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Research Article

EFFECT OF NATURAL COAGULANT ON PHYSICO-CHEMICAL PROPERTIES OF CHANNA BASED SWEETMEAT

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ABSTRACT
Sweetmeats are a significant element in Indian cuisine. Indians are known for their unique taste and experimental behaviour when it comes to food. Ingredients and preferred types of dessert vary by region. Channa well known traditional indigenous milk product is used extensively as a base material for large variety of Indian delicacies namely Sandesh, Rasogolla, Channa Murki, Rasmalai and many other such products. Sandesh is a popular channa based sweetmeat of West Bengal because of its palatability. It is very important to health point of view because of its high content of protein, fat and minerals content. Soybeans are an excellent and cheap source of quality protein. Sandesh is made generally by coagulating milk by using citric acid, calcium lactate. The present study was carried out to standardize sandesh by using natural coagulant i.e. Kiwi fruit juice. The kiwi fruit juice prepared and used as coagulant in the manufacturing process of channa based sweet meat Sandesh. The sandesh was prepared by using 70 per cent cow milk and 30 percent soymilk. Soymilk blended and kiwi fruit juice used as a coagulant prepared sandesh would offer several distinct nutritional advantages to the consumer. Due to its properties as well as to the accessibility of the primary source for the preparation of the aqueous solution, it might represent a good coagulant.

Keywords: *Sandesh, Indigenous milk product, kiwi fruit, Soya milk*

INTRODUCTION
The sweetmeats made from milk are delicious, highly nutritious and very popular items. From birth to death in each part of life milk sweetmeats have occupied a significant place in our society. Sandesh is usually prepared from cow's milk because it produces soft body and uniform grains size (De and Ray, 1954). Sandesh is a kind of sweetmeats which is prepared by heating the mixture of freshly prepared channa and sugar on a slow fire (Mathur, 1991).
Soya milk is also known as soy milk or soymilk, a plant based drink produced by soaking and grindings soybeans, boiling the mixtures, and filtering out remaining particulars. Soymilk may be used as a substitute for dairy milk by individuals who are vegan or are lactose intolerant. Soya milk is also used in making imitation dairy products such as soy yoghurt, soy cream, Soy kefir and soy based cheese analogues (Business wire, 2016). Most of the people of our country can't afford the other source of protein like meat, eggs and other protein supplements due to high price. Due to use of soymilk to replace some quantity of cow milk it reduces the cost of sandesh and also increases the protein content of sandesh.
Kiwifruit is very popular in the human diet due to its pleasant taste and high content of vitamin C and several investigations on possible health-promoting effects of kiwifruit have been reported (Rush, *et al.,* 2002 , Jung *et al.,* 2005). Kiwifruit content minerals (potassium, phosphorus, iron) and low calorific value. Kiwifruits are good sources of folate, potassium and contain large amounts of vitamin E in the seeds. Moreover, kiwifruit juice is known to contain highly active proteolytic enzymes (Kaur, *et al.,* 2010). Protease enzymes are multifunctional class of enzymes (Marques, *et al.,* 2010). Hence Kiwifruit enzyme as a protease enzyme can be used in food industry as milk clotting enzyme. Approximately 1 million metric tons of kiwifruits are processed annually worldwide; this results in

about 30% (wet weight) of by-products, such as pulp and peel, and there is a growing interest in utilizing these by-products in the food industry (Yang *et al.*, 2013).
Coagulation is a basic step in channa manufacturing and is most commonly achieved by addition of citric acid. Vegetable or plant extract have been used as coagulants since ancient times, although relatively few is known about their action. Cheeses made with plant coagulant can be found mainly in Mediterranean, West African and southern European countries (Piero *et al.*, 2002, Roseiro *et al.*, 2003). Proteolytic enzymes extracted from plants, such as Lactuca sativa (Piero and Petrone, 1999;), Streblus asper (Tripathi *et al.*, 2011), Solanum elaeagnifolium (Gutierrez-Mendez *et al.*, 2012), Kiwi juice (Puglisi *et al.*, 2014), kiwi juice coagulated mozzarella cheese (Karki, *et al.*, 2018), kiwi fruit enzyme for preparation of cottage cheese (Sharma and Vaidya, 2018), papaya plant latex for making cottage cheese (Jesmin, *et al.*,2021) among others, are a subject of growing interest in dairy technology.

