www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(11): 809-814
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www.thepharmajournal.com
Received: 21-09-2017
Accepted: 22-10-2017

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Preparation and quality assessment of Chhana Podo prepared by using buffalo, coconut and soy milk

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DOI: https://doi.org/10.22271/tpi.2017.v6.i11l.1504

Abstract
Chhana podo is an indigenous baked dairy product. Baking is the key step in the preparation of chhana podo prepared by using buffalo milk, coconut milk and soy milk during which the product undergoes physico-chemical and structural changes due to simultaneous heat and mass transfer. The objective of this study was to optimize the baking conditions of chhana podo using response surface methodology, and to predict the physico-chemical and microbiological properties of chhana podo during baking. Chhana podo was prepared by kneading chhana, sugar and semolina (20:5) to a homogeneous and smooth dough. A Study on the Chhana podo prepared by using Milk of Buffalo, Coconut and Soy Milk**".** Soy Milk is low in fat, carbohydrate, calcium, phosphorus, and riboflavin, but high in iron, thiamin, and niacin in comparison with cows' Milk. Soy Milk contains higher amount of protein than Buffalo Milk and is deficient in sulfur containing amino acids. Channa podo prepared by buffalo, coconut and soy milk in treatment T_3 was best in terms of organoleptic characteristics and received highest score in organoleptic evaluation (colour & appearance, body & texture, Flavour & taste, overall acceptability). In view of the experimental results obtained during the present investigation, it may be concluded that the channa podo prepared by buffalo, coconut and soy milk can be successfully prepared.

Keywords: Buffalo milk, coconut milk, soy milk sugar, maida and citric acid or lactic acid

Introduction
Milk and milk based products have been a good source of nutrition to human health.India has emerged as the largest milk producing country in the world with present level of annual milk production estimated as 94.5 million tones. We expect a production level of 135 million tones by the year 2015. The livestock population is projected to increase to 322 million by the year 2015.A number of traditional techniques developed at home for preparing foods have been modified and improved.

They are now being converted into technologies that are science and engineering based to make these products commercially in larger quantities for institutional uses and for establishing economically viable food industries to meet the emerging socio-economic conditions. India's total production of Chhana a heat acid coagulated product is 2 million tonnes valuedat Rs 7000 million As per ISI specification (1964) Chhana is a coagulated product obtained by the acid coagulation of whole or standardized milk of cow, buffalo or their admixtures. The coagulant used can be sour Chhana whey, lactic acid or citric acid. Chhana shall not contain any ingredients foreign to milk. According to Prevention of Food Adulteration (PFA) rules (1976), the Chhana product shall not have more than 70% moisture and not less than 50% fat on dry matter basis. Chhana serves as a base material and filler for a large variety of Indian sweet-meats like Rosogolla, Sandesh, Chum-Chum, and Chhana-Murki, etc.

The production of Chhana is confined mostly to the eastern region of the country notably West Bengal, Bihar and Orissa. This is mainly due to technological development for the preservation and packaging, leading to enhanced shelf life, better buying capacity and versatile food habits etc. (Sanjai Kumar and R. Chandra 2016)

The traditional dairy products are of masses made in india since time immemorial. The products have great social religious, cultural, meditional and economics importance. It is estimate that about 50 to 55% (approx 42 million tonnes) of milk produced in India is converted into variety of Indian milk products valued at Rs 400 billion (Patil and Pal, 2005) on products.

India has a heritage of many indigenous ethenic cultures and thousands of delicious recipes that have developed over millennia. The food of nearly 50 major Indian cultures and many minor cultures have created over 5000deitary preparations which includes the items of daily consumption to protect and sustain health. Historically techniques have been developed for the protection, storage and preparation of diets, the ingredients of which mutually supplement and complement each other to provide balanced and more delicious diets. A number of traditional techniques developed at home for preparing foods have been modified and improved. They are now being converted into technologies that are science and engineering based to make these products commercially in larger quantities for institutional uses and for establishing economically viable food industries to meet the emerging socio-economic conditions. India's total production of Channa a heat acid coagulated product is 2 million tonnes valued at Rs.7000 million (Aneja *et al*. 2002) [2].

