

Physico-Chemical and Sensorial Characteristics of Chocolate Prepared from Soymilk

A.A. Gatade, R.C. Ranveer and A.K. Sahoo

Department of Food Science and Technology, Shivaji University,
Kolhapur – 416004, M.S., India

Abstract: The demand of milk product is increasing. Among all the milk products chocolate is mostly preferred confectionary product. In the present research the beany flavour of soymilk was reduced to a greater extent by autoclaving and washing. Various combinations of ingredients were tried for preparation of soymilk chocolate. Among the entire formulations sample 'O' had excellent appearance, color, glossiness and smooth texture. It also contained moisture (10.40%), protein (4.06%), fat (27.96%), ash (1.20%) and carbohydrate (56.38%). This sample scored maximum sensory scores with respect to color, flavour, taste, mouthfeel and texture among all samples.

Key words: Soymilk, chocolate, lactose free, cholesterol free and sensory parameters

INTRODUCTION

Soybean (*Glycine max*) is an important protein source for million of people for over five thousand years (Mathur, 2004). The flavour associated with soybean is regarded as one of the important factor limiting their use in food products (Deshpande *et al.*, 2008). The various flavour compounds isolated from soybean are carbonyl compounds, phenolic acids, volatile fatty acids, amines, alcohol, phosphatidylcholine, linoleic and linolenic acids. Their auto-oxidations and lipoxygenase catalysis give rise to off flavour (Mattick and Hand, 1969). The off flavor can be reduced by using various processing techniques (Salunkhe and Kadam, 1989).

The milky white fluid obtained from soybean by soaking, grinding and filtering is called as "Soymilk" (Lo *et al.*, 1968). Soymilk contains some major and minor components like protein, fat, carbohydrate, calcium, iron, sodium, carotene, vitamin-E and riboflavin (Deshpande *et al.*, 2008). The soymilk is used in various products like paneer, yogurt, cheese, tea and coffee whiteners, shrikhand, rasogolla and various indigenous milk sweets, confectionary etc. (Wang *et al.*, 2001).

Milk is one of the most important ingredient in chocolate production. Other basic ingredients required for chocolate manufacturing process are milk powder, cocoa powder, sugar, butter, emulsifiers and stabilizers (Patil and Jha, 2008; Nazaruddin *et al.*, 2006; Beckett, 2002). Liquid glucose, refined wheat flour (RFW) and corn flour were used in soymilk chocolate to improve the texture and to increase the binding capacity of chocolate. The texture, flavour and level of mouthfeel were unique characteristics, which play an important role in the development of chocolate (Nazaruddin *et al.*, 2006).

In the present work attempts have been made to reduce the beany flavour of soymilk and its utilization for preparation of chocolate. The optimization of ingredients and additives were tried extensively to produce a best quality chocolate from the soymilk.

MATERIALS AND METHODS

This study was conducted in the period from January 2009 to April 2009 at the department of Food Science and Technology, Shivaji University, Kolhapur.

Soybean of JS-335 cultivar was used for the preparation of soymilk. The controlled sample of soymilk was prepared as per the procedure suggested by Deshpande *et al.* (2008), where some modifications were made to reduce the off flavour. The flow diagram for the preparation of soymilk is given in Fig. 1.

The soymilk chocolates were prepared by varying different ingredients. The quantities of different ingredients are tabulated in Table 1 and 2. The flow diagram for the preparation of soymilk chocolate is as shown in Fig. 2.

Soybean, Soymilk and Soymilk chocolate (sample-O) were analyzed for physico-chemical properties like protein, fat, carbohydrate, total solid and ash content. The standard procedures were used for determinations (Ranganna, 2000).

The sensory evaluation of soymilk and soymilk chocolates were carried out using 10 points hedonic scale (Fang *et al.*, 1971). The soymilk was judged for flavour before and after pre-treatment and the results obtained are presented in Table 4. One branded milk chocolate obtained from the local market was taken as reference sample. The data generated in the present study was statistically analyzed (Panse and Sukhatme, 1989).

