulation). The milk was heated and then cooled to 70 to 75°C. Freshly prepared coagulation was heated to 70°C prior to addition in order to maintain the coagulation temperature (70°C), then 2% citric acid solution, the coagulate was added to milk with constant and gentle stirring till curd formation then it was allowed to settle for about 5 minutes. Curd was separated out from the whey by pouring the content over muslin cloth, stretched over an empty vessel. The separated curd was filled into hoops lined with muslin cloth and for about 20-25 minutes. The pressed Paneer was removed from the hoop and transferred to chilled water (4 to 6°C for 2 hours) and then placed on wooden plank to allow loose water for about 10-15 minutes. Then after draining Paneer was cut into cubes.

Preparation of Paneer by the addition of Herbs

a. Kasuri Methi Paneer

Milk was standardized to 5% fat and 8.5% SNF



Heated upto 85°C and then cooled to 70 to 75°C



Kasuri methi (2%) was added to milk



Paneer was prepared according to the procedure followed to develop control paneer.



b. Preparation of Curry leaves Paneer

Milk was standardized to 5% fat and 8.5% SNF



Heated upto 85°C and then cooled to 70 to 75°C



Cleanly chopped Curry leaves (2%) was added to milk



Paneer was prepared according to the procedure followed to develop control paneer.

c. Preparation of Spinach Paneer

Milk was standardized to 5% fat and 8.5% SNF



Heated upto 85°C and then cooled to 70 to 75°C



Blanched Spinach paste (2%) was added to milk



Paneer was prepared according to the procedure followed to develop control paneer.

Organoleptic evaluation

The developed control paneer and flavoured herbs-based paneer were evaluated for sensory characteristics such as appearance, colour, texture, flavour, taste and overall acceptability, and were served to semi trained panelists for organoleptic evaluation on a nine point hedonic scale, with score 9 as excellent and score 1 as disliking. Sensory evaluation was carried out by 20 semi trained panel members (Devaki and Premavalli, 2012).

Analysis

Moisture content, ash content and free fatty acid (FFA) values in herbs-based paneer were carried out as per the method of AOAC (2005). Carbohydrates, protein, and fat contents was carried out as

per the method described by AOAC (1990). Titratable acidity expressed as Lactic acid (%) was carried out as per the method of AOCS (1999). pH was measured using microprocessor based digital pH meter (CYBER SCAN, MODEL PH 1500, EUTECH INSTRUMENTS, India). Water activity was measured by Aqualab 4TE water activity meter. Microbiological analysis was carried according to APHA (1992) and data were transformed into logarithms of the number of colony forming units (CFU/ml).

Statistical analysis

The data obtained for all the parameters and effect of storage on them was statistically analyzed through student t-test to see the critical difference at 5% level of significance using CPCS1 software.

Results and Discussions

Nutritional composition of different flavoured paneer

Initially, control and all the different herb-based flavoured paneer were evaluated for nutrient composition. Control paneer had moisture 41.2%, protein 18%, fat 32%, ash 1.66% and carbohydrates 7.14%. Kasuri methi paneer had moisture 40.7%, protein 20%, fat 28%, ash 2.33% and carbohydrates 8.97%. Curry leaves paneer had moisture 44.4%, protein 20.2%, fat 28%, ash 2% and carbohydrates 5.4%. Spinach paneer had moisture 42.8%, protein 20.5%, fat 28%, ash 1.66% and carbohydrates 7.04%. Developed spinach paneer showed lesser in fat and carbohydrates, higher in moisture, protein and ash. This is because of the addition of blanched spinach paste increased the moisture content. According to Shivakumar et al., (2014) standard paneer had moisture 50.74%, protein 22.8%, fat 28.88% and ash 1.60%. When compared with the control paneer, the results obtained from the present study showed that there was significant decrease in moisture in kasuri methi paneer; increase in protein and ash; and decrease in fat in all the flavoured paneers.

Storage studies of Control and different flavoured paneer

Shelf life of any product shows its ability for being stored for a definite period of time without any deteriorating effects on its quality parameters. Storage life of developed products indirectly shows the market life of the product. The shelf-life of paneer is reported to be only 6 days at 10°C without much deterioration in quality but the freshness of the product lost after 3 days (Bhattacharya et al., 1971). Its flavour remains acceptable even after 120 days when stored at -13 to -32°C (Arora, 1980). Herbs are currently used mainly for enhancing the flavour of foods (Almeida et al., 2000). Kaur et al., (2003) and Bajwa et al., (2005) reported that incorporation of

coriander and mint at level of 10% by weight in paneer improved the overall acceptability score and yield of product. In addition to imparting flavour, certain herbs prolong the shelf life of foods due

to their bacteriostatic or bactericidal activity and prevent rancidity by their antioxidant activity (Sharda 1980).