According to Prevention of food adulteration (PFA) rules 1976, the product shall not have more than 70% moisture and not less than 50% fat on dry matter basis. Skim milk chhana shall contain not more than 13% fat of the dry matter (IS 5162, 1962). Chhana serves as a base nmaterial and filter for a large variety of indian sweets meats like Rossogolla, Sandesh, Chum chum and chena murki etc. the production of chhana is confined mostely to the estern region of the country notably West Bengal, Bihar and Orissa. This is mainly due to enhanced shelf life, population flow across the globe, better buying capacity and versatile food habits etc.

Kelu bheru in Phal and Pratihara family in puri was the first to prepare Podo delicacy, Podo means burning in oriya. There are 16 major production centers in present in Orissa and outputs from those centers are 600 tonnes/annum. The total annual production of chhana podo is 1000 tonnes/annum. The value of product is Rs 80m\ million (Ghosh *et al*. 2002).

Traditionally chhana podo is prepared by mixing of chhana, Maida and sugar in a alluminium vessel and baking it slowly by keeping red burnt wood on top and bottom depend upon size, shape of the product. Chhana podo has no proper size and shape and it is prepared as per desired ness. The size shape and appearance varies from place to place and once manufacture to another.

Buffalo Milk

Buffalo Milk is used for Chhana making as it yields fine, compact, close knit and smooth texture with velvety body, which is highly desirable for different Chhana based products. High calcium content, different protein make up, higher total solids and curd tension of Buffalo Milk as compared with Cow Milk results in harder and coarse Chhana. Therefore, a study was undertaken in order to find out suitable concentration of different coagulants to make best quality Buffalo Milk Chhana (Kulkarni *et al*., 1984).

Table: Composition of buffalo milk

Water	83.84
Fat	4.5
Protein	1.0
Ash	0.2
Lactose	7.1

Soy Milk

Soy milk is made by soaking soybeans, grinding them with water. The fluid which results after straining is called soy milk. You can make soy milk at home with basic kitchen tools or with a soy milk machine. Soy milk is most commonly found in aseptic cartons. Most of the soy milk available in the market is flavoured and fortified with extra calcium or vitamins Soymilk is an excellent source of high quality protein and B-vitamins. Soymilk is not a rich source of calcium, this is way most commercial soymilk products are fortified with calcium. Soy protein is highly digestible (92 to 100%) and contains all essential amino acids. Soy protein products contain high concentration (up to 1 g/kg) of isoflavones that exerts protective properties against breast, prostate, colon and lung cancers (Gupta, 1976).

Composition of soy milk

Water	93.3	G
Fat	2.0	G
Protein	2.8	G
Ash	0.27	G
Lactose	1.8	G

Coconut Milk

Coconut milk is the liquid that comes from the grated meat of a brown coconut. It should not be confused with coconut water. The color and rich taste of coconut milk can be attributed to the high oil content. Most of the fat is saturated fat. Coconut milk is a very popular food ingredient used in Southeast Asia, South Asia, Southern China, the Caribbean and north of South America. Coconut Milk is derived from the flesh of the coconut. It is not the liquid that can be drained out from a coconut that has been punctured, although many people assume this. Getting coconut Milk from a coconut requires some processing, but the ingredient is also available in cans or bottles.

Coconut milk contains a large proportion of lauric acid, a saturated fat that raises blood cholesterol levels by increasing the amount of high-density lipoprotein cholesterol that is also found in significant amounts in breast milk and sebaceous gland secretions.

Composition of coconut milk

Fat	24
Carbohydrate	6
Protein	2
Water	68

Health Benefits of coconut and soy milk:

- Improves Heart Health by Lowering Blood Pressure and Cholesterol.
- Builds Muscle and Helps Lose Fat.
- Great source of magnesium.
- Moisturizer and treatment of sunburns.
- Provides Electrolytes and Prevents Fatigue.
- Helps Lose Weight.
- Improves Digestion and Relieves Constipation.
- Improve Lipid Profile.
- Strengthen Blood Vessel Integrity.
- Promote Weight Loss.
- Prevent Prostate Cancer.
- Prevent Postmenopausal Syndromes.
- Prevent Osteoporosis.

Justification

Chhana is still in its infancy and needs various parameters to be fixed and tested before its commercial use and large scale productions by organized sector. The present investigation entitled, "A Study on the Chhana podo prepared by using Milk of Buffalo, Coconut and Soy Milk**".** Soy Milk is low in fat, carbohydrate, calcium, phosphorus, and riboflavin, but high in iron, thiamin, and niacin in comparison with cows' Milk. Soy Milk contains higher amount of protein than Buffalo Milk and is deficient in sulfur containing amino acids. Soy Milk is characterized by beany or soy flavor which can be modified by lactic acid fermentation.

