International Journal of Food and Fermentation Technology
Citation: *Int. J. Food Ferment. Technol.*: **12**(02): 71-80, December 2022
DOI: 10.30954/2277-9396.02.2022.1

ASSOCIATION FOR AGRICULTURE ENVIRONMENT AND BIOTECHNOLOGY

RESEARCH PAPER

Study of Physicochemical Analysis of Soy-Cow Milk

Prashant Tanhaji Satpute and Shrikant Baslingappa Swami*

Department of Post-Harvest Engineering, Post Graduate Institute of Post-Harvest Technology and Management, Killa-Roha. Dist: Raigad (Maharashtra State) (Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli-Campus Roha) India

*Corresponding author: swami_shrikant1975@yahoo.co.in

Paper No.: 263 **Received:** 11-09-2022 **Revised:** 28-11-2022 **Accepted:** 06-12-2022

ABSTRACT

Cow milk, is a product of the mammary gland and soymilk is a creamy, milk-like product made by soaking and grinding soybeans in water. The present investigation was made to develop soy-fortified cow milk by partial addition of different levels of soymilk to cow milk T_1, T_2, T_3, T_4 and T_5 and to determine physico-chemical properties of these blends. The physico-chemical properties i.e. fat, protein, acidity, ash, TSS, specific gravity, and pH of soy: cow milk in the ratio 100:00%, 75:25%, 50:50%, 25:75% and 00:100% was determined. The treatments T_1, T_2,T_3, T_4 and treatment T_5 consist of 1.9 to 3.3% of fat; 3.1 to 3.3% of protein; 0.14 to 0.22% of acidity; 0.33 to 1.88% of ash; 6 to 10.7°B of TSS, 1.014 to 1.025 of specific gravity and 6.8 to7.3 of pH. The treatment T_4 had best results for physico-chemical properties of soy: cow milk blend such as 2.75% fat, 3.10% protein, 0.15 % acidity, 0.50% ash, and 10.7°B TSS, 1.023 specific gravity and 7.26 pH respectively.

Keywords: Physico-chemical, protein, soy-cow milk, TSS, acidity, pH, Protein, Fat, specific gravity

Soybeans *(Glycine max)* are one of the world's most important sources of protein and oil belonging to the family *leguminosae* constitutes one of the oldest cultivated crops of the tropical and sub-tropical regions. Soybeans are the most important oilseed legume which has its origin in Eastern Asia, mainly China. Soybean can furnish protein supplement to bridge the protein deficiency gap at low cost than any other crops. Among the numerous soy food items, soy milk (extract of soybean) had been the first product ever prepared and consumed since a long ago (Rehman *et al.* 2007). Soymilk not only provides protein but also is a source of carbohydrates, lipid, vitamins and minerals (Chien and Synder, 1983).

Soy foods are traditional foods from soybeans in Asia, it become popular in western countries. Soy foods have high plant protein content and contain polyphenol components, such as isoflavones. The use of soy ingredients in food is receiving significant attention from the food industry and consumer because of their roles as functional foods (Isanga *et al.* 2008).

Soymilk is a creamy, milk-like product made by soaking and wet grinding of soybeans (Raja *et al.* 2014). However the water absorption of soybeans in soaking is directly related to the changes in textural characteristics and grinding properties of soybeans for processing (Pan *et al.* 2003). Soybean or soymilk has always been a rich source of protein which is inexpensive (Derbyshire *et al.* 1976) and abundantly available. Soymilk is used in various food products such as tofu, fruit flavored puddings, calcium and protein rich soymilk. Soy milk contains about the same proportion of protein as cow's milk: around

How to cite this article: Satpute, P.T. and Swami, S.B. (2022). Study of Physicochemical Analysis of Soy-Cow Milk. *Int. J. Food Ferment. Technol.*, **12**(02): 71-80.

Source of Support: None; **Conflict of Interest:** None

3.5%; also 2% fat, 2.9% carbohydrate, and 0.5% ash besides being rich in protein, vitamins and minerals (Raja *et al.* 2014). Soy milk is an intermediate product in the manufacture of soy paneer. It is often used in confections, meat fillers, beverages, and as part of infant formulas for children allergic to dairy milk (Lan *et al.* 1981). Soymilk is very economical, lactose free, highly digestible and nutritious alternative of dairy and meat centered diet. It is cholesterol free product, has a very low fat content and is rich in polyunsaturated fatty acids of phospholipids (Raja *et al.* 2014).

The knowledge of physico-chemical properties of soy-fortified cow milk is essential for identification and effective quality control of milk. In many cases processing parameter can be selected or modified depending upon the nature of physico-chemical properties of milk for manufacture purpose. The selected physico-chemical parameter results in the production of the final product with desirable properties and characteristics. Soymilk and cow milk have similar protein content (soybean to water, 1:8 (w/v)) with close amino acid makeup, except sulfur containing amino acids which are deficient in soymilk. (Chaiwanon *et al.* 2000). Various products have been prepared from soy:cow milk blend, soy milk and cow milk has been reported in the literature i.e. soymilk and skim milk blended paneer (Raja *et al.* 2014); toned dairy milk and soy milk for paneer (Jain and Mhatre, 2009); traditional fermented food i.e. Tarhana of Turkey (Koca *et al.* 2002); yoghurt from cow milk and soy milk and soy milk blend (Talekar *et al.* 2015); ice cream from soymilk (Aboulfazli *et al.* 2014); milk blend from soy milk, peanut milk and cow milk (Kpodo *et al.* 2013); rasomalai from cow milk channa (acid curd) with soy milk channa (Islam *et al.* 2015); dessert/pudding (Yadav *et al.* 2017).

