Preparation of Legume Extract-Bovine Milk Blends and Development of Food Product Using Them
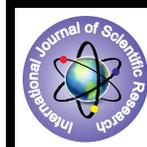
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ABSTRACT
Despite being a largest producer of milk, India has a very low per capita milk production and the price of milk is also not affordable for common people. Legume extract based dietary strategies prove not only nutritious but also economical. In this study legumes soybean, pigeonpea, chickpea and cowpea extracts (SoE, PiE, ChE and CoE) were prepared and blended with bovine milk (BM) at 50% ratio. Proximate and mineral analyses of these extracts were also done. To check their acceptability, mango shake with different variants (Variant A (SoE-BM), variant B (PiE-BM), variant C (ChE-BM), variant D (CoE-BM) and variant D (SoE:PiE:ChE:CoE-BM)) along with standard were prepared. Results indicate that SoE, PiE, ChE and CoE act as a good source of protein, fat and carbohydrates. Sensory evaluation outcomes of Mango shake depict that these blends can become suitable for preparing milk based products.
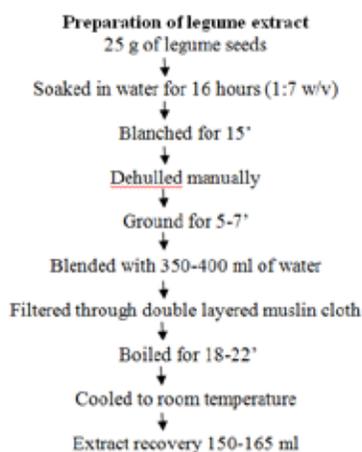
Introduction

There has been increasing interest in legume extract or vegetable milk because of the growing awareness of the nutritional benefits of low cholesterol diets (Aidoo et al., 2012). On the other hand, in India, the cost of bovine milk and its products is very high. A cheap substitute in the form of a beverage prepared from locally available plant can offer an easy way to supplement and balance the quality as well as quantity of bovine milk (Baghaei et al., 2008). Non-dairy ingredients like legume extract find a critical role in synergy of the chemical constituents of dairy foods to enhance their sensory, nutritional profile, at the same time influencing the cost of the resultant product (Hirpara et al., 2011). Legumes provide protein, carbohydrates, minerals, vitamins and phytochemicals along with trace elements, fatty acids and dietary fibre which are considered to be responsible for the protective effects against CVD and cancer (Trinidad et al., 2010). In this research work, SoE, PiE, ChE and CoE were prepared using household processing methods. Thereafter proximate principle and mineral analysis (calcium and iron) of these extracts were carried out. SoE, PiE, ChE and CoE were blended with BM in the ratio of 50:50 to prepare milk shake. Thus the challenge was to prepare an acceptable product using these extracts.

Methodology

Preparation of legume extracts using appropriate household processing methods

JS-335 of soybean, Bahar of pigeonpea, RSGK-6 of chickpea and RC-101 of cowpea varieties were used to prepared legume extracts. Extracts of the four legumes were prepared by improvising over a method of *Omueti and Ajomale* (2005) and the salient steps of the method are given as here under:

Preparation of legume extract
25 g of legume seeds
↓
Soaked in water for 16 hours (1:7 w/v)
↓
Blanched for 15'
↓
Dehulled manually
↓
Ground for 5-7'
↓
Blended with 350-400 ml of water
↓
Filtered through double layered muslin cloth
↓
Boiled for 18-22'
↓
Cooled to room temperature
↓
Extract recovery 150-165 ml

Nutrient and antinutrient analysis

Moisture, ash and crude fibre of legume extracts and their raw forms were determined by AOAC (2000) method. Crude protein and crude fat were determined by the Micro- Kjeldahl and Soxhlet extraction method respectively. Total crude carbohydrates were obtained by difference method. Calcium and iron were estimated by following the AOAC (2000) method.

Method of preparation of *Mango shake* with variants and its sensory evaluation

For preparing Standard recipe, ripe mango was washed and peeled to get mango pulp then sugar, milk and WPC (whey protein concentrate) were added to it. Mixture was blended well in a blender till light, frothy and smooth. Cardamom powder and crushed ice were also added at the end. In variant A soy extract-bovine milk (50:50) blend was used in place of bovine milk and rest of the procedure was followed same as that of control. In variant B pigeonpea extract-bovine milk (50:50) blend was taken for making the recipe. Same method was used to make Mango shake as that of control. In variant C chickpea extract-bovine milk (50:50) blend was added in the recipe. Rest of the method was same as that of control. In variant D cowpea extract-bovine milk (50:50) blend was selected to prepare the Mango shake with the same procedure. In variant E four legume (soybean, pigeonpea, chickpea and cowpea) extract-bovine milk (50:50) blend was chosen for the recipe following the standard procedure. Ingredient used in this recipe is given in table no.1. Thereafter, sensory evaluation was done using nine-point hedonic rating scores.

