

# Effect of Blending of Soymilk with Cow Milk

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**ABSTRACT:-** *The blending of soymilk with cow milk enhanced the nutritional quality of the product as soymilk is a rich source of vitamin C and iron which supplement. The cow milk as it is poor in vitamin C and iron. The result of sensory evaluation showed that the soymilk may be incorporated with cow milk up to 15 percent with affecting its sensory attributes. The incorporation of soymilk with cow milk enhanced the protein and decreased fat, ash and carbohydrate content in the blends.*

**Keywords:** soymilk, cow milk, blending.

## I. INTRODUCTION

Milk is an almost ideal food. It has high nutritive value. It supplies body building proteins, bone forming minerals and health giving vitamin and furnishes energy giving lactose and milk fat. Besides supplying certain essential fatty acid, it contain the above nutrients in an easily digestible and assimilable form. The milk is so much nutritionally rich that it can be said as "nutritional bank" [1]. Milk contains mostly Ca, P, and constitutes the most important source of bio available Ca in our diet. Milk and Dairy products are part of a healthy diet [2]. A report released in 1995 estimated that over 12,000 food products were available that contained soy protein [3], and sales of soy beverages rose more than 82% in 1999 [4] "25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease." One serving, (1 cup or 240 ml) of soy milk, for instance, contains 6 or 7 grams of soy protein. Soy milk is one of the novel products of Soybean, which is rich in protein, vitamins, and minerals and free from lactose and cholesterol. Plain soy milk is unsweetened, although some soy milk products are sweetened. Salted soy milk is also consumed in China. In the West, soymilk has become a popular alternative to cow's milk, with a roughly similar protein and fat content. Soy milk is commonly available in vanilla and chocolate flavours as well as its original unflavoured form. In some Western countries where 'veganism' has made inroads, it is available upon request at cafés and coffee franchises as a cow's milk substitute Soy milk has about the same amount of protein as cow's milk, though the amino acid profile differs. Natural soy milk contains little digestible calcium as it is bound to the bean's pulp, which is indigestible by humans. To counter this, many manufacturers enrich their products with calcium carbonate available to human digestion. Unlike cow's milk, it has little saturated fat and no cholesterol. It is low in saturated fats and contains all Soy Oligosaccharides. A recent study from Europe found that individuals with a

habitually health-conscious lifestyle (e.g., individuals who did not eat meat, but did eat fish, or were vegetarians or vegans) were more likely to consume soy foods than the average person [5]. The blending of soymilk with cow milk will reduce the cost and enhancement the nutritional quality of the product as soymilk is a rich source of vitamin C and iron which will supplement the cow milk as it is poor in vitamin C and iron content. The work on blending of soymilk with cow milk is very scanty. Therefore the blending of soymilk with cow milk was made the develop highly nutritional blends.

## II. MATERIAL AND METHODS

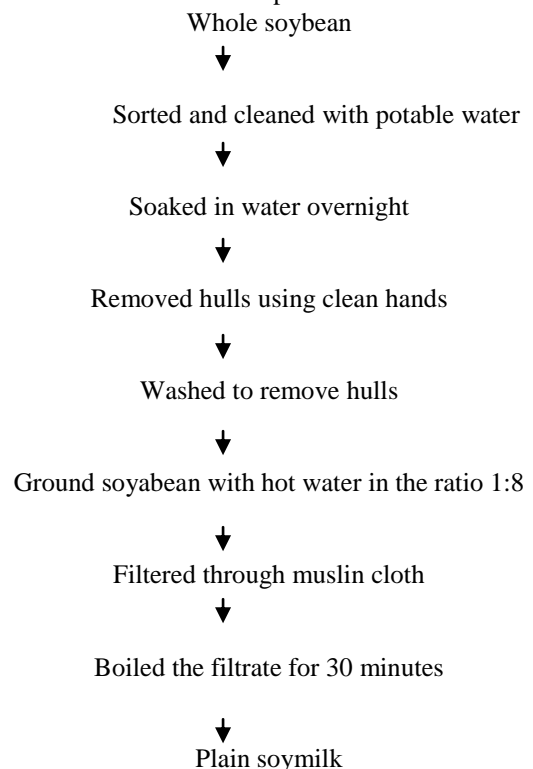
### Procurement of Materials

#### Soyabean

Soy beans and cow milk were procured from the local market of Gwalior.