MATERIALS AND METHODS

Preparation of kiwi fruit juice extracts

The kiwi fruit obtained from local market. First of all wash the kiwi fruit with clean water. The skin of kiwi fruit was removed. Cut the kiwi fruit in to small pieces with knife and make a homogeneous mass of juice by grinding in to mixer. Then juice is filtered through muslin cloth and collects in glass bowl. Finally kiwi fruit juice is ready to use as a coagulant in making of sandesh.

Preparation of Sandesh

Good quality of standardized milk purchased from local market. Blended it with fresh prepared soymilk and strained with the help of muslin cloth. Then milk was transferred to stainless steel vessel and boils it up to 90^0c temperature. After that vessel removed from fire and brought temperature of milk down to 75^0c. At this temperature the coagulant kiwi fruit juice added slowly in to the milk and stirred it to mixed properly. After coagulation the coagulated milk strained through muslin cloth in another vessel to drain the whey. After draining of whey, we got channa which is the base of sandesh. After getting channa, kneading of channa to be done to make smooth paste of channa. After that kneaded channa divided it to two parts. Then addition of sugar @30 per cent (preferably grinded sugar) to one part of channa and transferred it in to a karahi for cooking. Cooking has been done at 75^0c for 15-20 min. During cooking continuous stirring and scrapping done till pat formation. Now add remaining second part of channa to karahi and cooking has been continued for 5-10 min at 60^0c for cooked flavour development. Soon after cooking, removed the karahi from heat and cool it up to 37^0c in next 10 minutes. Then after give any shape to cooked channa by using different moulding and finally sandesh is ready to serve.

RESULTS AND DISCUSSION

The data obtained were subjected to statistical analysis using method recommended by Snedecor and Cochran, (1994).
From the table it is observed that mean score of Ascorbic acid for Kiwi fruit Sandesh ranged between 42.32 to 52.79. The lowest score was observed in T_1 (48.52) where as highest score observed in T_3 (52.79). Score for Ascorbic acid increased as the rate of coagulant increased. In T_1 7.1 % of coagulant was added whereas in T_3 7.7 % of coagulant was added. The results in this study also collaborates with Pallavi, *et al.*, (2020) they discovered that in preparation of nutrient rich lassi by using different fruit pulp, kiwi fruit pulp added lassi have 45.76 per cent of Ascorbic acid in it.
From the table it is observed that mean score of moisture for Kiwi fruit sandesh ranged between18.51 to 21.00. The lowest score was observed in T_1 (18.51) where as highest score observed in T_3 (21.00). Score for Moisture increased as the rate of coagulant increased. The coagulant used 7.1 %, 7.7 % and 8.3 % in T_1, T_2 and T_3 respectively. In a study Rana, *et al.*, (2017a) discovered that cottage cheese prepared from buffalo milk with different levels of papaya latex moisture content of cottage cheese was lying from 42.10 percent to 42.57 as compared to cheese prepared by rennet it was 42.00 percent. In another study Rana, *et al.*, (2017b) in cottage cheese preparation uses alternative coagulant ,

Table, Effect of different level of kiwi fruit juice as coagulant on physico-chemical quality of Sandesh.

Treatment	Ascorbic Acid		Moisture		Total Mineral		Protein		Fat		Carbohydrate	
T_0	42.320	0.185	20.323	0.104	0.893	0.081	15.010	0.059	18.230	0.093	24.260	0.172
T_1	48.520	0.215	18.510	0.222	0.717	0.023	16.140	0.106	20.180	0.217	25.540	0.279
T_2	51.487	0.306	20.007	0.151	1.077	0.032	17.993	0.185	22.357	0.136	26.397	0.160
T_3	52.793	0.189	21.007	0.098	1.193	0.046	19.140	0.099	24.097	0.141	27.640	0.276
C.D.	0.758		0.504		0.168		0.401		0.508		0.757	
SE(m)	0.229		0.152		0.051		0.121		0.153		0.229	
SE(d)	0.324		0.215		0.072		0.171		0.217		0.323	
C,V.	0.813		1.320		9.037		1.229		1.252		1.526	