Review of Literature

Ray and De, (1954) suggested that Buffalo milk contains all the nutrients in higher proportions than cow milk. The compositional differences between buffalo and cow milk are reflected on their physical and chemical properties. Buffalo milk is the more preferred for preparing milk and dairy of western and indigenous. The inherent properties of buffalo milk like high total solids.

Stan, (2003), Coconut milk is the liquid that comes from the grated meat of a brown coconut. It should not be confused with coconut water.

Kumar, (2008) [12] developed the technology for dietetic chhana podo. He used three different artificial sweeteners namely aspartame, sucralose and saccharine, and reported that sucralose was the most suitable for dietetic chhana podo.

Kumar and Bhatia, (1994) reported that lipase and phosphates activity were less in buffalo milk. The free amino acids were presents as 0.44% and 0.15%, respectively in buffalo milk and cow milk.

Production of Chhana

Chhana is a soft solid coagulated mass formed by the acid precipitation of milk proteins. It is used as a base material for most milk-based sweets like rasogolla, rasmalai, chum-chum, sandesh, chhana podo, etc. Its characteristics are creamish-white appearance with compact spongy body, sweetish and acidic flavour. Though this product originated in the eastern states, it is now popular in the north and northwestern regions of India (Aneja *et al*., 2002) [2]. Production of chhana involves precipitation of casein along with entrapped fat and water soluble components of milk (lactose, whey proteins, minerals, vitamins) by addition of coagulating agent like citric acid.

Material and Methods

Collection of ingredients

Buffalo milk buffalo milk (6.0fat, 9.0SNF) was collected from the local market of Allahabad.

Coconut milk Coconut was collected from the local market of Allahabad

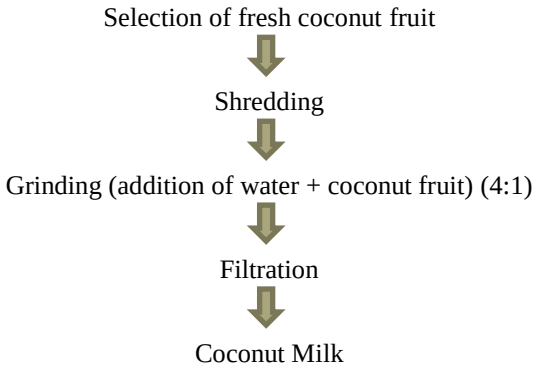
Soya milk Soy was collected from the local market of Allahabad

Citric acid obtained from research lab, college of food and dairy technology, Allahabad.

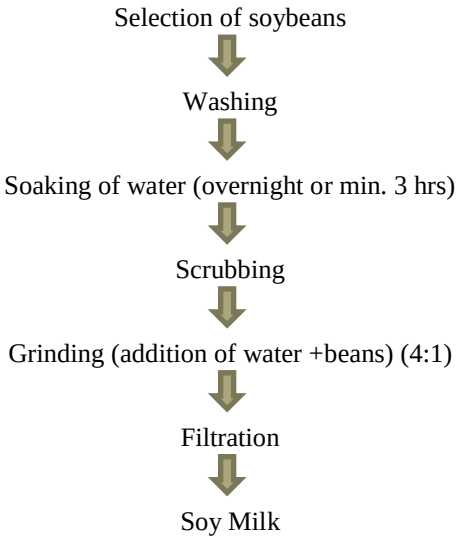
Sugar obtained from the local market of Allahabad was used as sweetening agent.