#### Preparation of soymilk

Soyabean grains were sorted and cleaned with potable water. Cleaned soybean was soaked in water overnight and hulls were removed by rubbing with clean hands and washing with clean water. The soaked soybean was ground with hot water in the ratio of 1:8 and filtered through muslin cloth. The filtrate was boiled for 20 minutes and cooled to obtain plain milk.



**Fig 1: Processing of soymilk**

### III. ANALYTICAL PROCEDURES

#### Physico-chemical composition of soybeans, soymilk and cow milk

Chemical components such as fat, protein, carbohydrate, total ash, total solids and minerals were determined according to methods given in [6].

#### Sensory evaluation of blends of soymilk with cow milk

Different blends of soymilk with cow milk were subjected to sensory evaluation by using untrained laboratory panel. The blends were evaluated between 11:00 am and 12:00 noon or from 02:00 pm to 03:00 pm. The panellists were presented the samples and requested to record their ratings for, colour, flavour taste and overall acceptability on a 9 point Hedonic scale using numerical values ranging from 1 to 9, were 1 represented disliked extremely and 09 represented like extremely. The data obtained were analysed statistically on a completely randomized design using analysis of variance technique [7] to find if the differences were significant or not at 5 percent level of significant.

**Table 1 - Chemical composition of Soyabean, Soymilk and Cow milk.**

Attribute (per cent)	Soyabean	Soymilk	Cow Milk
Moisture	7.60	89.60	87.1
Fat	19.68 (db)	2.28	3.8
Protein	34.76(db)	4.03	3.30
Ash	4.47 (db)	0.58	0.70
Carbohydrate (by difference)	33.49	3.51	5.10
Calcium (mg)	277	25	119.83
Phosphorus (mg)	704	52	94.03

Db=dry basis

\*Values are average of three determinations

### IV. RESULTS & DISCUSSION

#### Chemical composition of raw material

The chemical composition of Soyabean, Soymilk and Cow Milk are presented in Table1. From the results it can be revealed that moisture, fat, protein, ash and carbohydrate content of soyabean were 7.60, 19.68, 34.76, 4.47 and 33.49 per cent, respectively. The results showed that the Soyabean contained 277 mg/100g and 704 mg/100g of calcium and phosphorus respectively. The values are similar to those reported by [8]. The result presented in Table 1 revealed that the moisture, fat, protein, ash and carbohydrate content in soymilk were 92.12, 2.28, 4.03, 0.58 and 0.99 percent, respectively. The results showed that soymilk contained 25 mg/100g and 52 mg/100g of calcium and phosphorus respectively. It was observed that values obtained in the present investigation are similar to those reported by [8], [9], [10] and [11].

The moisture, fat, protein, ash and carbohydrate content in cow milk were 87.0, 3.8, 3.30, 0.7 and 4.3 per cent, respectively. Cow milk contained 119.83 mg calcium and 94.03 mg phosphorus per 100 gram The values are similar to those reported by [10], [8], [9] and [12]. The results reported in Table 1 showed that the richest source of fat, protein and ash are soymilk and cow milk respectively.

#### Blending of soymilk with cow milk

#### Chemical composition of blends of soymilk with cow milk

The results of effect of blending of soymilk with cow milk on chemical composition like total solids, protein, fat, ash, , pH and acidity of blends are presented in Table 2. Soy milk was incorporated in cow milk at 5, 10, 15, 20, 25, 50, 75, and 100 percent to produce different blends of milk. From the results presented in Table 2 it is revealed that cow milk and soymilk contained 12.9 per cent and 10.4 per cent total solids, respectively. The total solid content of blends varied proportionately. The variation was non significant up to 15 per cent proportion of soymilk. This indicated that the blending of soymilk with cow milk reduced the amount of total solids. The variation in the amount of total solids was significant ( $P \leq 0.05$ ) at 20 per cent and above proportion of soymilk blend with respect to cow milk, however it was non significant at lesser than 20 per cent, level of soymilk with cow milk blends.