In the present study physico-chemical properties of five different blends of soy-cow milk were studied to get the information of variability in fat, protein, acidity, ash, TSS, specific gravity and pH among the blends. These blends could be further utilized for the development of soya-fortified paneer.

MATERIALS AND METHODS

Raw material

Soybean required for experimentation was purchased from the Agriculture Produce Market Committee, Washi, Mumbai. The soybean was cleaned by removing infected seed, damage seeds made it free from dirt, dust and stones. Cow milk was purchased from the local market

Determination of moisture content

The moisture content of soybean seeds where determined as per (AOAC, 2000). The soybeans were taken into a pre weighted moisture boxes 3 no. and placed in the Hot air oven (Make: M/s Aditi Associate Goregaon (East) Mumbai-63 (India); Model: ALO-136). The Hot air oven was set at 105°C and samples were loaded in the oven and the lid was kept open. The samples were exposed to 105°C± 1°C for 24 hrs and the weight of the seeds after 24 hr were recorded. The moisture content (% db) was recorded by using the following equation (1).

$$M_C = \frac{M_1 - M_2}{M_1} \times 100 \quad \ldots(1)$$

Where,

M_1 = Initial weight (g)

M_2 = Final weight (g)

Preparation of soymilk

The soymilk was extracted as per the procedure described by (Raja *et al.* 2014). Fig. 1 shows the flow chart for preparation of soymilk. The soybean 500g was soaked in water, the soybean: water ratio was 1:3 the soaking time was for 10 hrs (Sopade *et al.* 1990). The soaked water was decanted and the seeds were washed with fresh water. The hundred grams of soaked soybean seeds per 300 ml of water was used for wet grinding. The seeds were wet grounded in a food processor (Make: M/s Jaipan Kitchen Appliances, Navagoan Dahisar (W), Mumbai- 68 (India); Model: 12045). The wet grinding was performed at power level knob placed at low, medium and high 18000-

24000 RPM for 5 min ON/ 3 min OFF to reduce the particle size, total grinding time was 8 min. The resulting suspension was filtered through a double layered muslin cloth. The muslin cloth was wrapped around the bean pulp, okara are squeezed by hand till all the liquid was fully extracted. The squeezing was stopped when there is no liquid was coming out. The filtrate obtained (soymilk) was pasteurized in a beaker placed in water bath at 80°C for 15 min. The soymilk was then cooled and refrigerated for few hours (Raja *et al*. 2014).

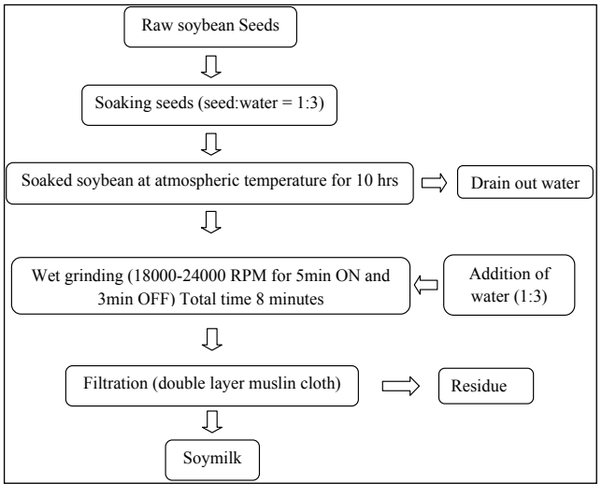

Fig. 1: Flow chart for the preparation of soymilk

Physico-chemical analysis

The physico-chemical properties i.e. fat, protein, acidity, ash, total soluble solids, specific gravity and pH of various combinations of soy milk and soy-fortified cow milk and cow milk was determined by the standard procedure as follows. The samples of various treatments were i.e. T_1 = 100 % soy milk, T_2 = 75% soy milk and 25 % cow milk, T_3 = 50% soy milk and 50% cow milk, T_4 = 25 % soy milk and 75% cow milk and T_5 = 100 % cow milk was taken for the study. Fig. 2 shows the various blends of soy:cow milk as per the treatments $T_1 - T_5$ The experiments were performed in the Department of Post Harvest Engineering, Post Graduate Institute of Post Harvest Management, Killa-Roha, Dist-Raigad (MH).

Fig. 2: Soymilk, cowmilk and their blends

1. Fat

The fat content of soy milk, cow milk and their blends (T_1 to T_5) where determined as per (AOAC, 2000). 10 ml of sulphuric acid were added to the butyrometer (graduated 0-10%). 10.75 ml of milk sample were drawn by using pipette and was slowly added from the side walls of butyrometer. Care was taken not to wet the neck of the butyrometer. 1.0 ml of amyl alcohol was added to it using automatic tilt measure. The butyrometer was closed with a rubber stopper and locked and shaken well for 1 min. The butyrometer was placed in a gerber centrifuge, the rotor of centrifuge balance and started the centrifuge at 1100-1200 rpm for 5 min. The butyrometer was removed from the centrifuge and kept in water bath at 65°C for 5 minutes. The fat content (colour less column) reading was recorded from buytrometer scale. The experiment was repeated for three times for each replication and average value was reported.