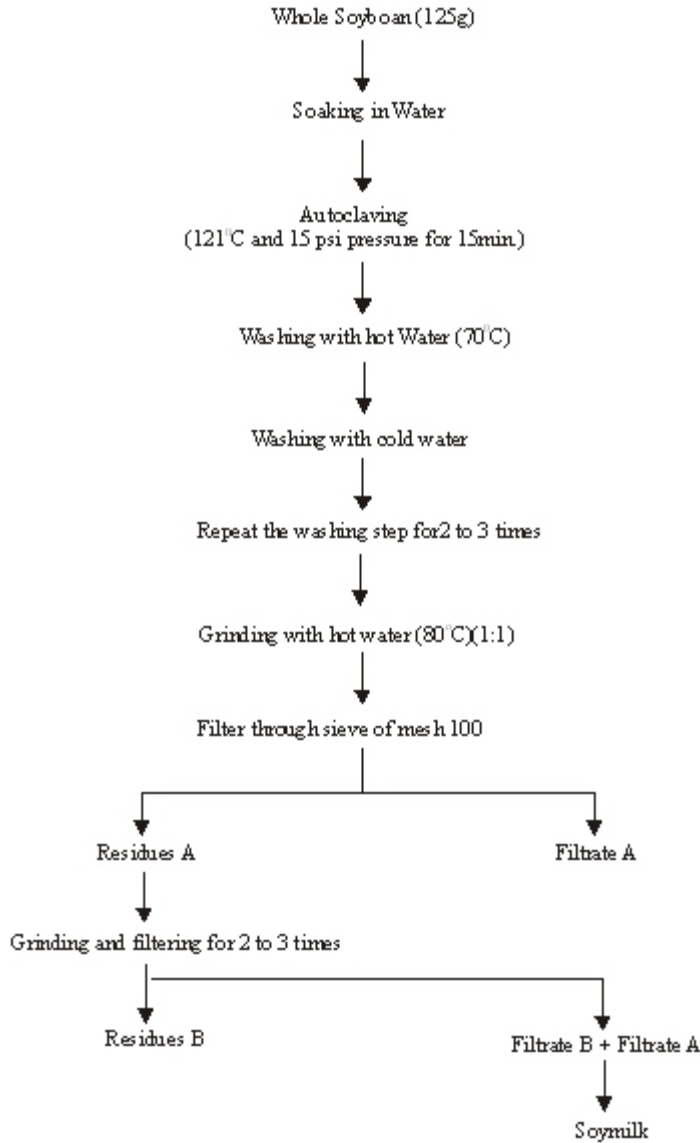


Fig 1: Flow diagram for preparation of Soymilk

Table 1: Batch-I, Composition of soymilk chocolate

Sample Code	Soymilk(ml)	Sugar(g)	Cocoa Powder(g)	vegetable shortening (g)	RWF(g)	Alginate(g)	GMS(g)
A	50	50	8	8	8	0.6	0.6
B	50	50	8	8	6	0.6	0.6
C	50	50	8	8	12	0.6	0.6
D	50	50	8	8	8	1	1

Table 2: Batch-II, Composition of soymilk chocolate

Sample Code	Soymilk(ml)	Sugar(g)	Liquid glucose(g)	Cocoa powder (g)	vegetable shortening(g)	Corn Flour (g)	Alginate(g)	GMS(g)
E	50	50	15	8	8	-	-	0.6
F	50	50	5	8	8	-	-	1.2
G	50	50	-	8	8	6	1	1.0
H	50	50	3	8	8	3	-	1.0
I	50	50	1.5	8	8	3	1	1.0
J	50	50	-	8	8	3	1	1.0
K	50	50	3.0	8	8	3	1	1.0
L	50	16.7	1.3	6.7	6.7	3	-	1.3
M	50	16.7	-	6.7	6.7	2	-	1.3
N	50	16.7	0.5	6.7	6.7	2	-	1.3
O	50	16.7	-	6.7	10	2	-	1.3