**Table 2 –Effect of blending on chemical composition of soymilk with cow milk**

Proportion of soymilk, (%)	Total solids (%)	Protein (%)	Fat (%)	Ash (%)	pH	Acidity (%)
0	12.90	3.30	3.80	0.70	6.90	0.21
5	12.78	3.34	3.72	0.69	6.89	0.21
10	12.65	3.38	3.65	0.69	6.88	0.21
15	12.53	3.41	3.57	0.68	6.88	0.21
20	12.40	3.45	3.50	0.68	6.86	0.22
25	12.28	3.48	3.42	0.67	6.85	0.22
50	11.65	3.67	3.04	0.65	6.82	0.23
75	11.03	3.86	2.66	0.62	6.78	0.23
100	10.40	4.03	2.28	0.58	6.74	0.24
CD at 5%	0.50	0.12	0.19	0.03	0.04	0.01

% = per cent

\*Values are average of three determinations

The values for protein content in cow milk and soy milk obtained in the present investigation were 3.3 per cent and 4.03 per cent respectively. The protein content in blends varied proportionately. This indicated that the blends of soy milk with cow milk increased the amount of

protein significantly ( $P \leq 0.05$ ) in the blends containing more than 15 per cent soymilk; however the variation was non significant upto 15 per cent soymilk. The values for fat content in cow milk and soy milk obtained in the present investigation were 3.80 per cent and 2.28 per cent respectively. The fat content in blends was found to be proportionately decreased with an increase in the amount of soymilk. The decrease in the fat content was significant ( $P \leq 0.05$ ) in blends containing 15 per cent and more amount of soymilk. In the present study, the value of 0.7 per cent for ash content was obtained in cow milk and 0.58 per cent in soy milk. The variation in ash content was non significant up to 20 per cent level of soymilk, however the variation was significant ( $P \leq 0.05$ ) at 25 per cent and more soymilk proportion with cow milk. The enhancement in protein amount and decrease in total solids, fat and ash content might be due to the variation in the proximate composition of soymilk and cow milk. The values of pH for cow milk and soymilk were 6.9 and 6.74, respectively, in the present investigation. The pH decreased slightly and proportionately in the blends with an increase in the amount of soymilk. The variation in pH was non significant below 20 percent level of soymilk in blends thereafter a significant ( $P \leq 0.05$ ) change in pH was observed. The variation in pH might be due to the pH of water used in preparation of soymilk and it may have slightly lower pH in comparison of cow milk. The value of acidity per cent for cow milk and soymilk were 0.21 and 0.24, respectively in the present investigation. The acidity increased slightly and proportionately of the blends with an increase in the amount of soymilk. The variation was non significant in the blends below 20 per cent level of soymilk and thereafter a significant ( $P \leq 0.05$ ) increase was observed. The changes in pH and acidity might be due to the use of slightly acidic water to prepare soymilk because of which the pH of soymilk was lower and acidity was higher than cow milk.

**Sensory Evaluation of blended cow milk with soy milk**

A laboratory panel consisting of 10 untrained members evaluated soy cow milk blends for sensory attributes such as colour, flavour, taste and overall acceptability. Sensory scores along with statistical analysis of soy cow milk blends are presented in Table 3 to 6. Results presented in Table 3 showed that the mean sensory score for colour of cow milk was maximum. However, the inclusion of soymilk up to 25 percent did not decrease the colour significantly ( $p \leq 0.05$ ) and thereafter the increased levels of soymilk lowered the colour of blends significantly ( $p \leq 0.05$ ). The mean score for colour of milk obtained from the blends containing 75 and 100 per cent soymilk were in acceptable range on a 9 point Hedonic Scale, and did not differ significantly ( $p \leq 0.05$ ) from each other. However, the blend.

**Table 3: Sensory scores for colour of blends of soy milk with cow milk**

Panellists	Proportion of soymilk, per cent								
	0	5	10	15	20	25	50	75	100
1	8	7	7	7	7	7	6	5	5
2	8	8	8	8	7	7	6	5	5
3	8	8	8	8	7	7	6	5	5
4	8	8	8	7	7	6	6	5	5
5	8	8	8	8	7	7	6	5	5
6	8	8	7	7	7	7	6	5	5
7	8	8	8	8	7	7	6	5	5
8	8	8	8	8	7	7	6	5	5
9	8	8	8	8	7	7	6	5	4
10	7	7	7	7	7	7	6	5	5
Mean	7.9	7.8	7.7	7.6	7	6.9	6	5	4.9
CD at 5% level: 0.31									

**Table 4: Sensory scores for flavour of soy milk and cow milk blends**

Panellists	Proportion of soymilk, per cent								
	0	5	10	15	20	25	50	75	100
1	8	7	7	8	7	6	5	5	5
2	8	8	8	7	7	6	6	5	5
3	8	7	8	8	7	6	5	5	4
4	8	8	8	8	7	6	6	5	5
5	8	7	8	8	7	6	5	5	5
6	8	8	8	7	7	6	6	5	5
7	8	8	7	8	7	6	5	5	4
8	7	8	7	7	7	6	5	5	5
9	8	8	8	7	7	6	6	5	4
10	7	8	7	7	7	6	5	5	5
Mean	7.8	7.7	7.6	7.5	7	6	5.4	5	4.7
CD at 5% level: 0.38									

