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Physico-chemical and Sensory Evaluation of Ready to Drink Soy-cow Milk Blend

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Abstract: Physico-chemical and sensory properties of ready to drink soy-cow milk blend were studied. Different processing techniques were applied to minimize beany flavour of soymilk. It was found that cooking of soybean in water having pH 8 at temperatures ranging from 90 to 100°C for 1h produced soymilk with mild beany flavour. The astringency of soymilk was reduced by blending with cow skim milk powder. Minimum astringency of soymilk was noted in soymilk blended with 50-60% of cow skim milk powder. The overall acceptability of soy-cow milk blend improved with addition of fat and sugar.

Key words: Soymilk, skim milk, astringency, beany, flavour

Introduction

The importance and role of soybean protein in Asia has been reported for many centuries (Winarno and Muchtadi, 1984). The rapid growing population of the developing countries is facing acute shortage of protein. Soybean is rich in protein content and can furnish protein supply to bridge up the protein deficiency gap at low-cost than any other crop. Among the numerous soy food items, soymilk (extract of soybean) had been the first product ever prepared and consumed by human since long ago. Soymilk not only provides protein but also is a source of carbohydrate, lipid, vitamins and minerals (Chien and Snyder, 1983).

Soymilk is an alternate of dairy animal milk due to its cheaper high-quality protein. Soymilk and cow milk have similar protein content [soybean to water, 1:8 (w/v)] with close amino acid makeup, except sulfur containing amino acids which are deficient in soymilk. (Chaiwanon *et al*., 2000).

Soymilk is a healthy drink and is important for people who are allergic to cow milk protein and lactose. In spite of its nutritional merits, it has not gained much popularity mainly due to its beany flavour and astringency (Cheman *et al*., 1989). Heat treatment is a common method to inactivate soybean lipoxygenase activity; however, it lowers protein solubility (Ediriweera *et al*., 1987). Several methods have been investigated to inactivate lipoxygenase to improve flavour of soymilk, including heating, soaking in ethyl alcohol (Ashraf, 1980) and adjustment of pH (Rehman *et al*., 2007). Off-flavour, is hardly detected in raw whole beans but its development occurs following break down of the cell structure and is evident even after cooking.

In soybean, the enzyme lipoxygenase catalyzes the oxidation by molecular oxygen of poly-unsaturated lipids especially linoleic acid producing products such as aldehydes, ketones and alcohols. Most of these products have undesirable odour, especially ethyl vinylketon, which has raw green bean flavour (Mattick and Hand 1969). Another demerit of soymilk is its astringency, recognized as throat catching factor has received less attention (Cowan *et al*., 1973). This sensation of flavour is generally due to polyphenolic substances present in soymilk that interact with mucoprotein in mouth and throat. Soymilk can be made less astringent with the addition of cow skim milk (SM), $CaSO_4$ or citric acid (Chien and Snyder, 1983). Keeping in view the above facts, this project was designed to evaluate physico-chemical and sensory properties of ready to drink soy-cow milk blend.

Table 1: Chemical composition of soybean

Chemical constituents (%)	NARC 90-1	Local unknown
Moisture	7.50	8.26
Crude fat (db)	19.73	14.96
Crude protein (db)	34.81	21.45
Ash (db)	4.57	4.46
Crude fiber (db)	5.29	6.10
Nitrogen free extract (db)	35.6	53.03

db = dry basis

Materials and Methods

Soybean grains of cultivar-NARC 91-1 and a local variety obtained from National Agriculture Research Council, Islamabad and from the market, respectively were analyzed for moisture, ash, crude protein, crude fat, crude fiber and nitrogen free extract (AACC, 2000). Various processing techniques were applied to minimize beany flavour of soymilk e.g. heating of soybean grains for different times at various temperatures, percentages of ethyl alcohol aqueous

Table 2: Effect of skim milk blending on taste and flavour of soy-cow milk blend

Parameters	Skim milk powder 0%	Skim milk powder 10%	Skim milk powder 20%	Skim milk powder 30%	Skim milk powder 40%	Skim milk powder 50%	Skim milk powder 60%
Taste	7.00F	5.60E	4.60D	3.60C	2.60B	1.20A	1.40A
Flavour	7.00F	5.70E	4.90D	3.90C	2.20B	2.20B	1.20A