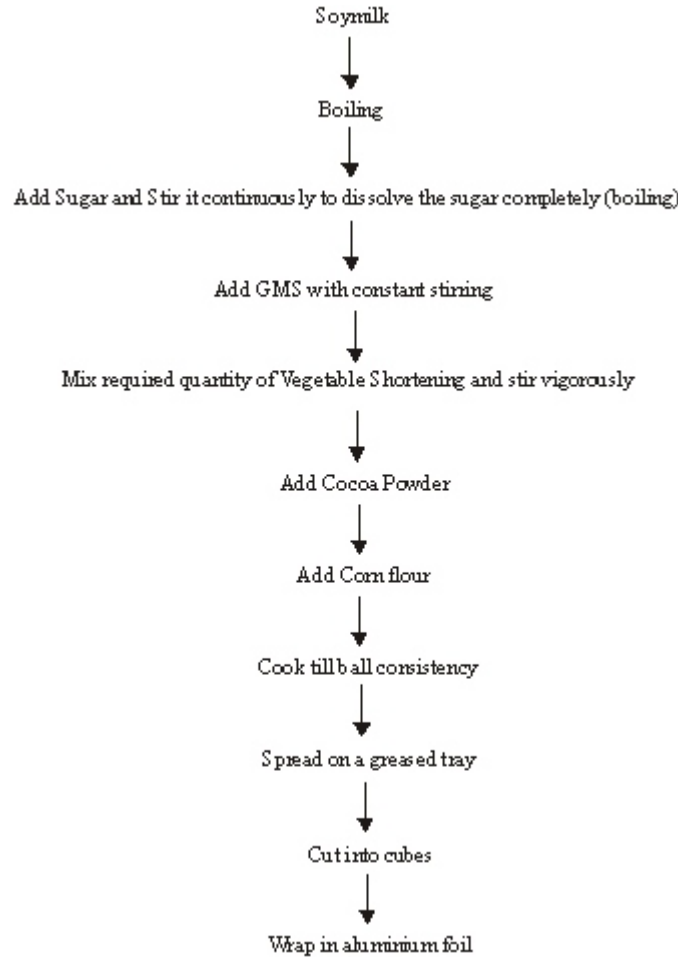


Fig 2: Flow diagram for preparation of Soymilk chocolate

RESULTS AND DISCUSSION

The chemical composition of soybean and soymilk is given in Table 3. The results obtained for soybean composition were in close agreement with those of earlier reported by Salunkhe and Kadam (1989). The soymilk contains total solids (9.8%), fat (2.6%), protein (4.8%), carbohydrate (2.0%) and ash (0.6%). These are in conformation with those reported by Deshpande *et al.* 2008.

The results as shown in Table 4, denotes that the beany flavour of soymilk was reduced to a greater extent by autoclaving and washing. Also, the pre-treated soymilk had scored maximum sensory score with respect to taste and overall acceptability. Wilkens *et al.* (1967) had reported in their findings that the heat treatment followed by hydrated grinding could reduce the off flavour in soymilk by inactivating lipooxidase.

The chocolate acceptance was evaluated based on product appearance, colour, glossiness and smooth texture. It is very evident from Table 5, which shows the results of sensory analysis of soy milk chocolates

prepared with different combination of ingredients that sample 'B', of batch-I was best among all the samples with respect to overall acceptability. However, it was sticky to the palate and would soften soon when kept at room temperature. Thus the additives used and their level of use for binding and shortening actions found to be not effective to control the stickiness and softening of the chocolates prepared. Hence attempts were made to

Table 3: Chemical composition of soybean and soymilk*

Constituent	Soybean(%)	Soymilk(%)
Moisture	11.4	90.2
Protein	32.6	4.8
Fat	17.8	2.6
Ash	4.2	0.4
Total Carbohydrate	34.0	2.0

*Values are average of three determinations.

Table 4: Effect of pre-treatment on sensory quality of soymilk

Sample Code	Colour	Flavour	Taste	Overall acceptability
Control	9.0	6.0	7.0	7.0
Pre-treated*	9.0	8.0	9.0	8.5

Description of sensory score: Excellent (9-10), Very good (8-9), Good (7-8), Fair (6-7), Acceptable (5-6), Unacceptable (< 5).

* Sample prepared by autoclaving (at 121°C temperature and 15psi pressure, for 15 minutes) and washing (Hot water and cold water for 3 times) treatment.

Table 5: Sensory evaluation of samples of batch – I

SampleCode	Colour	Flavour	Taste	Mouth feel	Texture	Overallacceptability
A	9.0	9.0	8.0	8.0	8.0	8.0
B	9.0	9.0	9.0	8.0	8.0	8.0
C	9.0	9.0	9.0	7.0	8.0	8.0
D	8.0	8.0	8.0	8.0	8.0	7.0
SE	0.10	0.10	0.12	0.10	0.01	0.10
CD (p=0.05)	0.21	0.21	0.24	0.21	0.02	0.21

Description of sensory score: Excellent (9-10), Very good (8-9), Good (7-8), Fair (6-7), Acceptable (5-6), Unacceptable (< 5).

Table 6: Sensory evaluation of samples of batch – II

SampleCode	Colour	Flavour	Taste	Mouth feel	Texture	Overallacceptability
E	7.0	9.0	9.0	7.0	8.0	7.0
F	9.0	9.0	9.0	8.0	8.0	8.0
G	8.0	9.0	9.0	7.0	7.0	7.0
H	9.0	9.0	9.0	7.0	7.0	8.0
I	8.0	9.0	9.0	8.0	7.0	8.0
J	7.0	9.0	9.0	8.0	7.0	7.0
K	5.0	9.0	9.0	8.0	4.0	5.0
L	9.0	9.0	9.0	9.0	6.0	7.0
M	9.0	9.0	9.0	8.5	8.0	8.5
N	9.0	9.0	9.0	8.0	8.0	8.5
O	9.0	9.0	9.0	9.0	8.5	9.0
Milk Chocolate*	9.0	9.0	9.0	9.0	9.0	9.0
SE	0.15	0.01	0.03	0.09	0.16	0.13
CD (p=0.05)	0.31	0.02	0.06	0.18	0.32	0.28

Description of sensory score: Excellent (9-10), Very good (8-9), Good (7-8), Fair (6-7), Acceptable (5-6), Unacceptable (< 5).