2. Protein

The protein content of soy milk, cow milk and their blends (T_1 to T_5) where determined as per (AOAC, 2000). 5g of milk sample was warmed in a water bath at 38°C for 5 min in a test tube and transferred it to each quartz digestion tubes of 5 no. and one tube was kept blank. 5 g of potassium sulphate and 1g of copper sulphate was added to it as catalyst. Add 12-15 ml of concentrated sulphuric acid to the mixture in digestion tubes along with blank tube and mixed it gently for 1 min. The sample was loaded in the manifold and was placed in digestion unit. The system was switched ON and connects tap water with maximum flow (liter) rate to flush the fumes

during the process. The temperature of digestion unit was 410±10°C. Digestion process was taken 1 to 1½ hours. The end point of the test was clear green colour, indicated that the digestion of the sample is completed. After digestion the samples were kept in cooling rack at normal temperature for 30 min for cooling. After completion of digestion process, 25ml to 50ml of distilled water was added to each tube and diluted (1:2) the digested sample thoroughly. The entire solution was being clear without any precipitation. The digested sample was transferred to inner glass tube of distillation unit through dropping funnel. 25 ml of boric acid solution with two drops of mixed indicator (Bromocressol + Methyl Red + 90% Ethanol) i.e. (0.3:0.2:400) in 250 ml conical flask and placed it at the receiver end. After the sample was transferred in the inner glass of distillation unit through the dropping funnel and tap of funnel was closed. 50 ml of 40% NaOH solution was filled in dropping funnel. The steam generator of the unit was started. The sample in the inner tube started boiling and vapors were produced. The NaOH solution was added to the sample slowly and continues the distillation process till the sample in the conical flask turns red to green (around 150 ml) which is the end point of process. Then sample was titrated with 0.1N HCL till the color changes back from green to red. The 3 no. of replications were tried for each sample and average value of protein content (%) was reported.

$$\% \text{ Nitrogen} = \frac{14.01 \times 0.1N \times (TV - BV) \times 100}{W \times 1000} \quad \ldots(2)$$

$$\text{Protein } P\% = \% N \times 6.38 \text{ (Conversion factor for Dairy sample)} \quad \ldots(3)$$

Where,

14.01 - Ammonia's molecular weight.

0.1N - Titration solution's normality.

TV - Titer Value.

BV - Blank Value.

W - Sample Weight.

3. Acidity

Acidity of soy milk, cow milk and their blends (T_1 to T_5) were determined by using the procedure described in Laboratory. Manual of FSSAI (Method of Analysis of Foods Milk and Milk Products, 2015). 10 g of the milk sample were weighted accurately taken into a beaker and then transferred it to a 250 ml conical flask. 30 ml of warm water was added to it, 1 ml of phenolphthalein indicator was added to it. The mixture was shaken well and titrated against standard 0.1N NaOH solution. 3 no. of replications were tried for each trial and average value was reported. The acidity was calculated using following equation (4).

$$\text{Titratable acidity as Lactic acid} = \frac{9AN}{W} \quad \ldots(4)$$

Where,

A = Volume of standard NaOH required for titration

N = Normality of Standard NaOH solution

W = Weight of the sample taken for test

4. Ash

Ash percentages of the soymilk, cow milk and their blends (T_1 to T_5) were determined by using the procedure as described (AOAC, 2000). 2 g of the dried milk powder sample was weighed accurately in the crucible. The crucible was heated gently on a burner for 5 min at first and then strongly in a muffle furnace at 550 ± 20°C for 2 hours, till grey ash was obtained. Cool the crucible in desiccators and weigh. The % ash (w/w) was calculated by using following equation (5).

$$\% \text{ Ash } (w/w) = \frac{\text{Weight of sample portion, g} - \text{weight loss on ashing, g}}{\text{Weight of sample portion, g}} \times 100 \quad \ldots(5)$$

5. Total soluble solids (TSS)

The TSS of soymilk, cow milk and their blends (T_1 to T_5) were determined by refractometer. The refractometer (Make: M/s Atago, Japan; Model: MASTER-M) was calibrated using distilled water. A

drop of distilled water was put on the prism of the refractomerer and its TSS was recorded as 1.0. The sample of various treatments were from T_1 to T_5 were put on the prism of the refractometer and the TSS was recorded. The 3 no. of replications was taken for each trial. The average of the three reading was reported.

6. Specific gravity

Specific gravity of the soymilk, cow milk and their blends (T_1 to T_5) were determined by using Lactometer as per the procedure of Raja *et al.* (2014). The soymilk samples of various treatments T_1 to T_5 was filled in a 100 ml cylinder. Lactometer was inserted into the cylinder of the lactometer; the lactometer readings were recorded at which the soymilk touches the stem of the lactometer. Specific gravity was calculated using the equation (6). The experiment was repeated four times and the average reading after calculation was reported as specific gravity.

$$\text{Specific Gravity} = \frac{CLR}{1000} + 1 \qquad \ldots (6)$$

Where,

CLR is Correct Lactometer Reading.