A= Excellent B= Very good C= Good D = Satisfactory E=Poor F= Very poor

Table 3: Sensory evaluation of cow milk and soy-cow milk blend

Parameters	cow milk	Soy-cow milk blend
Colour	8.00A	6.60B
Flavour	7.60A	6.60B
Taste	8.00A	6.60B
Overall acceptability	8.40A	7.40B

A = Excellent B = very good

Table 4: Chemical composition of soymilk, soy-cow milk blend and cow milk

Constituents	Soymilk	Soy- cow milk blend	cow milk
Total solids (%)	10.40	18.21	12.90
Protein (%)	4.03	5.97	3.30
Fat (%)	2.28	3.88	3.80
Ash (%)	0.58	0.68	0.70
pH	6.74	6.76	6.90
Acidity (%)	0.24	0.20	0.21

solutions and pH values of water. Soymilk was then prepared by grinding soybean grains in an osterizer by adding calculated quantity of water. The slurry obtained was diluted so that 100g of soybean could produce 800 ml soymilk (Kapoor *et al.*, 1977). The slurry so obtained was also homogenized in a homogenizer at 1450 rpm and 8000 psi pressure. The homogenized soymilk was pasteurized at 80°C for 15 minute and then cooled to 25°C. The prepared soymilk was then blended with various levels of skim milk powder i.e. 10%, 20%, 30%, 40%, 50% and 60% and subjected to sensory evaluation on 7-points quality scoring method (Chien and Snyder, 1983). Score "1" and "7" indicated best and worst, respectively in 7-point scale for sensory evaluation. The overall acceptability of soy-cow milk blend increased with the addition of milk, fat and sugar.

Sensory evaluation of soy-cow milk blend (SCMB): Soy-cow milk blend and cow milk (CM) were sensory evaluated by the judges for colour, taste, flavour and overall acceptability on 9-point hedonic scale (Land and Shepherd, 1988).

Chemical analysis: Soymilk, soy-cow milk blends and cow milk were analyzed for fat, moisture, ash, total soluble solids, pH and acidity (AOAC, 2000).

Statistical analysis: The data were analyzed using ANOVA and treatment means were compared by using Duncan's Multiple Range ($DMR_{0.05}$) test to determine the effects of treatments when the F-test was statistically significant at $p<0.05$. (Steel *et al.*, 1997).

Results and Discussion

Chemical composition of two cultivars of soybean showed that soybean cultivar obtained from the local market contained less fat, protein and ash contents and high moisture, fiber and NFE contents than cultivar NARC 91-1 (Table 1). Soymilk prepared by heating soybean grains for 1 h at 100°C in water at pH 8, (soybean water extract) had less beany flavour and more protein solubility. Similar results were reported by Kapoor *et al.*, 1977 who found that heat treatment improved taste and flavour marginally. These results were also in line with the findings of Nelson *et al.* (1976) who studied that the pH affects flavour and taste of milk. Soymilk prepared by homogenization of soybean water extract at 8000 psi showed good suspendibility of solids, which decreased with decreasing pH and vice versa. Similar, results were reported by Johnson *et al.*, 1981 who reported that taste and flavour of soymilk at its natural pH (6.74) improved with the addition of skim milk powder (Table 2). Addition of skim milk powder (50-60%) reduced soymilk astringency and produced blend with good flavour. Similar findings were reported by Chein and Snyder, 1983 who added skim milk in soymilk. The acceptability of soy-cow skim milk blend increased with the addition of 3% sugar and 1.62% fat. Yazici *et al.*, 1997 obtained similar properties of soy-skim milk blend prepared under identical conditions. When soy-cow milk blend was compared with cow milk for colour, taste, flavour and overall acceptability, judges considered cow milk as excellent, whereas, soy-cow milk blend was considered as very good (Table 3).

