PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
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Pakistan Journal of Nutrition 6 (2): 134-137, 2007
ISSN 1680-5194

Preparation and Quality Evaluation of *Lathyrus sativus* L-bovine Milk Blend

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Abstract: The aim of this study was to develop methodology for the preparation of *Lathyrus sativus* (matri)-bovine milk blend and its quality evaluation through physico-chemical and sensory analyses. Different pre-treatments were applied to detoxify and dehulled grains in order to inactivate lipoxygenase and to improve flavour of milk including heating, immersion in ethyl alcohol and pH adjustment. The results exhibited that the milk sample having 5% skim milk powder, 5% *Lathyrus sativus* (*LS*) milk, 3% sugar and 1.68% fat (T_3) was declared the best with regard to all the parameters of sensory evaluation. Skim milk powder and *LS* milk at a ratio of 50:50 on total solids basis produced the most acceptable product.

Key words: Indian vetch, sensory evaluation, *lathyrus sativus*, conventional protein

Introduction

Increase in the world population has caused substantial decline in per capita supply of conventional protein. This situation has created a great demand for vegetable proteins as obtained from legumes such as *Lathyrus sativus* (matri). *Lathyrus sativus* is native to Southern Europe and Western Asia. It is also known as Indian vetch and mainly grown in India, Bangladesh and Pakistan. *Lathyrus sativus* seeds are used as food, feed and important source of concentrate in rations of animals (Rehman *et al*., 2006b).

The approximate composition of the seed of *Lathyrus sativus* has been reported as moisture l0g, protein 25g, fat l.0g, total carbohydrates 61g, fiber 15g, ash 3g, Ca 110mg, Iron 5.6mg, Vit. A 70lU, Thiamine 1.0mg and Riboflavin 40mg per 100g and some essential amino acids are also present (Kay, 1979). Soaked dried *Lathyrus sativus* contains 8.8% moisture, 28.38% protein, 2.7% fiber 3.36% ash and 1.37% fat (Rehman *et al*., 1998).

Lathyrus sativus seeds contain a neurotoxin; beta-N-oxalyl-L-alpha-beta diaminopropionic acid (ODAP) that causes lathyrism, a paralysis of lower limbs both in men and animals. Research efforts are being accelerated to develop improved varieties with low toxin (ODAP) (Malik, 1994).

It is a cheap legume and usually used as an adulterant in gram flour which is consumed in the form of savoury products such as pakhora. It may be injurious for human health when it is used without depleting toxin. However, *Lathyrus sativus* seeds can be detoxified by steeping in double quantity of water for 7-8 hours at 60-70°C (Rehman *et al*., 2006b).

Detoxified *Lathyrus sativus* has been used for the preparation of *Lathyrus sativus* milk powder (Rehman *et al*., 2006a), enrichment of bread (Lodhi *et al*., 2003), biscuit (Rehman *et al*., 1997), doughnuts (Rehman *et al*., 2007), ice cream (Rehman *et al*., 2004) and chapatti (Rehman *et al*., 2006b). Detoxified *Lathyrus sativus* can be utilized to produce *Lathyrus sativus* millk to provide the people a cheaper source of essential amino acids, vitamins and minerals and a milk substitute for those who cannot tolerate cow milk.

Keeping in view the above facts, this project was designed to develop methodology for the preparation of *Lathyrus sativus*-bovine milk blend and its quality evaluation through physico-chemical and sensory analyses.

Materials and Methods

Lathyrus sativus (matri), bovine skim milk powder, cream, sugar and skim milk flavour were purchased from local market. It was cleaned and detoxified by steeping in double quantity of water for 8 hours at 60-70°C, water was changed 7 times, drained and *Lathyrus sativus* (*LS*) was sun dried as described by Rehman *et al*. (2006b).

Chemical analysis of *LS*: *LS* was chemically analyzed for moisture, ash, crude protein, crude fat, crude fiber and nitrogen free extract (NFE) according to the methods described by AACC, 2000.

Pre-treatments of *LS*: Several pre-treatments were applied to the pre-cleaned, detoxified and dehulled *Lathyrus sativus* to inactivate lipoxygenase and improve flavour of *LS* milk, including heating, addition of ethyl alcohol and pH adjustment.