*Reference sample obtained from the market

improve the texture by preparing various combinations of other additives like liquid glucose and corn flour with prevailing additives. It is reported by Minifie (1980) that stabilizers and emulsifiers were used to improve the texture and surface appearance of the chocolates.

In order to improve the texture and appearance, the refined wheat flour was replaced with liquid glucose and corn flour. Various formulations were tried to improve the quality of sample 'B' as described in Table 2. It can be noted from Table 6 that the sensory scores of sample 'M' and sample 'N' was the highest in almost all sensory characteristics. Since the texture of sample 'M' was better than sample 'N', sample 'M' was selected for further modification with respect to appearance. To increase the glossiness of sample 'M' the quantity of vegetable shortenings was increased without any modification in other ingredients. The modified sample prepared was coded as sample 'O'. The sample 'O' had scored maximum over all sensory score than the other samples. Sensory characteristics of sample 'O' with respect to texture and appearance were as good as that of market sample. No previous findings are available on the preparation of chocolate from soymilk.

The sample 'O' was subjected to proximate analysis and the results obtained were presented in Table 7. The results showed that the soymilk chocolate was rich in mineral and protein content. The chocolate prepared with soymilk is nutritionally equivalent to milk chocolate (Minifie, 1980).

CONCLUSION

The demand of milk product is increasing among all the classes of consumers. Among all the milk products

Table 7: Chemical composition of soymilk chocolate*

Constituents	Soymilk Chocolate
Moisture	10.40
Protein	4.06
Fat	27.96
Ash	1.20
Carbohydrate	56.38

*Values are average of three determinations

chocolate is mostly preferred confectionary product. Some people can not tolerate lactose and also allergic to milk products, thus use of soymilk as a milk substitute can be a probable solution for these problems. The modified procedure could produce a soymilk of less beany flavour and acceptability. The chocolate prepared from soymilk (Sample 'O') was of excellent quality than the other samples with respect to mouthfeel, texture and overall acceptability. Hence production of this type of value added products can increase the utilization of soybean.

REFERENCES

- Beckett, S.T., 2002. The Science of Chocolate. 1st Edn.. Royal Society of Chemistry. Cambridge.
- Deshpande, S., P. Bargale and K. Jha, 2008. Suitability of soymilk for development of shrikhand. J. Food Sci. Technol., 45(3): 284-286.
- Fang, T.T., P. Footrakul and B.S. Luh, 1971. Effect of blanching, chemical treatment and freezing methods on quality of freeze dried mushrooms. J. Food Sci., 36 (7): 1044-1048.
- Hand, D.B., 1964. Pilot plant studies on soybean milk. Food Technol., 18: 139-142.
- Lo, W.Y., K.H. Steinkraus and D.B. Hand, 1968. Soaking soybeans before extraction and it affects chemical composition and yield of soymilk. Food Technol., 22: 1188-1190.

- Mathur, S., 2004. Soybean the wonder legume. Beverage Food World, 31(1): 61-62.
- Mattick, L.R. and D.B. Hand, 1969. Identification of volatile compound in soybean that contribute to the raw bean flavour. J. Agric. Food Chem., 17: 15-17.
- Minifie, B.W., 1980. Chocolate, Cocoa and Confectionery, 2nd Edn. Avi Publishing Co. Inc., Westport, Connecticut.
- Nazaruddin, R., Z.A. Zawawi, Z. Kasim and A. Idris, 2006. Sensory evaluation characteristics of chocolate using goat's milk. Int. J. Dairy Sci., 1(2): 146-154.
- Panse, V.G. and P.V. Sukhatme, 1989. Statistical methods for agricultural Workers. Publication and Information division, Indian Council of Agricultural Research,
- Patil, R.T. and K. Jha, 2008. Optimisation of stabilizer and emulsifier requirement for production of soy ice-cream by response surface analysis. J. Food Sci. Technol., 45(3): 267-269.
- Ranganna, S., 2000. Hand book of analysis and quality control for fruit and vegetable products. 2nd Edn. Tata Mc Graw Hill Publ. Co. Ltd., New Delhi.
- Salunkhe, D.K. and S.S. Kadam, 1989. Hand Book of World Food Legume, Vol. III, CRC Publication, Press, Inc. Boca Raton, Florida, pp: 1-31.
- Wang B., Y. Xiong and C. Wang, 2001. Physicochemical and sensory characteristics of flavoured soymilk during refrigeration storage. J. Food Qual., 24: 513-526.