Paneer Samples	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	CHO (%)*
Control	41.2±0.03	18.0±0.02	32.0±0.07	1.66±0.03	7.14±0.23
Kasuri methi	40.7±0.21	20.0±0.12	28.0±0.03	2.33±0.04	8.97±0.16
Curry leaves	44.4±0.05	20.2±0.14	28.0±0.16	2.00±0.12	5.40±0.10
Spinach	42.8±0.08	20.5±0.07	28.0±0.01	1.66±0.05	7.04±0.12

*CHO – carbohydrate

Table 1: Nutritional composition of different flavoured paneer (n = 3).

In the present study, four different types of paneer viz., control, herb based - kasuri methi, curry leaves and spinach paneers were developed. Paneer samples were stored at refrigeration condition (4°C) and were evaluated periodically for quality parameters, sensory parameters and microbial parameters. pH, Water activity, titrable acidity and free fatty acids, were considered as quality parameters, sensory evaluation for overall acceptability and microbiological studies were studied in the stored samples. The acceptability scores helped to establish the shelf life.

Changes in Quality parameters

The results on the changes in quality parameters during storage of control and different flavoured paneer are given in Table 2. As shown in the table, there was decrease in pH from 6.0 to 5.0 in control paneer during first month of storage. In kasuri methi, curry leaves and spinach paneer, pH was decreased from 6.1 to 5.1, 6.0 to 5.5 and 6.2 to 5.8 respectively. Bhattacharya et al., (1971) observed similar decreasing trend in pH in citric acid and cultured whey treated samples of vacuum packaged skim milk paneer and paneer prepared from standardized buffalo milk (pH from 6.60 to 5.80) respectively during storage under room refrigeration temperature (7°C).

There were decreasing trends in water activity from 0.98 to 0.90 in control paneer during first month of storage. In kasuri methi, curry leaves and spinach paneer, water activity were decreased from 0.97 to 0.89, 0.99 to 0.90 and 0.97 to 0.91 respectively. Das et al., (2018) observed similar decreasing trend in water activity from 0.99 to 0.92 when stored at 4°C±1.

Titrable acidity in control paneer increased from 0.63 to 0.90, in kasuri methi, curry leaves and spinach paneer, titrable acidity were increased from 0.90 to 1.44, 0.72 to 1.99 and 0.72 to 1.08 % of lactic acid respectively. As shown in Table 2. Khatkar et al., (2017) estimated the titrable acidity and were found to be 0.16 to 0.43 in 5 days in LDPE when stored at 8±1°C. The increase in titratable acidity of control and flavored paneer samples is a natural process. The increase in titrable acidity of paneer during storage was also reported previously by various research workers (Bhattacharya et al., 1971). Free fatty acids values of all control and different flavoured paneer got increased. Khatkar et al., (2017) 0.175 to 0.541 in 5 days in LDPE when stored at 8±1°C. The increase in free fatty acids was mostly due to lipolysis action.

Quality parameters	Period in days	Control paneer	Kasuri methi paneer	Curry leaves paneer	Spinach paneer
pH	0	6.0±0.01	6.1±0.27	6.0±0.14	6.2±0.17
	10	5.7±0.04 ^c	5.8±0.27 ^b	5.9±0.13 ^c	6.0±0.19 ^c
	20	5.4±0.12 ^c	5.5±0.10 ^c	5.7±0.17 ^a	5.9±0.32 ^b
	30	5.0±0.11 ^b	5.1±0.15 ^a	5.5±0.13 ^c	5.8±0.20 ^a

