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Standardization and sensory evaluation of Rabadi by incorporating legume extract-bovine milk blends

Preeti Verma — Assistant Professor, Department of Home Science, The IIS University, Jaipur.

Dr. Sheel Sharma — Professor, Banasthali Vidyapith, Home Science Department, Banasthali Vidyapith, Tonk, Rajasthan-304022.

ABSTRACT

In this research work, the efforts were made to prepare Rabadi by incorporating legume extract- bovine milk blends. 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, Rabadi with different variants (Variant A (SoE-BM), variant B (PiE-BM), variant C (ChE-BM), variant D (CoE-BM) and variant E (SoE:PiE:ChE:CoEBM)) along with standard were prepared. Results indicate that SoE, PiE, ChE and CoE act as a good source of protein, fat and carbohydrates. On the basis of overall acceptability of Rabadi, standard was the most acceptable. After standard, variants C and E had the same mean scores followed by variants A, D and B respectively. No significant difference was found in all variants and standard. Thus all variants were equally acceptable as standard.

KEYWORDS : Bovine milk, Legume extract, Rabadi

Introduction:

Fermented foods contribute to about one-third of the diet worldwide (Campbell-Platt, 1994). These are extremely popular in most of the Indian sub-continent. Among fermented products, *Rabadi is made from* buttermilk and cereals like pearl millet, wheat and sorghum. Great prospects exist in India for value-addition and improving health benefits of milk and milk by-products (Modha and Pal, 2011). Non-dairy ingredients like legume extract find a critical role in synergy of the chemical constituents to enhance their sensory and nutritional profile (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 *Rabadi*.

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:

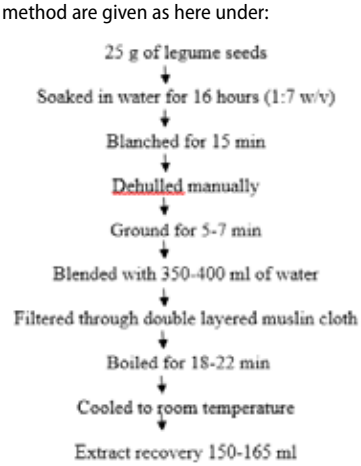


Fig.1 Flow chart elucidating preparation of legume extracts

Nutrient and mineral 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. Carbohydrates were obtained by difference method. Calcium and iron were estimated by following the AOAC (2000) method.

Method of preparation of *Rabadi* with variants and its sensory evaluation:

For preparing standard recipe, Pearl millet flour was mixed with sour curd. It was diluted with 300 ml of plain water. Salt was added at the time of cooking. When it started boiling, it was simmered for 10-15 minutes. In variant A soybean 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 *Rabadi* 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 *Rabadi* 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:

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. Proximate composition and minerals are given in table no. 2 and 3 respectively.

Sensory evaluation of *Rabadi:*

On the basis of overall acceptability, standard was the most acceptable. After standard, variants C and E had the same mean scores followed by variants A, D and B respectively (Table 4). No significant difference was found in all variants and standard. Thus all variants were equally acceptable as standard. Sharma et al. (2009) developed *Soft serve ice cream* by substituting standardized milk with different proportions of soymilk. Substitution of standardized milk with soymilk up to 30 % resulted in acceptable flavor. On the other hand, Gupta and Nagar (2014) again conducted a study on the role of traditional processing (cooking, fermentation, dehulling, utensil, preparation methods and cereals) on minerals and antinutrients of pearl millet, wheat flour, and refined wheat flour *Rabadi.* Results showed that the process of cooking and fermentation enhanced minerals (calcium, iron and phosphorus) in all types of *Rabadi* samples in significant level. While antinutrients (phytic acid, total phenol and oxalates) reflected a decline trends. Dehulling caused a loss of minerals but antinutrients were also decreased after dehulling. Earthen pot *Rabadi* samples showed better biochemical composition than *Rabadi* prepared in steel pot. Nutritive value of Rabadi along with variants have been mentioned in figure no.2.

Conclusion:

Results revealed that on the basis of overall acceptability, all variants were equally liked as standard. Protein was found to be highest in SoE and lowest in PiE. The extracts prepared from legumes after appropriate processing steps, their blending with bovine milk and food product development could offer an easy way out for a nourishment option with favorable availability and economy and higher nutrition and health care options than those of milk. On the basis of this study, it can be concluded that legume extracts can be utilized for the preparation of Rabadi upto 50% proportion.

Table no. 1. Ingredient used in the recipe *Rabadi* 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)
Pearl millet flour	20	15	15	15	15	15
Soybean flour	-	5	-	-	-	1.25
Pigeonpea flour	-	-	5	-	-	1.25
Chickpea flour	-	-	-	5	-	1.25
Cowpea flour	-	-	-	-	5	1.25
Sour Curd	60	60	60	60	60	60
Black pepper	A dash	A dash	A dash	A dash	A dash	A dash
Salt	To taste	To taste	To taste	To taste	To taste	To taste
Total	**80**	**80**	**80**	**80**	**80**	**80**

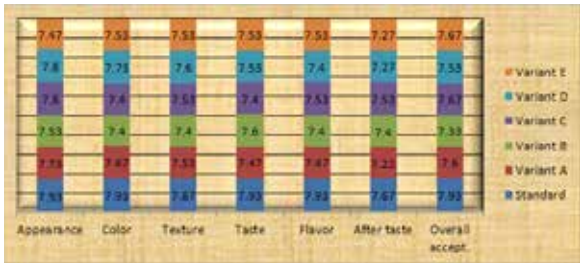
Sour curd was made in variant A by using soybean extract-bovine milk blends (50%50), in variant B by incorporating pigeonpea extract-bovine milk blends (50%50), in variant C by adding chickpea extract-bovine milk blends (50%50), in variant D by mixing cowpea extract-bovine milk blends (50%50) and in variant E by using four legume (soybean, pigeonpea, chickpea and cowpea) extract-bovine milk (50:50).

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

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



Fig/pic. 2: Mean sensory evaluation (9 point hedonic) scores of standard and variants of *Rabadi*

Table no. 4. Nutritive composition of the Rabadi and its variants:

	Energy (kcal)	Protein (g)	Fat (g)	Carbohydrates (g)
Standard	135.25	5.22	4.25	19.12
Variant A	138.28	7.86	4.15	17.36
Variant B	119.27	5.38	2.15	19.45
Variant C	126.07	6.25	2.76	19.93
Variant D	123.64	6.06	2.19	19.94
Variant E	142.15	7.40	3.16	21.02

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