Maida obtained from the local market of Allahabad

Flow diagram for preparation of coconut milk

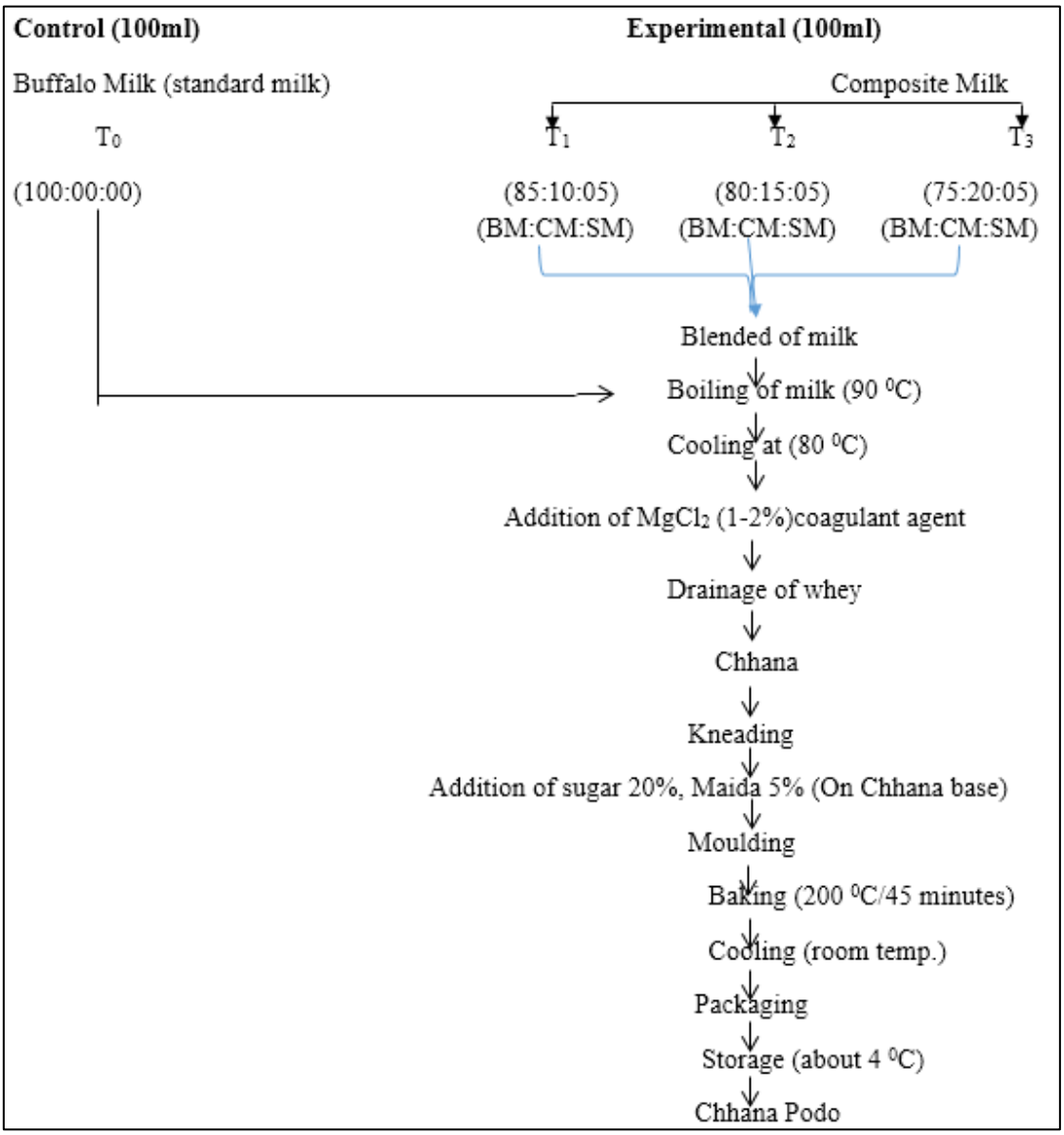


Flow diagram for preparation of soy milk



Plan of Work

Flow diagram adopted for Preparing Control and Experimental Chhana



Results and Discussion

The different parameters of control and experimental Channa podo from a using buffalo coconut and soy milk"

Physico-chemical characteristics of control and experimental Channa podo.

	Treatments				
Parameters	**T0**	**T1**	**T2**	**T3**	**S/NS**
1. Physico-chemical analysis					
Carbohydrate %	37.592	38.46	38.562	38.573	S
Protein %	12.574	12.536	12.66	12.680	S
Fat %	23.93	23.970	24.04	24.022	S
Ash %	2.926	2.854	2.948	3.101	S
Total solids%	77.832	78.146	78.502	78.832	S
Moisture %	22.68	21.818	21.352	21.104	S
Titratable acidity (Lactic acid %)	0.298	0.362	0.438	0.52	S
2. Organoleptic scores (9 point hedonic scale)					
Colour & appearance	6.86	7.162	8.374	8.57	S
Body & texture	7.57	6.586	7.778	8.376	S
Flavour & taste	7.576	6.782	6.994	7.968	S
Overall acceptability	7.392	6.848	7.714	8.32	S
SPC ($x10^3$ cfu/ml)	14	13.60	13.00	12.40	S
Percentage of yield	17.576	21.262	23.166	25.252	S

Summary and Conclusion

Carbohydrate

The highest mean score for carbohydrates the channa podo (37.592) was obtained for the treatment T_3 followed by T_2 (38.46) and T_1 (38.562). The minimum percentage (38.573) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (27.11) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on carbohydrates percentage.