7. pH

pH of the soymilk, cow milk and their blends (T_1 to T_5) were determined by using digital pH meter (Make: M/s Hanna Instruments; Model: HI 98127). The equipment was standardized by 4 and 7 pH standard solution. Around 100 ml sample was taken for the study. The pH reading was recorded from the equipments. The experiment was repeated three times for each treatment and the average pH was reported for each treatment.

RESULTS AND DISCUSSION

The physico-chemical properties of soymilk, cow milk and their blends have been discussed as follows.

Fat (%)

Fig. 3 shows the fat (%) present in treatment T_1 to T_5. The fat (%) present in the sample were in the range of 1.9- 3.3 %. As the percentage of soy milk decreases in the blend from 100 % to 0 % the fat (%) found to be increased. The fat (%) for sample T_1, T_2, T_3, T_4 and T_5 was 1.9, 2.3, 2.4, 2.7 and 3.3% respectively.

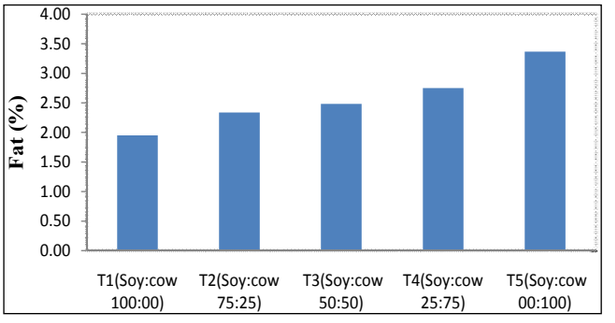

Fig. 3: Fat (%) present in soy-cow milk blends

Table 1: Physico-chemical properties of soy-cow milk samples

Treatments	Sample	(a) Fat (%)	(b) Protein (%)	(c) Acidity (%)	(d) Ash (%)	(e) TSS (°B)	(f) Specific Gravity	(g) pH
T_1	Soy: Cow (100:00)	1.9±0.20	3.3±0.04	0.14±0.02	1.88±0.04	6±0.00	1.014±0.00	6.8±0.11
T_2	Soy: Cow (75:25)	2.3±0.11	3.2±0.02	0.15±0.00	0.45±0.03	6.9±0.05	1.017±0.00	7.2±0.10
T_3	Soy: Cow (50:50)	1.7±0.06	3.1±0.05	0.2±0.02	0.33±0.02	7.9±0.11	1.021±0.00	7.3±0.05
T_4	Soy: Cow (25:75)	2.4±0.03	3.1±0.02	0.15±0.00	0.5±0.02	10.7±0.25	1.023±0.00	7.2±0.05
T_5	Soy: Cow (00:100)	3.3±0.05	2.9±0.10	0.20±0.01	0.75±0.03	10±0.11	1.025±0.00	6.8±0.05
S.E		0.07	0.03	0.03	0.02	0.08	0.00	0.05
C.D		0.22	0.11	0.00	0.06	0.25	0.00	0.15

Table 2 (a) shows the ANOVA for fat % present in the treatment T_1 to T_5. The lowest fat percentage was observed at treatment T_1 and highest fat % was observed in treatment T_5. ANOVA shows that the treatments are significantly different at p≤0.01. The results are in agreement with the average fat content in five samples of soy-cow milk i.e. 100:00, 75:25, 50:50, 25:75 and 00:100 by Jain and Mhatre, (2009); Boraey *et al.* (2015); Mohamed *et al.* (2016); Neha and Tiwari, (2015); Talekar *et al.* (2015). The value of fat % for 100 % soymilk was similar to value recorded by Rehaman *et al.* (2007); Singh *et al.* (2016) and Tunde-Akintude *et al.* (2009) recorded same value by using cold extraction method for soymilk. Raja *et al.* (2014) recorded similar value of fat % for 75:25 soy-cow milk blends. The result obtained by Jiang *et al.* (2013) for non-germinated soybean milk was in range.

Protein (%)

Fig. 4 shows the protein (%) present in treatment T_1 to T_5. The protein (%) present in the sample were in the range of 2.9- 3.3 %. As the percentage of soy milk decreases in the blend from 100 % to 0 % the protein % found to be decreased. The protein % for sample T_1, T_2, T_3, T_4 and T_5 was 3.3, 3.2, 3.1, 3.1 and 2.9 % respectively.

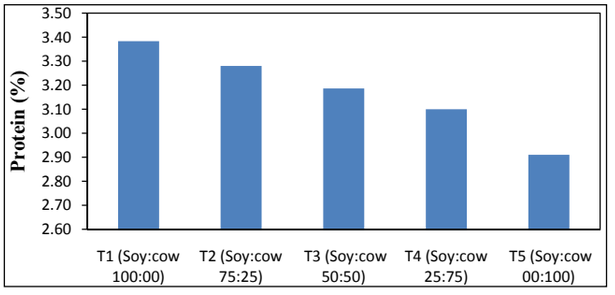

Fig. 4: Protein (%) present in soy-cow milk blends

Table 2 (b) shows the ANOVA for protein (%) present in the treatment T_1 to T_5. The lowest protein percentage was observed at treatment T_5 and highest protein % was observed in treatment T_1. It indicated that the treatments are significantly different at p≤0.01. The result were in agreement with average protein content in five samples of soy-cow milk i.e. 100:00, 75:25, 50:50, 25:75 and 00:100 by Mohamed *et al.* (2016); Ahanian *et al.* (2014); Boraey *et al.* (2015); Talekar *et al.* (2015); Jain and Mhatre, (2009); Neha and Tiwari, (2015). Singh *et al.* (2016) recorded similar result of protein for 100% soya milk. The results recorded by Onouorah *et al.* (2007) for protein % in soymilk by using different method of extraction are in range with the observed results. The result obtained by Jiang *et al.* (2013) for non-germinated soybean milk was in range.