Table 1: Chemical composition of raw *LS* detoxified and water soaked dried *LS* flour

Chemical constituents (%)	Raw *LS*	Detoxified *LS*	Dried *LS* flour (Water soaked)
Moisture	10.42	10.70	10.60
Protein*	28.32	25.45	23.98
Fiber*	8.92	9.02	1.20
Fat*	1.31	1.13	1.09
Ash*	3.90	3.12	2.26
Nitrogen Free Extract*	57.55	61.28	71.47

*= dry weight basis

Effect of temperature and time on *LS* water extract (Trial I): *LS* was heated in water at 70°, 80°, 90° and 100°C for 45, 60 and 70 minutes separately. After this, each sample was blended in an osterizer and homogenized by adding water in *LS* flour in a ratio of 1:8 (*LS*:water). Each sample was evaluated for taste and flavour for the selection of best treatment.

Soaking of *LS* in ethyl alcohol (Trial II): The best selected sample (trial I) was further treated with 2, 4, 6 and 8% (v/v) aqueous solution of ethyl alcohol at 100°C for 60 minutes. After this, each sample was blended in an osterizer and homogenized by adding water in *LS* flour in a ratio of 1:8 (*LS*:water). Each sample was evaluated for taste and flavour for the selection of best treatment.

Soaking of *LS* in water at various pH (Trial-III): The best selected sample from previous (trial II) was soaked in water at 100°C for 60 minutes and pH of water was adjusted at 3, 4, 5, 6, 7, 8 and 9. After this, each sample was blended in an osterizer and homogenized by adding water in *LS* flour in a ratio of 1:8 (*LS*:water). Each sample was evaluated for taste and flavour for the selection of best treatment.

***LS* milk production:** The best selected soaking conditions were applied and then the *LS* was sun dried to a moisture level of 10-12%. The dried *LS* was milled in the Qadrumate Senior Experimental Mill. Break and reduction flours were mixed, packed in air tight jars and stored at ambient temperature. Slurry of *LS* flour was prepared and diluted with water at ratio of 1:10 (*LS*:water) and then it was homogenized, pasteurized and cooled.

Reduction in beany flavour and astringency

Addition of sucrose: Sucrose at the rate of 1, 2, 3, 4 and 5% was added and mixed in osterizer. The samples were sensory evaluated and best level was selected on the basis of sensory characteristics.

Addition of fat: Various levels of fat, 1.00, 1.68, 2.40 and 3.20% were added in to the selected sample of *LS* milk, mixed and sensory evaluated for further selection of the best one.

Addition of skim milk powder: Skim milk powder was added to the best selected *LS* milk sample at various levels as given below:

T_0 = *LS* Milk without anything (Total solids 10%)
T_1 = 3% skim milk powder + 7% *LS* milk + 3% sugar + 1.68% fat
T_2 = 4% skim milk powder + 6% *LS* milk + 3% sugar + 1.68% fat
T_3 = 5% skim milk powder + 5% *LS* milk + 3% sugar + 1.68% fat
T_4 = 6% skim milk powder + 4% *LS* + 3% sugar + 1.68% fat
T_5 = 7% skim milk powder + 3% *LS* + 3% sugar + 1.68% fat
T_6 = 8% skim milk powder + 2% *LS* + 3% sugar + 1.68% fat

(Total solids were adjusted by the addition of water to make volume 100 ml)
Final treatments of *LS* milk were again pasteurized, cooled, filled in bottles, sealed and refrigerated.

Physico-chemical analysis of *LS-bovine* milk blend: Bottled *LS-bovine* milk blend was analyzed for total solids, protein, fat, ash, acidity and pH according to the methods of AOAC, 2000.

Sensory evaluation: The bottled *LS-bovine* milk blend was sensory evaluated by a panel of judges for colour, flavour, taste and overall acceptability as described by Land and Shepherd, 1988.

Statistical analysis: The data obtained was subjected to analysis of variance according to the procedures of Steel *et al.*, 1997.

Results and Discussion

Chemical composition of *LS*: The chemical compositions of raw, detoxified, soaked, dried and milled LS flours are shown in Table 1. These results are comparable to the findings of Rehman *et al.*, 2006a.