**Table 5: Sensory scores for taste of soy milk and cow milk blends**

Panellists	Proportion of soymilk, per cent								
	0	5	10	15	20	25	50	75	100
1	8	8	8	8	7	7	6	5	5
2	8	8	8	8	7	7	6	5	5
3	8	7	7	7	7	7	7	5	5
4	8	8	8	8	7	6	6	5	5
5	8	8	8	8	7	7	6	5	5
6	8	8	7	7	7	7	7	5	5
7	8	7	8	8	7	7	6	5	5
8	8	8	7	7	7	7	6	5	5
9	8	8	8	7	8	7	6	5	4
10	7	8	8	8	8	7	7	5	5
Mean	7.9	7.8	7.7	7.6	7.2	6.9	6.3	5	4.9
CD at 5% level: 0.37									

**Table 6: Sensory scores for overall acceptability of soy milk and cow milk blends**

Panellists	Proportion of soymilk, percent								
	0	5	10	15	20	25	50	75	100
1	8	8	7	7	7	7	6	5	5
2	8	8	8	8	7	6	6	5	5
3	8	8	7	8	7	7	7	5	5
4	8	8	8	8	7	6	6	5	5

5	8	7	8	8	7	7	6	5	5
6	8	8	7	7	7	7	7	5	5
7	8	8	8	8	7	7	6	5	5
8	8	8	8	8	7	7	7	5	5
9	8	8	8	7	8	7	6	5	4
10	7	7	8	7	8	7	7	5	5
Mean	7.9	7.8	7.7	7.6	7.2	6.8	6.4	5	4.9
CD at 5% level: 0.37									

containing 50 per cent soymilk was in an acceptable range but was rated significantly ( $p \leq 0.05$ ) lower than all other blends containing less than 50 percent soymilk and significantly ( $p \leq 0.05$ ) higher than those having 75 and 100 percent soymilk. The effect of soymilk inclusion with cow milk on the flavour presented in Table 4 showed that the cow milk scored highest for flavour on 9 point Hedonic scale. It was found that the incorporation of soymilk up to 15 per cent did not lower the mean scores for flavour significantly ( $p \leq 0.05$ ). The increase in soymilk proportion from 15 to 20 percent had no significant ( $p \leq 0.05$ ) variation in flavour. Further increase in the proportion of soymilk lowered the mean sensory score for flavour significantly ( $p \leq 0.05$ ). The variation in flavour between the blends with 20 and 25 per cent soymilk and 25 and 50 per cent were non-significant. The blend consisting 50, 75 and 100 per cent proportion of soymilk were in acceptable range. The result of the effect of soymilk inclusion on the taste of blends showed that cow milk scored highest for taste on 9 point Hedonic scale. It was observed that the incorporation of soymilk up to 15 percent did not lower the mean sensory scores for taste significantly ( $p \leq 0.05$ ) and thereafter it had significant ( $p \leq 0.05$ ) effect. However raising of soymilk from 15 to 20 per cent did not alter the taste significantly ( $p \leq 0.05$ ). The blend prepared with 20 per cent soymilk differ significantly ( $p \leq 0.05$ ) from cow milk. But further increase in the proportion of soymilk lowered the score significantly ( $p \leq 0.05$ ). The differences in taste between the blends having 20 and 25 per cent soymilk were non significant and those between 25 and 50 per cent soymilk were non significant. The blend having 50 per cent soymilk was in acceptable range and thereafter it was in unacceptable range. The cow milk scored highest for mean overall acceptability attributes but the inclusion of soymilk up to 15 percent did not lower the mean overall acceptability scores significantly ( $p \leq 0.05$ ). The blend containing 50 percent soymilk were in acceptable range on a 9 point hedonic scale. The further increase in the proportion of soymilk in the blends lowered mean overall acceptability below acceptable range on a 9 point Hedonic scale. Statistical analysis of all the four attributes of sensory evaluation concluded that the incorporation of soymilk in cow milk up to 15 per cent proportion was found most suitable, however, soymilk may be included up to 25 per cent proportion in cow milk without significantly ( $P \leq 0.05$ ) affecting any sensory attributes.

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