Acidity (%)

Fig. 5 shows the acidity (%) present in treatment T_1 to T_5. The acidity (%) present in the sample was in the range of 0.14-0.22 %. There is no as such trend has been observed in the blends. As the soy milk percentage decreases from 100 % to 50 % the acidity increase. The acidity found to be decreased, as the soy milk percentage found to be decrease from 50 % - 25 % respectively. The acidity (%) for sample T_1, T_2, T_3, T_4 and T_5 was 0.14, 0.15, 0.2, 0.15 and 0.22 % respectively.

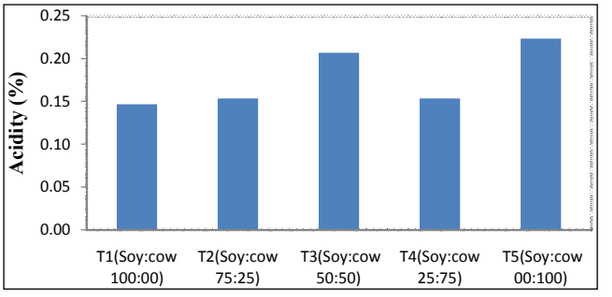

Fig. 5: Acidity (%) present in soy-cow milk blends

Table 2 (c) shows the ANOVA for acidity % present in the treatment T_1 to T_5. The lowest acid percentage was observed at treatment T_1 and highest acid (%) was observed in treatment T_5. ANOVA shows that the treatments are significantly different at p≤0.01. The results are in agreement with the average acidity in five samples of soy-cow milk i.e. 100:00, 75:25, 50:50, 25:75, and 00:100 by Boraey *et al.* (2015); Mohamed *et al.* (2016); Neha and Tiwari, (2015) and Ahanian *et al.* (2014).

Ash (%)

Fig. 6 shows the ash (%) present in treatment T_1 to T_5. The ash (%) present in the sample were in the range of 0.33- 1.88 %. As the percentage of soy milk decreases in the blend from 100 % to 50 % the ash % found to be decreased but further increase with increase in cow milk % up to 75-100 %. The ash (%) for sample T_1, T_2, T_3, T_4 and T_5 was 1.88, 0.45, 0.33, 0.5 and 0.75 % respectively.

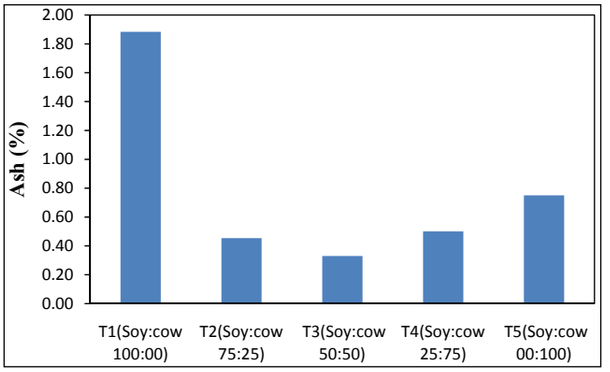

Fig. 6: Ash (%) present in soy-cow milk blends

The lowest ash percentage was observed at treatment T_3 and highest ash % was observed in treatment T_1 because soybean is good source of iron, potassium, calcium, magnesium and phosphorus with water soluble B complex vitamin (Gupta *et al.* 1982). Table 2 (d) shows the ANOVA for ash (%) present in the treatment T_1 to T_5. It indicated that the treatments are significantly different at $p \leq 0.01$. The results for ash content recorded by Raja *et al.* (2014) for 100% soymilk, 50:50 soy: cow milk and 75:25 soy: cow milk were similar. Bisla *et al.* (2012) recorded similar result for ash content in cow milk. The average ash content recorded by Boraey *et al.* (2015); Mohamed *et al.* (2016); Neha and Tiwari, (2015) and Singh *et al.* (2016) were in agreement with all five composition of soy-cow milk i.e. 100:00, 75:25, 50:50, 25:75, and 00:100 respectively.