Water activity	0	0.98±0.19	0.97±0.17	0.99±0.15	0.97±0.14
	10	0.94±0.02 ^a	0.95±0.19 ^a	0.97±0.16 ^b	0.95±0.16 ^a
	20	0.92±0.18 ^b	0.92±0.14 ^c	0.95±0.23 ^a	0.93±0.21 ^b
	30	0.90±0.36 ^a	0.89±0.11 ^c	0.90±0.14 ^c	0.91±0.11 ^b
Titrable acidity (% Lactic acid)	0	0.63±0.13	0.90±0.15	0.72±0.21	0.72±0.12
	10	0.63±0.18 ^a	1.02±0.17 ^b	0.90±0.27 ^b	0.90±0.16 ^a
	20	0.72±0.21 ^b	1.08±0.18 ^a	1.08±0.11 ^c	0.90±0.05 ^a
	30	0.90±0.12 ^c	1.44±0.15 ^a	1.99±0.17 ^c	1.08±0.16 ^b
Free fatty acid(%/g)	0	0.78±0.23	0.78±0.19	0.81±0.04	0.78±0.03
	10	0.90±0.16 ^b	1.01±0.20 ^c	0.84±0.06 ^c	1.41±0.18 ^a
	20	1.77±0.18 ^a	1.97±0.27 ^c	2.00±0.07 ^a	1.97±0.16 ^a
	30	1.90±0.16 ^b	2.17±0.21 ^a	3.32±0.17 ^c	2.14±0.02 ^a

*Note: Values with different superscripts are significant difference with initial period at the level, a: p<0.0001, b: p<0.001, c: p<0.01, d: p<0.05

Table 2: Quality parameters of control and different flavoured paneer (n = 3).

Changes in sensory parameters

One of the most important criteria for evaluation of foods is their acceptability which is based on the sensory attributes. In this study, the products were served to a semi-trained group of panelists with 20 panel members. Samples were randomly drawn for each experimental block, coded and served to the panelists. Initially control and flavored paneer cubes- paneer butter masala and rated for their organoleptic characteristics in the terms of appearance, color, texture and body, flavor, taste and overall acceptability on the 9 point hedonic scale. As shown in Table 3, the control paneer butter masala was rated as 8.1 for texture and appearance, 8 for colour, flavor, taste and overall acceptability (OAA). Kasuri methi paneer butter masala had score of 8.58 for appearance, 8.47 for colour, 8.52 for texture, 8.74 for flavor, 8.75 for taste and 8.6 for

OAA. Curry leaves paneer butter masala had score of 8.9 for appearance, 8.54 for colour and texture, 8.7 for flavour, 8.66 for taste and 8.76 for overall acceptability. Spinach paneer butter masala had score of 8.9 for appearance, taste and overall acceptability, 8.88 for texture, 8.84 for colour and 8.81 for flavor. All the four products showed good sensory scores and were highly acceptable. Among herb-based paneer, spinach paneer had highest scores for all sensory parameters. Initially acceptability scores of control and different flavoured paneer butter masala viz., Kasuri methi, Curry leaves and spinach was 8.9, 8.6, 8.76 and 8.9 on 9 point hedonic scale and decreased slowly with the storage period and curry leaves paneer got spoiled on 25th day of storage

SL.No	Paneer	Period In days	Appearance	Colour	Texture	Flavor	Taste	Overall acceptability
01	Control paneer	0	8.10±0.18	8.00±0.19	8.10±0.18	8.00±0.22	8.00±0.12	8.00±0.10
		10	7.67±0.02 ^c	7.65±0.16 ^a	7.76±0.14 ^c	7.79±0.11 ^a	7.40±0.11 ^a	7.62±0.09 ^c
		20	7.42±0.07 ^c	7.35±0.13 ^a	7.35±0.07 ^c	7.55±0.12 ^a	7.19±0.02 ^c	7.36±0.23 ^a
		30	7.22±0.06 ^c	7.11±0.12 ^c	7.14±0.09 ^c	7.20±0.11 ^c	7.05±0.01 ^c	7.16±0.12 ^a
02	Kasuri methi	0	8.58±0.18	8.47±0.14	8.52±0.21	8.74±0.19	8.75±0.06	8.60±0.04
		10	8.57±0.09 ^c	8.42±0.05 ^c	8.48±0.26 ^a	8.48±0.12 ^c	8.73±0.09 ^a	8.43±0.45 ^c
		20	8.37±0.18 ^c	8.25±0.17 ^c	8.27±0.11 ^b	8.35±0.19 ^a	8.35±0.14 ^a	8.40±0.87 ^a
		30	8.25±0.09 ^c	8.28±0.07 ^c	8.22±0.16 ^b	8.22±0.10 ^c	8.22±0.27 ^a	8.37±0.12 ^b