Chemical composition showed that soy-cow milk blend had higher crude protein (5.97%) and fat (3.88%) but low pH (6.76), acidity (0.20%) and ash (0.68%) contents than cow milk. Soymilk had more protein (4.03%) than cow milk but less than the blend. The soymilk had less pH (6.76), fat (2.28%) and ash (0.58%) than cow milk and the blend (Table 4). Similar, composition of soy-cow milk prepared from cultivar 92-2 were reported by Wang and Toledo, 1987.

Conclusion: Soymilk prepared by soaking soybeans in water having pH 8 at 100°C for l h contained less beany flavour and the resulted soymilk if then blended with 50-60% cow skim powder produced a soy-cow milk blend that had very good colour, taste and flavour as compared to the soymilk alone. Also soy-cow milk blend possessed almost similar properties as that of cow milk.

References

AACC, 2000. Approved Methods of American Association of Cereal Chemists. The American Association of Cereal Chemist, Inc. St. Paul. Minnesota, U.S.A.

AOAC, 2000. Official Methods of Analysis. Association of Official Analytical Chemists, Arlington, D.C., U.S.A.

Ashraf, H.R.L., 1980. Flavour and composition of soymilk as influenced by ethanol soaking, heating and pH control. Dissertation Abstr. Int., 40: 5190.

Chaiwanon, P., P. Puwastien, A. Nitithamyong and P.P Sirichakwal, 2000. Calcium fortification in soybean milk and in vitro bioavailability. J. Food Comp. Anal., 13: 319-327.

Cheman, Y.B., L.S. Wei and A.I. Nelson, 1989. Acid inactivation of soybean lipoxygenase with retention of protein solubility, J. Food Sci., 54: 963-967.

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

Cowan, J.C., J.J. Rackies and W.J. Wolf, 1973. Soybean protein flavour components: A review: J. Am. Oil Chemists Soc., 50: 426-440.

Ediriweera, N., Y. Akiyama and K. Saio. 1987. Inactivation of lipoxygenase in soybean with retention of protein solubility. J. Food Sci., 52: 685-689.

Johnson, L.A., W.J. Hoover and C.W. Deyoe, 1981. Yield and quality of soymilk processed by steam infusion cooking. J. Food Sci., 46: 239-243, 248.

Kapoor, U., I.C. Datta, M.A. Quadri and H.S. Kushwah, 1977. Note on the chemical analysis and acceptability of soymilk. Ind. J. Agri. Sci., 47: 475-760.

Land, D.G. and R. Shepherd, 1988. Scaling and Ranking Methods. In "Sensory Evaluation of Foods" J. R. Piggott (Ed). Elsevier Applied Science. London.

Mattick, L.R. and D.B. Hand, 1969. Identification of a volatile components in soybean that contributes to raw bean flavour, J. Agric. Food Chem., 17: 15-19.

Nelson, A.I., M.P. Steinberg and L.S. Wei, 1976. Illinois process for preparation of soymilk, J. Food Sci., 41: 57-60.

Rehman, S., S. Hussain, H. Nawaz, M.M. Ahmad, N. Huma and W.A. Virk, 2007. Preparation and quality evaluation of *lathyrus sativus* L-bovine milk blend, Pak. J. Nutr., 6: 134-137.

Steel, R.G.D., J.H. Torrie and D. Dickey, 1997. Principles and Procedures of Statistics: A Biometrical Approach. 3rd ed. McGraw Hill Book Co. New York.

Wang, S.H. and M.C.F. Toledo, 1987. Inactivation of soybean lipoxygenase by Microwave Heating: Effect of moisture contents and exposure time. J. Food Sci., 52: 1344-1347.

Winarno, F.G. and D. Muchtadi, 1984. Appropriate technology in soybean utilization: its prospect for nutritional improvement program. In "Human Nutrition; Better Nutrition Better Life. Proceeding of the 4th Asian Congress of Nutrition" V. Tanphaichitr, A. Valyasevi, W. Dahlan, and V. Suphakarn, (Eds), Aksonsmai press, Bangkok, Thailand, pp: 461-467.

Yazici, F., V.B. Alvarez, M.E. Mangino and P.M.T. Hansen, 1997. Formulation and processing of a heat stable calcium-fortified soymilk, J. Food Sci., 62: 535-538.