Total Soluble Solids (TSS) (°B)

Fig. 7 shows the TSS (°B) present in treatment T_1 to T_5. The TSS present in the sample was in the range of 6-10 (°B). As the percentage of soy milk decreases in the blend from 100% to 25% the TSS found to be increased but further it is observed to be decreased at 100% cow milk. The TSS for sample T_1, T_2, T_3, T_4 and T_5 was 6, 6.9, 7.9, 10.7 and 10 °B respectively. The lowest TSS was observed at treatment T_1 and highest TSS was observed in treatment T_4. Table 2 (e) shows the ANOVA for TSS present in the treatment T_1 to T_5. It indicated that the treatments are significant at $p \leq 0.01$. The result obtained by Jiang *et al.* (2013) for non-germinated soybean milk is similar with the present findings. The results obtained by Raja *et al.* (2014) for composition 100% soymilk, 50:50, soy: cow milk and 75:25 soy: cow milk are in agreement with the treatments. The results obtained by Mohamed *et al.* (2016); Boraey *et al.* (2015) and Neha and Tiwari, (2015) were in agreement with all five composition of soy-cow milk i.e. 100:00, 75:25, 50:50, 25:75, and 00:100 respectively.

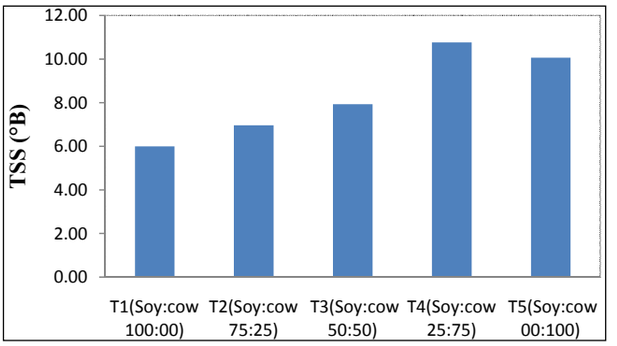

Fig. 7: TSS (°B) present in soy-cow milk blends

Specific gravity

Fig. 8 shows the specific gravity in treatment T_1 to T_5. The specific gravity in the sample was in the range of 1.014-1.025. As the percentage of soy milk decreases in the blend from 100% to 0% the specific gravity found to be increased. The specific gravity for sample T_1, T_2, T_3, T_4 and T_5 was 1.014, 1.017, 1.021, 1.023 and 1.025 respectively. The lowest specific gravity was observed at treatment T_1 and highest specific gravity was observed in treatment T_5. The increase in specific gravity of milk as the soymilk % decreases might be due to increase in fat % in milk. Table 2 (f) shows the ANOVA for specific gravity present in the treatment

Table 2: Statistical analysis of T_1 to T_5 treatments of soy-cow milk blends

ANOVA

Parameter	Source of Variance	DF	SS	MSS	F_{cal}	F_{Tab} 1%	Result
(a) Protein	Composition of soy: cow milk	4	5.18256	1.29564	93.07759	5.035378	SIG
	Error	10	0.1392	0.01392			
	Total	14	5.3217600				
(b) Fat	Composition of soy: cow milk	4	0.3911066	0.097777	28.15067	5.035378	SIG
	Error	10	0.0347333	0.003473			
	Total	14	0.4258400				
(c) Acidity	Composition of soy: cow milk	4	0.0112	0.0028	10.2439	5.035378	SIG
	Error	10	0.0027333	0.000273			
	Total	14	0.0139333				
(d) Ash	Composition of soy: cow milk	4	4.8174	1.20435	1237.346	5.035378	SIG
	Error	10	0.0097333	0.000973			
	Total	14	4.8271333				
(e) TSS	Composition of soy: cow milk	4	49.190666	12.29767	658.8036	5.035378	SIG
	Error	10	0.1866666	0.018667			
	Total	14	49.377333				
(f) Sp. gravity	Composition of soy: cow milk	4	0.0002384	5.96E-05	178.8	5.035378	SIG
	Error	10	3.33333E-06	3.33E-07			
	Total	14	0.0002417				
(g) pH	Composition of soy: cow milk	4	0.6533	0.163333	24.5	5.035378	SIG
	Error	10	0.0666	0.006667			
	Total	14	0.7200				

T_1 to T_5. It indicates that the treatments are significant at $p \leq 0.01$. The results obtained by Islam *et al.* (2015) and Ladokun *et al.* (2014) for 100% soy milk sample was similar.

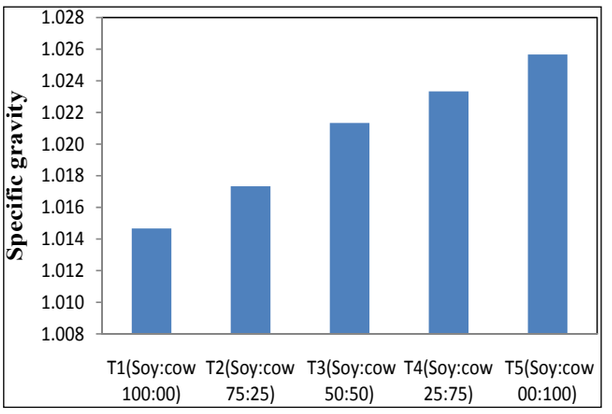

Fig. 8: Specific gravity of soy-cow milk blends

The results obtained by Raja *et al.* (2014) for 50:50, soy: cow milk and 75:25 soy: cow milk was similar to our findings. The results obtained by Avhad *et al.* (2017) for custard apple soy milk shake at three different level of soy milk: custard apple 95:05, 90:10 and 85:15 were similar. The results obtained by Charrondiere *et al.* (2012) for whole milk was similar to the present findings i.e. 1.03 respectively. The result obtained by Jiang *et al.* (2013) for non-germinated soybean milk was similar.

pH

Fig. 9 shows the pH of treatment T_1 to T_5. The pH of the samples were in the range of 6.8-7.3 As the percentage of soy milk decreases in the blend from 100% to 0% the pH found to be increased up to 50% and then decreased up to 0%. The pH for sample T_1, T_2, T_3, T_4 and T_5 was 6.8, 7.2, 7.3, 7.2 and 6.9 respectively.