03	Curry leaves	0	8.90±0.15	8.54±0.53	8.54±0.13	8.70±0.43	8.66±0.49	8.76±0.09
		10	8.62±0.17 ^b	8.55±0.29 ^b	8.10±0.16 ^a	8.00±0.32 ^c	8.20±0.26 ^a	8.05±0.34 ^c
		20	7.87±0.54 ^c	7.65±0.09 ^a	7.12±0.32 ^c	7.43±0.13 ^b	7.18±0.18 ^a	7.42±0.21 ^b
04	Spinach	0	8.90±0.32	8.84±0.51	8.88±0.26	8.81±0.18	8.90±0.12	8.90±0.31
		10	8.59±0.65 ^c	8.48±0.19 ^a	8.55±0.06 ^c	8.34±0.03 ^a	8.29±0.06 ^a	8.28±0.17 ^b
		20	8.15±0.43 ^a	8.07±0.49 ^b	8.35±0.02 ^a	8.20±0.08 ^c	8.25±0.01 ^b	8.18±0.28 ^a
		30	8.05±0.76 ^a	8.03±0.27 ^c	8.24±0.45 ^a	8.20±0.41 ^c	8.19±0.05 ^a	8.14±0.18 ^c

*OAA- overall acceptability

*Note: Values with different superscripts are significant difference with initial period at the level, a: p<0.0001, b: p<0.001, c: p<0.01, d: p<0.05

Table 3: Sensory scores of Control and flavored Paneer butter masala (n = 20).

Changes in Microbial parameters

The developed flavored paneer samples were evaluated for its microbial qualities and are represented in Table 4. Singh et al., (2014) studied microbial quality of turmeric incorporated paneer for standard plate count (SPC) and yeast & moulds. The rate of change in standard plate count of samples containing turmeric is slower than the samples without turmeric. David (2014) examined peanut paneer for microbiological studies such as standard plate count and coliform test. He reported that coliform count was completely absent in the prepared peanut paneer samples. The microbiological analysis carried out in the present study, clearly shows the sterilization of the products and the microbial readings were within the limits of FSSAI. SPC had shown increasing trend with extended storage however on storage at refrigerated temperature, SPC was present in control and all flavored paneer samples was less in quantity according to FSSAI specification. Yeast and moulds were present in all flavored paneer samples. Coliform was nil in control paneer, kasuri methi paneer and spinach paneer and were stable upto one month at refrigerated temperature (4°C). Curry leaves paneer got spoiled on 25th days due to microbial growth (mould growth) on the surface of the paneer samples. Curry leaves paneer samples had less keeping quality under the refrigeration condition. Control paneer, kasuri methi paneer and spinach paneer samples were not spoiled till 30th days under refrigeration condition (4°C), so these paneer samples had good keeping quality more than 30 days under the refrigeration storage condition. The microbiological analysis showed the sterilized condition of the paneer, coliform was nil, which was reflecting the safety of the product.

Serial number	Samples	Period in month	Standard plate count (CFU/gm)	Coli-forms (CFU/gm)	Yeast & Moulds (CFU/gm)
1	Standard	0	28×10 ³	Nil	24×10 ¹
		1	75×10 ³	Nil	52×10 ¹
2	Kasuri methi	0	24×10 ²	Nil	20×10 ¹
		1	91×10 ²	Nil	58×10 ¹
3	Curry leaves	0	31×10 ²	Nil	21×10 ¹
		1	171×10 ²	2×10 ¹	71×10 ¹
4	Spinach	0	30×10 ³	Nil	23×10 ¹
		1	105×10 ³	Nil	84×10 ¹

Table 4: Microbial analysis of Control and flavored Paneer.

Conclusion

Paneer represents a variety of soft cheese, which is used as a base material for the preparation of a large number of comestible dishes and is highly nutritious and wholesome. Paneer is bland in taste, so in the present study, herbs viz., kasuri methi, curry leaves and spinach based paneer were developed. When the nutritive value was compared with control, the herb-based paneer samples were rich in protein, ash and had lesser amount of fat. Sensory scores revealed that herbs-based paneers had more acceptability scores compared to control paneer. These flavoured paneer helped to enhance the overall acceptability of products prepared, and therefore improves the consumption rate. During storage, quality parameters

and microbial counts were increased and sensory scores were decreased. The developed standard paneer, kasuri methi and spinach paneer were stable for one month, curry leaves paneer was stable for 25 days at refrigerated condition.

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