Production of *LS*-bovine milk blend: Different treatments were applied to *LS* prior to preparation of *LS* milks. Different temperatures and time periods combinations significantly affected the taste and flavour of the *LS* milk. The highest mean scores were awarded to the sample treated at 90°C for 60 minutes. This selected milk sample when further treated with different levels of aqueous ethyl alcohol, significant difference between these levels was observed. The *LS* milk

Table 2: Chemical analysis of *LS*-bovine milk blend

Treatments	Total Solids (%)	Protein (%)	Fat (%)	Ash (%)	Titratable Acidity (%)	pH
T_0	10.00b	2.77f	0.15b	0.48d	0.06e	7.11a
T_1	14.38a	3.14e	1.79a	0.51d	0.15d	6.97b
T_2	14.38a	3.23de	1.80a	0.57c	0.23c	6.94b
T_3	14.38a	3.32cd	1.82a	0.59bc	0.30b	6.87c
T_4	14.38a	3.41bc	1.78a	0.60bc	0.36a	6.87c
T_5	14.37a	3.51ab	1.79a	0.62b	0.37a	6.83c
T6	14.37a	3.59a	1.78a	0.67a	0.38a	6.77d

Values sharing similar letters in a column are non-significant (P>0.05)

Table 3: Sensory evaluation of *LS*-bovine milk blend

Treat-ments	Colour	Flavour	Taste	Overall Acce-ptability
T_0	4.17d	3.67c	4.67e	4.83b
T_1	5.33c	5.50b	5.33de	4.50b
T_2	5.67bc	6.17ab	5.67cd	5.17b
T_3	7.83a	7.17a	7.50a	7.33a
T_4	6.83ab	6.67ab	6.50bc	6.67a
T_5	6.67b	7.00a	7.33ab	6.83a
T_6	6.50b	6.50ab	7.17ab	7.00a

Values sharing similar letters in a column are non-significant (P>0.05)

produced without the treatment of ethyl alcohol was highly accepted in sensory characteristics. Different levels of pH had a significant effect on the quality of milk. Highest scores were obtained by the *LS* milk treated at pH 4. When sucrose was added in the milk at different levels in order to improve the taste, the milk having 3% sucrose was found to be best in taste, while the sample prepared without sugar was not accepted. Addition of different levels of fat in the *LS* milk also affected the taste and flavour significantly. The most acceptable level of fat was 1.68%. The best selected treatments were applied and different samples of *LS* milk were prepared by using different levels of skim milk powder.

Chemical Analysis of *LS*-bovine milk blend: Highest mean total solids (14.38%) were found in treatments having skim milk powder, sugar and fat (T_1, T_2, T_3 and T_4), while the lowest (10.0%) in *LS* milk (T_0) (Table 2). The statistical analysis showed that the treatments differed significantly; however, the difference between the samples with added sugar, fat and skim milk powder was non-significant. The results indicated that increase of skim milk powder and decrease of *LS* flour did not affect the total solids which remained almost constant. The results are similar to the findings of Mittal *et al.*, 1976.

The results regarding the protein content of different milk samples gave the highly significant difference. The highest mean value (3.59%) was obtained by sample having 8% skim milk powder, 2% *LS* milk, 3% sugar and 1.68% fat (T_6), while the lowest (2.77%) by the control treatment (Table 2). The trend exhibited that as the ratio of skim milk powder to *LS* flour increased, the protein content increased. The results are similar to the findings of Singh (1978) and Kayani (1987) who have prepared the milk from soybean.

The fat content of different milk samples differed significantly; however, the samples containing skim milk powder, sugar and fat had non-significant difference in their fat contents. The highest fat content (1.82%) was observed in the treatment having 5% skim milk powder, 5% *LS* milk, 3% sugar and 1.68% fat (T_3). The lowest fat content (0.15%) was found in *LS* milk without anything (Table 2).

The difference in the ash content of milk samples was found statistically significant. The highest mean value (0.67%) was recorded in sample having 8% skim milk powder, 2% *LS* milk, 3% sugar and 1.68% fat (T_6). The lowest ash content (0.48%) was noted in control treatment (Table 2). The results of ash content in this study are similar to the findings of Singh (1978) and Kayani (1987). The variation in ash content is due to the increase in skim milk powder and decrease in *LS* flour.

Titratable acidity recorded for milk samples was statistically different. The highest acidity (0.38%) was found in the milk having 8% skim milk powder, 2% *LS* milk, 3% sugar and 1.68% fat (T_6). The minimum acidity value (0.06%) was observed in control sample (Table 2). The range of titratable acidity is similar to the findings of Sexena and Singh, 1997.

The highest pH value (7.11) was noted in control sample, and the lowest (6.77) in the sample having 8% skim milk powder, 2% *LS* milk, 3% sugar and 1.68% fat (T_6) (Table 2). Statistically pH values for all the treatments were highly significant. The results are comparable with the findings of Sexena and Singh (1997) and Chien and Snyder (1983).