The lowest pH was observed at treatment T_1 and highest pH was observed in treatment T_3. Table 2 (g) shows the ANOVA for pH present in the treatment T_1 to T_5. It indicates that the treatments are significant at $p \leq 0.01$. The results are in agreement with the average pH content in five samples of milk i.e. 100:00, 75:25, 50:50, 25:75, and 00:100 by Mohamed *et al.* (2016); Neha and Tiwari, (2015); Boraey *et al.* (2015); Ahanian *et al.* (2014); the result obtained by Hajirostamloo, (2009); Rehman *et al.* (2007); Ladokun *et al.* (2014) and Jiang *et al.* (2013) for 100% soy milk sample was similar. Onuorah and Adejare (2007) extracted soymilk by three different methods that are Illinois (A), Cornel (B) and Traditional (C), They reported the pH values of 100 % soymilk extracted by these three methods are found to be similar.

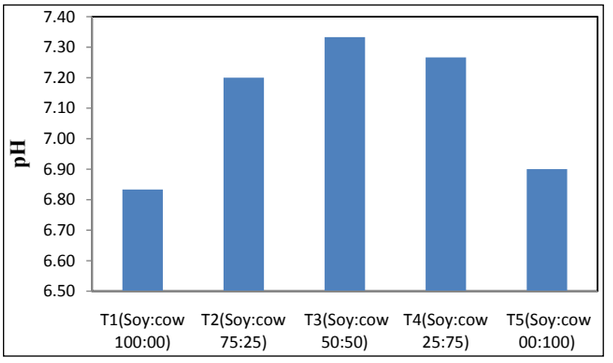

Fig. 9: pH values of soy-cow milk blends

CONCLUSION

The sample T_4 with 25 % soy milk and 75 % cow milk was superior in quality with respect to its physical and chemical parameters. Compare with all these treatments T_1 to T_5 the sample T_4 with 25 % soymilk and 75% cow milk has fat 2.7 %, protein 3.1%, acidity 0.15 %, ash 0.5%, TSS 10.7°B, specific gravity 1.023 and pH 7.2 respectively. The various combinations of soy-cow milk could be utilized with the development of soy-fortified products like soy-paneer.

REFERENCES

Aboulfazli, F., Baba, A.S. and Misran, M. 2014. Effect of vegetable milks on the physical and rheological properties of ice cream. *Food Sci. and Technol. Res.*, **20**(5): 987-996.

Ahanian, B., Pourahmad, R. and Mirahmadi, F. 2014. Effect of substituting soy milk instead of skim milk on physicochemical and sensory properties of sesame ice cream. *Indian J. Scientific Res.*, **7**(1): 1134-1143.

AOAC, 2000. Association of Analytical Chemists. Official Methods of Analysis. (17th edn), Washington, DC, USA.

Avhad, R., Patil, V. and Sarode, N. 2017. Standardization and PhysicoChemical Properties of Custard Apple Soya Milk Shake. *International Journal of Current Microbiology and Applied Sciences,* **6**(2): 1811-1817.

Biradar, G.S., Gujar, S.K., Dande, K.G. and Gaikwad, S.M. 2012. Studies on Physico-chemical Quality of *Paneer* (Indian Cheese) Papered From Blends of Soymilk and Buffalo Milk. *Journal of Animal Production Advances*, **2**(3): 142-145.

Bisla, G., Archana, P.V. and Sharma, S. 2011. Development of ice creams from Soybean milk and Watermelon seeds milk and Evaluation of their acceptability and Nourishing potential. *Res Journal of Dairy Science*, **5**: 4-8.

Boraey, N.A., Ismail, M.M. and Hoda, F.A. 2015. Chemical Composition, Sensory Evaluation, Rheological Properties and Starter Activity of Admixtures of Buffalo's, Cow's and Soymilk. *American Journal of Food Science and Nutrition Research*, **2**(4): 119-127.

Chaiwanon, P., Puwastien, P., Nitithamyong A. and Sirichakwal, P.P. 2000. Calcium fortification in soybean milk and in vitro bioavailability. *Journal of Food Composition and Analysis*, **13**: 319-327.

Charrondiere, R., Haytowitz, D. and Stadlmayr, B. 2012. FAO/INFOODS density database Version 2.0. 2012. *In* Food and agriculture organization of the United Nations technical workshop report.

Chien, J.T. and Snyder, H.E. 1983. Detection and control of soymilk astringency, *Journal of Food Science,* **48**: 438-440.

Derbyshire, E., Wright, D.J. and Boulter, D. 1976. Legumin and vicilin storage protein of legume seeds. *Phytochemistry*, **15**: 3-24.

FSSAI, 2015. *Manual for Method of Analysis of Foods Milk and Milk Products,* pp. 7-187.