instead of rennet they uses papaya latex and found that moisture content in cheese in range of 47.57 to 57.83 as compared to rennet cheese moisture per cent 48.09. The results in relation to moisture contents was in agreement with Sharma and Vaidya (2018) they validate that significant increase in moisture content in cottage cheese prepared with kiwifruit (68.80 %) enzyme than animal rennet (68.33 %). Karki and Ojha (2018) testify that there was moisture content 50.46 percent by using kiwi juice in coagulated mozzarella cheese as compared to animal rennet it was 54.12 percent. Ingale, *et al.*, (2019) having result that the average moisture content of the kiwi fruit whey beverage was found to be 90.31, 86.35, 84.49 and 83.14 percent for the treatments T_1, T_2, T_3 and T_4 respectively. The treatment T_1 had significantly higher moisture content as compared to the rest of the treatments. Due to decrease in proportion of whey and increase in Kiwi fruit extract from treatment T_2 to T_4 moisture content of kiwi fruit whey beverage were decreases. The moisture found in this study was in also agreement with Khushwaha and Shukla (2019) they discovered that Shrikhand prepared using Kiwi fruit pulp moisture increasing as increasing level of Kiwi fruit pulp than control. Maskey and Shrestha (2020) used Crude Papaya (Carica papaya) protease in soft-unripened cheese detected that moisture content of cheese prepared by using rennet 47.43 % and by using latex papaya moisture content in cheese was 48.22 %.

From the table it is observed that mean score of total mineral for Kiwi fruit sandesh ranged between 00.71 to 01.19. The lowest score was observed in T_1 (00.71) where as highest score observed in T_3 (01.19). Score for total mineral increased as the rate of coagulant increased .The reported value was in agreement with the value revealed by Rana, *et al.*, (2017a) they detected that cottage cheese prepared from buffalo milk with different levels of papaya latex ash content in cheese from 2.82 per cent to 3.79 percent which in rennet cheese was 2.75 per cent. Rana, *et al.*, (2017b) prepare cottage cheese using alternative coagulant, instead of rennet they uses papaya latex and found that ash content between 2.46 to 2.70 percent as compared to 02.19 per cent. our results also coincide with Ibrahim, *et al.*, (2019) they detected that quality of cheese produced from soy milk by using some selected natural coagulants ash content in between 1.31 to 1.74 percent. In the study Ingale, *et al.*, (2019) use Kiwi fruit extract to prepare fruit based Channa whey beverage they located that ash content in finished products was found to be 0.38, 0.47, 0.52 and 0.57 percent for treatment T_1, T_2, T_3 and T_4 respectively. The values were found to be in increasing order this may be due to the incorporation of

kiwifruit extract in increasing level, which contains the appreciable quantity of mineral in it. In another study Kushwaha and Shukla (2019) found that ash content in kiwi fruit pulp shrikhand was obtained from the treatment T_0 (1.47 %) followed by T_1 (1.43 %), T_2 (1.40 %). The minimum was obtained in T_3 (1.36 %). Jesmin, *et al.,* (2021) discovered in cottage cheese made from cow milk by using papaya plant latex ash content of cottage cheese in range of 2.00 to 2.90 per cent.

