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 lipoygenase 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.F.) 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 10g, protein 25g, fat 10g, total carbohydrates 61g, fiber 15g, ash 3g, Ca 110mg, iron 5.6mg, vit. A 740U, 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-alalya-beta diaminopropionic acid (ODAP) that causes lathyris, 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 pakora. 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., 2008b). Detoxified *Lathyrus sativus* has been used for the preparation of *Lathyrus sativus* milk powder (Rehman et al., 2008a), 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* milk 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 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 lipoygenase 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

<table>
<thead>
<tr>
<th>Chemical constituents (%)</th>
<th>Raw LS</th>
<th>Detoxified LS</th>
<th>Dried LS flour (Water soaked)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>10.42</td>
<td>10.70</td>
<td>10.60</td>
</tr>
<tr>
<td>Protein*</td>
<td>28.32</td>
<td>25.45</td>
<td>23.98</td>
</tr>
<tr>
<td>Fiber*</td>
<td>6.82</td>
<td>9.02</td>
<td>1.20</td>
</tr>
<tr>
<td>Fat*</td>
<td>1.31</td>
<td>1.13</td>
<td>1.08</td>
</tr>
<tr>
<td>Ash*</td>
<td>3.00</td>
<td>3.12</td>
<td>2.28</td>
</tr>
<tr>
<td>Nitrogen Free</td>
<td>57.55</td>
<td>61.28</td>
<td>71.47</td>
</tr>
</tbody>
</table>

*= 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 Cadrummate 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 skin milk powder: Skim milk powder was added to the best selected LS milk sample at various levels as given below:

\[
\begin{align*}
T_0 & = \text{LS Milk without anything (Total solids 10\%)} \\
T_1 & = 3\% \text{ skim milk powder} + 7\% \text{ LS milk} + 3\% \text{ sugar} + 1.68\% \text{ fat} \\
T_2 & = 4\% \text{ skim milk powder} + 6\% \text{ LS milk} + 3\% \text{ sugar} + 1.68\% \text{ fat} \\
T_3 & = 5\% \text{ skim milk powder} + 5\% \text{ LS milk} + 3\% \text{ sugar} + 1.68\% \text{ fat} \\
T_4 & = 6\% \text{ skim milk powder} + 4\% \text{ LS milk} + 3\% \text{ sugar} + 1.68\% \text{ fat} \\
T_5 & = 7\% \text{ skim milk powder} + 3\% \text{ LS milk} + 3\% \text{ sugar} + 1.68\% \text{ fat} \\
T_6 & = 8\% \text{ skim milk powder} + 2\% \text{ LS milk} + 3\% \text{ sugar} + 1.68\% \text{ fat}
\end{align*}
\]

(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., 2008a.

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
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 (14.36%) were found in treatments having skim milk powder, sugar and fat (T1, T2, T3 and T4), while the lowest (10.0%) in LS milk (T0) (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 (T0), 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 (T0). 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 (T0). 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 (T0). The minimum acidity value (0.06%) was observed in control sample (Table 2). The range of titratable acidity is similar to the findings of Saxena 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 (T0) (Table 2). Statistically pH values for all the treatments were highly significant. The results are comparable with the findings of Saxena 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 (T0) 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.) 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 lipoproteinase 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**