Gupta, A.K. 1982. Future prospectus of soy bean utilization Technology in India presented at 13th All India Coordinated Research Project or Soybean Workshop held at Pantnagar (UP), India.

Hajirostamloo, B. 2009. Comparison of nutritional and chemical parameters of soymilk and cow milk. *World Academy of Science, Engineering and Technology*, **57**: 436-438.

Isanga, J. and Zhang, G.N. 2008. Soybean bioactive components and their implications to health a review. *Food Reviews International*, **24**(2): 252-276.

Islam, M.N., Parvin, F., Hossain, M.S., Wadud, A., Siddiki, M.S.R. and Khan, M.S. 2015. Replacement of cow milk *chhana* with soy *chhana* in the preparation of *rasomalai*.

Bangladesh Journal of Animal Science, **44**(1): 59-63.

Islam, M.N., Hossain, M.S., Rashid, M.H., Siddiki, M.S.R., Khan, M.S. and Parvin, F. 2016. Preparation of dahi from buffalo milk and blends with soy milk. *Bangladesh Journal of Animal Science*, **44**(3): 137-142.

Ismail, M.M., Ghoneem, G.A., EL-Boraey, N.A., Tabekha, M.M. and Elashrey, H.F. 2017. Manufacture of Bio-Labneh Using ABT Culture and Buffalo and Soy Milk Mixtures. *The Journal of Microbiology, Biotechnology and Food Sciences*, **6**(6): 1237.

Jain, S.K. and Mhatre, S.S. 2009. The textural properties of soy *paneer*. *International Journal of Dairy Technology*, **62**(4): 584-591.

Jiang, S., Cai, W. and Xu, B. 2013. Food quality improvement of soy milk made from short-time germinated soybeans. *Foods*, **2**(2): 198-212.

Koca, A., Yazici, F. and Anil, M. 2002. Utilization of soy yoghurt in tarhana production. *European Food Research and Technology*, **215**(4): 293-297.

Kpodo, F.M., Afoakwa, E.O., Amoa, B.B., Saalia, F.K.S. and Budu, A.S. 2013. Application of multiple component constraint mixture design for studying the effect of ingredient variations on the chemical composition and physico-chemical properties of soy-peanut-cow milk. *International Food Research Journal*, **20**(2): 811-818.

Ladokun, O. and Oni, S. 2014. Fermented milk products from different milk types. *Food and Nutrition Sciences*, **5**(13): 1228.

Lan, C.Y., Tsai, S.J., Kao, C.S. and Chen, S.C. 1981. Studies on the Yield and Quality Characteristics of Tofu. *Journal of Food Science*, **46**: 1734-1737.

Mohamed Ismail Abou-Dobara, Magdy Mohamed Ismail and Nawal Mohamed Refaat. 2016. Chemical Composition, Sensory Evaluation and Starter Activity in Cow, Soy, Peanut and Rice Milk. *Journal of Nutritional Health and Food Engineering*, **5**(3): 175.

Neha, M.P. and Tiwari, A. 2015. Effect of Blending of Soymilk with Cow Milk. *International Journal of Engineering and Innovative Technology (IJEIT)*, **4**(7): 81-84.

Onuorah, C.E., Adejare, A.O. and Uhiara, N.S. 2007. Comparative physico-chemical evaluation of soymilk and soya cake produced by three different methods. *Nigerian food Journal*, **25**: 28-38.

Pan, Z. and Tangratanavalee, W. 2003. Characteristics of soybeans as affected by soaking conditions. *LWT-Food Science and Technology*, **36**(1): 143-151.

Raja, J., Punoo, H.A. and Masoodi, F.A. 2014. Comparative Study of Soy Paneer Prepared from Soymilk, Blends of Soymilk and Skimmed Milk. *Journal of Food Processing and Technology*, **5**: 301.

Rehman, S., Navaz, H., Ahmad, M.M., Hussain, S., Murtaza, A. and Shahid, S.H. (2007). "Physico-chemical and sensory evalution of ready to drink soycow milk blend, *Pakistan. Journal of Nutrition*, **6**(3): 283-285.

Singh, M., Verma, D.K. and Kumar, D. 2016. Techno-economic feasibility of soy-Tofu a health food in Indian context. *Asian Journal of Dairy and Food Research*, **35**(1): 23-27.

Sopade, P.A. and Obekpa, J.A. 1990. Modelling water absorption in soybean, cowpea and peanuts at three temperatures using Peleg's equation. *Journal of Food Science*, **55**(4): 1084-1087.

Talekar, R.U., Shelke, R.R., Karche, R.V. and Bhagat, A.V. 2015. Preparation of cow milk yoghurt blended with soymilk. *Research Journal of Animal Husbandry and Dairy Science*, **6**(1): 32-36.

Tunde-Akintunde, T.Y. and Souley, A. 2009. Effect of processing methods on quality of soymilk. *Pakistan Journal of Nutrition*, **8**(8): 1156-1158.

USDA, 2016. Foreign Agricultural Services (FAS), United States Department of Agriculture (USDA), Office of the Global Analysis (OGA).

Yadav A., Chandra, R., Arora, M. and Chandra, K. 2017. Formulation, standardization and nutritional analysis of soymilk based dessert. *International Journal of Food and Nutritional Science*, **6**(1): 2320 -7876.