Results and discussion

Proximate and mineral analysis

Proximate analysis of legumes and their extracts was shown in table no. 2. Mean values of moisture content was found to be highest in PiR (10.66 ±.10 g/100g) and lowest in SoR (08.41±.01). Same pattern was also seen in their extracts. To compare the nutritive values of legume extracts, nutrient content of BM was also estimated; mean value of moisture content of BM stood 88.33±.58. Except PiE, no significance difference was observed among SoE, ChE, CoE and BM. Total ash content was found to be highest in SoR (04.83±.01 g/100g) followed by PiR (04.00 ±.10 g/100g), CoR (03.72±.05 g/100g) and ChR (3.17±.02 g/100g). Similar trend was also seen in their extracts. BM got highest mean value of ash content i.e. 00.73±.01 g/100 ml when it was compared with ash content of legume extracts. No significant difference was found among them except PiE. Protein content of SoR, PiR, ChR and CoR was 39.33 ±.11 (g/100g), 22.58±.03 (g/100g), 23.30±.43 (g/100g), and 24.28±.26 (g/100g) respectively. Protein content in SoE was found to be highest i.e. 04.76±.23 (g/100ml). ChE, CoE and BM had near the same mean value of protein content i.e. 03.50 ±.10, 03.17 ±.15 and 03.53±.02 respectively. Lowest value was observed in PiE (01.62±.02

g/100ml). Significant difference was observed in SoE and CoE when it was compared with BM. Fat content of SoR, PiR, ChR and CoR was found 19.32 ±.02 g/100g, 01.50±.10 g/100g, 03.50±.10 g/100g and 01.50±.02 g/100g which depicts that SoR is a good source of fat especially unsaturated fatty acids. Though other legumes had fewer amounts of fats, these are healthy food especially for middle age and elderly. SoE competed with BM fat content; values were 02.36±.04 g/100ml and 03.41±.01 g/100ml respectively. Other ChE, CoE and PiE had very less amount of mean value of fat content 00.87 ±.06 g/100ml, 00.18 ±.01 g/100ml and 00.16±.00 g/100ml respectively. No significant difference was observed among them. Crude fiber content in SoR, PiR, ChR and CoR was 03.53±.15, 06.12±.03, 03.63±.36 and 03.78±.32 g/100g respectively. Removal of outer husk of legumes in the preparation of extracts decreased fibre content. Mean value of fibre content of SoE, PiE, ChE and CoE was found to be 00.32±.01, 00.47±.01, 00.32 ±.01 and 00.35 ±.02 respectively. Since BM does not have fibre content, no value was obtained for it. Legumes are good source of carbohydrates. PiR, ChR and CoR had mean value of carbohydrates 54.92±.06 g/100g, 55.19±.25 g/100g and 56.28±.48 g/100g. In comparison with PiR, ChR and CoR , SoR had less amount of carbohydrates i.e. 24.25 ±.12 g/100g. Its content decreased in legume extracts because of the addition of water in preparing extracts. Mean value of SoE, PiE, ChE and CoE was found to be 04.49±.18, 03.95±.05, 05.63±.06 and 05.77±0.15 g/100 ml respectively. Except PiE, no significant difference was observed among legume extracts and BM i.e. 04.31±.05 g/100ml. The highest mean value of calcium was found in SoR (272.33±6.42 mg/100g) while the lowest was observed in CoR (68±1 mg/100g). And same pattern was seen in their extracts. While BM had the highest mean value of calcium (124±1 mg/100g) when compared with SoE, PiE, ChE and CoE. Significant difference was observed among SoE, PiE, ChE, CoE and BM. Legumes are considered to be a good source of iron in comparison with milk. In their uncooked form, SoR (8.83±.11 mg/100g) got first place followed by CoR (6.85±.01 mg/100g), ChR (6.60±.1 mg/100g) and PiR (4.26±.11 mg/100g). Same trend was also observed in their extracts. Significant difference was also seen in SoE, PiE, ChE, CoE and BM. (table no. 3)