Sensory evaluation of *LS*-bovine milk blend: The scores awarded by the judges to the final product for colour, flavour, taste and overall acceptability are presented in Table 3. The results revealed that the milk sample having 5% skim milk powder, 5% *LS* milk, 3% sugar and 1.68% fat (T_3) was declared the best with regard to all the parameters of sensory evaluation. The lowest scores were awarded to the control sample with

respect to the colour, flavour and taste of the milk. The overall acceptability of the sample having 3% skim milk powder, 7% *LS* milk, 3% sugar and 1.68% fat (T_1) was the least. Statistical analysis revealed that all ingredients significantly affected the sensory parameters of milk samples. Similar results were reported by Chien and Snyder, 1983.

Conclusion: It is concluded that heating of *LS* in water (pH 4) at 90°C for 60 min proved the best treatment for the inactivation of lipoxygenase enzyme, as a result of which beany flavour minimized. To overcome the problem of astringency in *LS* milk, addition of 3% sucrose and 1.68% fat improved the taste. Further, blending of bovine skim milk powder and *LS* milk at a ratio of 50:50 on total solids basis produced an acceptable product.

References

AACC., 2000. Approved Methods of American Association of Cereal Chemists. The American. Association of Cereal Chemists. 15th Ed., Arlington, USA.

AOAC., 2000. Official Methods of Analysis, 17th Ed. The Association of Analytical Chemists, Arlington, D.C., USA.

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

Kay, D.E., 1979. Food Legumes. Tropical Products Institute, London.

Kayani, M.A., 1987. Preparation and quality evaluation of soymilk. M.Sc. Thesis, Deptartment of Food Technology, University of Agriculture, Faisalabad, Pakistan.

Land, D.G. and R. Shepherd, 1988. Scaling and Ranking Methods. In "Sensory Analysis of Foods". J.R. Piggott (Ed.). Elsevier Applied Sci. New York., pp: 155-185.

Lodhi, S.A., S. Rehman and N. Huma, 2003. Effect of supplementation of detoxified matri flour with wheat flour on the quality of pan bread. Pak. J. Sci. Indust. Res., 46: 207-210.

Malik, B.A., 1994. Grain legumes. In "Crop Production". E. Bashir and R. Bantel (Eds.) National Book Foundation, Islamabad, pp: 316-317.

Mittal, M., M.A. Quadri, H.S. Kushwah and I.C. Data, 1976. Comparative chemical analysis of soymilk vs cow milk. Ind. J. Nutr. Dietet., 13: 185-188.

Rehman, S., M.I. Siddique, J.A. Awan and H.E. Ullha, 1997. Nutritional impact of matri (*Lathyrus sativus*) on biscuits. J. Agri. Res., 35: 453-459.

Rehman, S., M.I. Siddique, J.A. Awan and H.E. Ullha, 1998. Effect of supplementation of matri (*Lathyrus sativus*) on the quality of biscuits. J. Agri. Res., 36: 299-306.

Rehman, S., B.H. Shah, S.Z.H. Kazmi and S.T. Muntaha, 2006a. Effect of incorporation of matri skim milk powder on dough rheology and bread sensory quality. Indus. J. Plant Sci., 3: 805-809.

Rehman, S., A. Paterson, S. Hussain, M.A. Murtaza and S. Mehmood, 2007. Influence of partial substitution of wheat flour with vetch (*Lathyrus sativus)* flour on quality characteristics of doughnuts. LWT-Food Sci. Tec., 40: 73-82.

Rehman, S., A. Paterson, S. Hussain, I.A. Bahtti and M.A.R. Shahid, 2006b. Influence of detoxified Indian vetch (*Lathyrus sativus* L.) on sensory and protein quality characteristics of composite flour chapatti. J. Sci. Food Agri., 86: 1172-1180.

Rehman, S., S. Hussain, A. Randhawa and M.S. Din, 2004. Physico-chemical characteristics of matri-skim milk blend ice cream. Food Sci., 25: 83-86.

Sexena, S. and G. Singh, 1997. Suitability of new soybean cultivar in the production of soymilk. J. Food Sci. Tec., 34: 150-152.

Singh, S., 1978. Potential of soy protein in improving. Indian Diet. Prof. Int. Soy Protein Food Conf., pp: 70-73.

Steel, R.G.D., J.H. Torrie and D.A. Dickey, 1997. Principles and Procedures of Statistics. A Bio-Metrical Approach. 3rd Ed. McGraw Hill Book Co., Inc. New York.