From the table it is observed that mean score of Protein for Kiwi fruit sandesh ranged between 15.01 to 19.14. The lowest score was observed in T_1 (16.14) where as highest score observed in T_3 (19.14). Score for Protein increased as the rate of coagulant increased. This might be due to high protein content in Kiwi fruit. Our results coincide with Sarani, *et al.,* (2014) they spotted 52.25 percent protein in Tofu prepared by using Withnia coagulans as a coagulant**.** Rana, *et al.,* (2017a) unearthed that cottage cheese prepared from buffalo milk with different levels of papaya latex, protein content of cheese in range from 21.00 to 21.87 percent which was in rennet cheese 21.35 per cent. In support to above results Karki and Ojha (2018) argue that in kiwi juice coagulated Mozzarella cheese protein content of Mozzarella cheese by using Kiwi juice 48.53 % and in rennet coagulated Mozzarella cheese it was 47.65 %. In a study Sharma, *et al.,* (2018) found that the protein content of 15.52 and 17.80 was recorded in both kiwi fruit and rennet cottage cheese respectively. In support the statement, Ingale, *et al.,* (2019) found that the protein content was in increasing order from T_1 to T_4 treatment. The highest protein content was recorded for treatment T_4 where as lowest protein content was recorded for T_1 (control). Ibrahim, *et al.,* (2019) discovered that protein content in cheese produced from soymilk by using some selected natural coagulants in range from 13.93 to 16.78 per cent. Jesmin, *et al.,* (2021) used papaya plant latex for making cottage cheese from cow milk content protein per cent from 26.20 to 30.97.

From the table it is observed that mean score of Fat for Kiwi fruit sandesh ranged between 18.23 to 24.09. The lowest score was observed in T_1 (20.18) where as highest score observed in T_3 (24.09). Score for fat increased as the rate of coagulant increased .The high fat content in T_1, T_2 and T_3 may be due to high fat content in kiwi juice. The reported value was in consistent with the value revealed by Olorunnisomo and Adewumi (2016) they native that fat content in soft cheese made from fresh and reconstituted milk by using Lime and Mango juice as a coagulant was in between 17.90 to 22.40 percent. In the study Rana, *et al.,* (2017b) spotted that cottage cheese prepared by using papaya latex fat content in range between 16.00 to 23.00 as compared to by using rennet 19.50. Karki and Ojha (2018) observed that fat content in kiwi juice coagulated Mozzarella cheese less (44.01%) as compared to rennet coagulated (45.06%). Sharma and Vaidya (2018) found that fat content was high in rennet cottage (4.10) cheese as compared to kiwifruit cottage cheese (4.00). Our results also coincide with Ingale, *et al.,* (2019) detected that fat level increased as there is increase in quantity of kiwi juice. Ibrahim, *et al.,* (2019) found that fat content in cheese produced from soymilk by using some selected natural origin coagulants was in range between 20.22 to 23.34 per cent .The results in relation to fat contents is in agreement with Jesmin, *et al.,* (2021) they unearthed that in making cottage cheese from cow milk by using latex of different parts of papaya fat content in range of 13.53 to 22.67 per cent.

From the table it is observed that mean score of Carbohydrate for Kiwi fruit sandesh ranged between 24.26 to 27.64. The lowest score was observed in T_1 (25.54) where as highest score observed in T_3 (27.64). Score for Carbohydrate increased as the rate of coagulant increased. This result was in agreement with Rana, *et al.,* (2017a) they detected that carbohydrate content in cottage cheese from buffalo milk with different levels of papaya latex was in range between 14.41 to 20.46 percent as compared to rennet coagulated cheese 14.04 percent. In another study Rana, *et al.,* (2017b) discovered that carbohydrate content in cottage cheese by using papaya latex as coagulant was in range between 5.02 to 9.44 percent as compared to rennet cheese 9.35 percent. Lactose is the major carbohydrate in milk. In addition to lactose, milk contains small amounts of glucose, gelatos and other saccharides. When milk is coagulated, greater percentage of lactose is present in the whey and the remaining in the curd. For this reason, cheese that is prepared from the curd is low in carbohydrates. In a study Ibrahim, *et al.,* (2019) located that carbohydrate content in range between 12.72 to 17.10 per cent in

cheese produced from soymilk by using some selected coagulants of natural origin. In another study Sharma, *et al.,* (2018) concluded that total carbohydrates content of cottage cheese produced with Kiwifruit enzyme was high (9.18) as compared to animal rennet (7.27).

Conclusion

From the present investigation it is cleared that all the samples were satisfactory in terms of physic-chemical properties like ascorbic acid, moisture, total mineral, protein, fat and carbohydrate content. By this study it may be concluded that kiwi fruit juice can be successfully used as a natural coagulant in preparation of channa based sweetmeats, this product has a potential on industrial scale.

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