Sensory evaluation of *Mango shake*

In terms of overall acceptability, variant B was the most was the most acceptable. It was followed by variants A, C, E and standard which had the same mean values. In comparison with these variants, variant C got the least mean value. Poul et al. (2009) prepared shake using custard apple in different ratio (10%, 15% and 20%) with control (buffalo milk). On the basis of result, it was concluded that custard apple pulp can be utilized for preparation of acceptable shake. Custard apple milk shake prepared from buffalo milk and custard apple pulp (90:10) was found most acceptable. Ganjyal et al. (2005) made banana milk shake incorporated with 20% sapota powder. It was evaluated for appearance, color, taste, texture, flavor and overall acceptability on the basis of composite rating scores. The mean scores ranged from 3.61 to 4.26 which show good acceptability. (figure 1).

Conclusion

The extracts prepared from legumes after appropriate processing steps and their blending with bovine milk for different food products preparation could offer an easy way out for a nourishment option with favorable availability and economic implications. Results of this study revealed that *Mango shake* was found acceptable. On the basis of this, it can be concluded that legume extracts can be used to prepared legume extract-bovine milk blends and that can be used for the preparation of milk based products to overcome the problem of shortage of milk supply.

Table no. 1. Ingredient used in the recipe *Mango shake* with variants (A, B, C, D and E)

Ingredients	Standard (g)	Variant A (g)	Variant B (g)	Variant C (g)	Variant D (g)	Variant E (g)
Mango pulp	100	100	100	100	100	100
Milk	180	180	180	180	180	180
Sugar	15	15	15	15	15	15
WPC	2	2	2	2	2	2
Cardamom	A pinch	A pinch	A pinch	A pinch	A pinch	A pinch
Total	**297**	**297**	**297**	**297**	**297**	**297**

In standard BM, in variant A, SoE-BM (50:50), in variant B, PiE-BM (50:50), in variant C, ChE-BM (50:50), in variant D, CoE-BM (50:50), in variant E, SoE:PiE:ChE:CoE-BM (12.5:12.5:12.5:12.5:50) were used

Table no. 2. Mean value of proximate principles of legumes and their extracts

	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
SoR	08.41±.01	04.83±.01	39.33 ±.11	19.32 ±.02	03.53 ±.15	24.25 ±.12
PiR	10.66 ±.10	04.00 ±.10	22.58±.03	01.50±.10	06.12±.03	54.92±.06
ChR	10.47±.38	3.17±.02	23.30±.43	03.50±.10	03.63±.36	55.19±.25
CoR	09.60±.10	03.72±.05	24.28±.26	01.50±.02	03.78±.32	56.28±.48
SoE	87.33±.30	00.48±.01	04.76±.23	02.36±.04	00.32±.01	04.49±.18
PiE	93.10±.65	00.37±.06	01.62±.02	00.16±.00	00.47±.01	03.95±.05
ChE	89.17 ±.21	00.27 ±.01	03.50 ±.10	00.87 ±.06	00.32 ±.01	05.63 ±.06
CoE	89.97 ±.95	00.28 ±.01	03.17 ±.15	00.18 ±.01	00.35 ±.02	05.77 ±0.15
BM	88.33±.58	00.73±.01	03.53±.02	03.41±.01	-	04.31±.05

Table no. 3. Mean value of minerals of legumes and their extracts

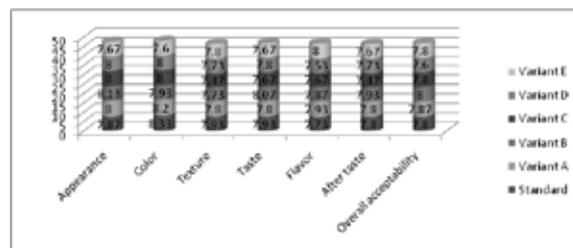|	SoR	PiR	ChR	CoR	SoE	PiE	ChE	CoE	BM
Calcium (mg %)	272.33 ±6.42	120.33 ±1.41	222.16 ±2.02	068.00 ±1	025.00 ±1.55	019.00 ±1	021.67 ±1.52	017.00 ±1	124.00 ±1
Iron (mg %)	8.83 ±.11	4.26 ±.11	6.60 ±.1	6.85 ±.01	0.88 ±.01	0.53 ±.01	0.75 ±.01	0.78 ±.01	0.25 ±.01

Fig1. Hedonic acceptability evaluation scores of standard and variants of *Mango shake*

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