Protein

The highest mean score for protein the channa podo (12.384) was obtained for the treatment T_3 followed by T_2 (12.526) and T_1 (12.66). The minimum percentage (12.796) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (454.52) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on protein percentage.

Fat
The highest mean score for fat the channa podo (23.88) was obtained for the treatment T_3 followed by T_2 (23.978) and T_1 (24.04). The minimum percentage (24.182) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (3.72) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on fat percentage.

Ash
The highest mean score for ash the channa podo (2.792) was obtained for the treatment T_3 followed by T_2 (2.854) and T_1 (2.948). The minimum percentage (3.114) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (21.01) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on ash percentage.

Moisture
The highest mean score for moisture the channa podo (22.13) was obtained for the treatment T_0 followed by T_1 (22.818) and T_2 (21.452). The minimum percentage (21.166) was obtained by T_3. As evident from the result of ANOVA, the F (Cal) value (644.60) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on moisture percentage.

Total solids
The highest mean score for total solid percentage the channa podo (77.832) was obtained for the treatment T_3 followed by T_2 (78.146) and T_1 (78.502). The minimum percentage (78.832) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (11382.46) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on total solid percentage.

Acidity
The highest mean score for acidity the channa podo (0.242) was obtained for the treatment T_3 followed by T_2 (0.362) and T_1 (0.446). The minimum percentage (0.57) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (1381.30) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on acidity.

Colour & appearance
The highest mean score for colour & appearance percentage in channa podo (6.86) was obtained for the treatment T_3 followed by T_2 (7.162) and T_1 (8.374). The minimum score (8.57) was obtained by T_0. As evident from the result of ANOVA, the F (Cal) value (980.31) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on colour and appearance score.

Body & Texture
The highest mean score for body & texture percentage in channa podo (7.57) was obtained for the treatment T_3 followed by T_2 (6.586) and T_0 (7.778). The minimum score (8.376) was obtained by T_1. As evident from the result of ANOVA, the F (Cal) value (14318.37) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on body and texture score

Flavour & Taste
The highest mean score for flavour & taste percentage in channa podo (7.576) was obtained for the treatment T_3 followed by T_0 (6.782) and T_2 (6.994). The minimum score (7.968) was obtained by T_1. As evident from the result of ANOVA, the F (Cal) value (2229.77) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on flavour and taste score.

Overall Acceptability
The highest mean score for Overall acceptability percentage in channa podo (7.392) was obtained for the treatment T_3 followed by T_2 (6.848) and T_0 (7.714). The minimum score (8.32) was obtained by T_1 as evident from the result of ANOVA, the F (Cal) value (16231.36) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on overall acceptability score.

Microbial Analysis
The highest mean of microbial analysis in channa podo (25.252) was obtained for the treatment T_3 followed by T_2 (23.166) and T_1(21.262),. The minimum score (17.576) was obtained by T_1 as evident from the result of ANOVA, the F (Cal) value (323990.82) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on microbial analysis in channa podo.

Percentage of Yield
The highest mean score for Percentage of yield percentage in channa podo (17.576) was obtained for the treatment T_3 followed by T_2 (21.262) and T_0 (23.166). The minimum score (25.252) was obtained by T_1 as evident from the result of ANOVA, the F (Cal) value (323990.82) was greater than the table value of F (3.49) at 5% level of significance. Therefore the difference was significant, indicating significant effect of treatments on overall acceptability score.

Conclusion
In view of the experimental results obtained during the present investigation, it may be concluded that the channa podo prepared by buffalo, coconut and soy milk can be successfully prepared. Channa podo prepared by buffalo, coconut and soy milk in treatment T_3 was best in terms of organoleptic characteristics and received highest score in organoleptic evaluation (colour & appearance, body & texture, Flavour & taste, overall acceptability).

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