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STUDIES ON THE DEVELOPMENT AND STORAGE STABILITY OF LEGUME AND VEGETABLE BASED SOUP POWDER

FAHIMA ROKHSANA[1], REZWANA YEASMIN[2] AND AKHTER NAHAR[3]

Abstract

Legumes are important constituents of Bangladeshi diet and provide a considerable portion of dietary proteins, minerals, and vitamins. The ready to eat soup powder prepared from legume and vegetables in the laboratory can provide an improved nutritional status. Incorporating processed rice, corn, and processed wheat flour as the starch source, three different samples of soup powder were prepared. Protein source was derived from legumes and vegetable paste was used as a mineral source. All these three developed formulations have a protein value ranging from 19.00 to 19.40% and calorie content 347 to 353 Kcal/100g (Table 2). Sensory evaluation of the products revealed a reasonable acceptance of the sample prepared from wheat flour. The selected soup powder contains 19.40 percent protein and 350 Kcal of energy per 100g. Commercially available soup powder was compared with all samples in the light of its nutritional values. Protein and energy content of the selected sample is comparable with the commercial one, which contain only 7.77 percent protein and 297 Kcal energy per 100 g. Prepared soup powder is also a good source of carbohydrate and minerals, mainly iron, calcium & phosphorus. Storage study was conducted to determine the shelf life of the developed food product. Statistical analysis shows that there is no significant difference during the storage of the selected soup powder for six months

Key Words: Storage, legume, soup powder.

Introduction

The search for new unconventional source of proteins to meet the requirements of ever expanding population of Bangladesh is the dire need of the present day. The trend in consumption of ready to eat food products is increasing due to increasing number of working women population concomitant with the increase in per capita income, urbanization, scarcity of household labour, lack of time and hectic schedules, compelling the consumer to look for foods of convenience, easy commercial availability, culturally acceptable, nutritive and minimally processed with longer shelf-life. Now-a-days the tendency of the quality conscious urban rich is to go for ready-to-eat foods. Many of the value added food products have

[1]Chief Scientific Officer, IFST, BCSIR, [2]Senior Scientific Officer, IFST, BCSIR, [3]Jonior Experimental Officer, IFST, BCSIR, Dhanmondi, Dhaka, Bangladesh.

entered the market and also becoming popular. Processed food from legume in Bangladesh are relatively low, only *chanachur* is produced commercially which is not suitable for babies. Traditionally some legume based food items are prepared in homes but these products do not have any access to commercial market. Legumes are important constituents of Bangladeshi diet and provide a considerable portion of dietary proteins, minerals and vitamins. Boiling in water and subsequent seasoning with oil and spices is the most widely employed method of cooking pulses. Under these conditions, most of the dehusked and split pulses (dhals) take about 40-60 min for cooking whole pulses (Patki *et al*., 1994). Taking into consideration all nutrition and food safety concerns, food scientist and nutritionist agree that any form of commercial soup is significantly nutritious, with higher nutrient content leading to higher nutritional value. Keeping in view the nutritional value of legumes and to make it easily available, a ready to eat soup powder was prepared. The present communication describes optimization of the process for preparation of ready to eat soup powder and its storage stability.

Materials and Method: Wheat flour, corn flour, rice flour, carrot, tomato, green papaya, umpkin, pulse (pea dahl) and spices used for the study are procured from local market.

Processing of wheat, rice and corn flour: Wheat and rice flour were purchased from the local market. Flours were hydrolised with dilute acid and then dried at 80°C until the moisture content reached at 10-12%, finally ground into powder. Corn flour was purchased from the local market and was used as it is.

Processing of legumes: Pulse (pea dahl) was soaked in water (1:3) containing sodium bicarbonate (0.5%) for about one hour. The soaked solution was decanted and the pulses were washed with water. The washed pulses were cooked in water until soft. The cooked pulses were then dried in hot air oven at 80°C and was milled in a blender.

Processing of vegetables: Tomato, potato, carrot, green papaya, and pumpkin were taken in a ratio of 10:1:3:3:1 accordingly. Vegetables were washed with water and then sliced into pieces. Tomatoes were deseeded and the skin was removed. The deseeded tomatoes were then mixed with sliced vegetable pieces. The whole mass was cooked until soft. All the cooked vegetables were mashed in a waring blender. The cooked vegetable was then dried by heating at 80°C till the moisture content reaches to 80-85%.

Preparation of soup powder: Incorporating processed rice flour, corn flour, wheat flour as starch source, three different samples of soup powder were

prepared. Protein source was derived from pulse and vegetable paste was used as mineral source. Starch flour, vegetable paste, legume flour, salt and spices were mixed according to the proportion (Table 1) The whole mass was then granulated. The granules were dried in a hot air drier till the moisture content reaches 6-7%. The dried ample was then ground in a mechanical grinder to get the final product. The flow chart for the preparation of soup powder was shown in Fig. 1.

Table 1. Proportion of various ingredients used in different formulations of soup powders.

Ingredients used (g)	Types of soup powders		
	Corn based	Rice based	Wheat based
Corn flour	15.12	Nil	Nil
Processed rice flour	Nil	13.12	Nil
Processed wheat flour	Nil	Nil	13.12
Processed legume	30.88	31.88	31.88
Processed vegetables	47.12	48.12	48.12
Salt	4.38	4.38	4.38
Black pepper	1.25	1.25	1.25
Testing salt	1.25	1.25	1.25
Total	100	100	100

Chemical analysis: All the three prepared soup samples were analyzed for their proximate composition according to the standard methods of AOAC (Sidney Williams, 1984) and the mineral content was also determined. Nitrogen wa estimated by Kjeldahl method and protein content was calculated by using conversion factor of N x 6.25. The carbohydrate content was estimated by difference and calorie content was determined by calculation (Ronald *et al*., 1999). Commercially available soup powder was also analyzed for comparative study with the sample developed in our laboratory.

Reconstitution: For preparation of soup mix two tea spoonfull (approx 10.0g) soup powder was dissolved in 1cup (approx. 130 ml) of clean and cold water. The whole mass was then boiled over a flame for 3-4 minutes with stirring and obtained one full cup (approx 110 ml) of prepared soup.

Organoleptic test: A hedonic test on a 9 point scale was conducted to determine the consumer's degree of liking for the three prepared soup powder and the commercially available soup powder. Fifteen-trained panelist evaluated the four soup samples.

The results were analysed by the ANOVA and Post Test. The F ratio, for treatments and panelists were calculated by dividing their MS values by the MS for error. Since the calculated F ratio for treatment is 10.04 which exceeded the

tabulated F ratio of 2.84. There was a significant ($p \leq 0.5$) difference among the mean hedonic scores for the four soup formulations.

The calculated panelist F ratio of 1.85, however, did not exceed the tabular ratio of 1.92. Thus no significant panelist effect was present (Watts *et al.,* 1989).

The ANOVA indicated that there is a significant difference among the four soup samples. Soup sample C (soup prepared from wheat flour) was liked significantly more than all other samples which was determined by Duncan's new multiple range test (Watts *et al*., 1989).

Packaging and storage: The best-identified sample was packed in polythene packets weighing 20 g each. All the packets were kept at room temperature and stored for a period of eight months. The stored samples were analysed after every one month interval for moisture, protein, fat, ash, crude fiber, and mineral content. Calcium, phosphorus and iron by the methods reported earlier. The data were statistically analysed following the principle of analysis of variance and Duncan's new multiple range test (Steel *et al*., 1960). Results are reported in Table 4.

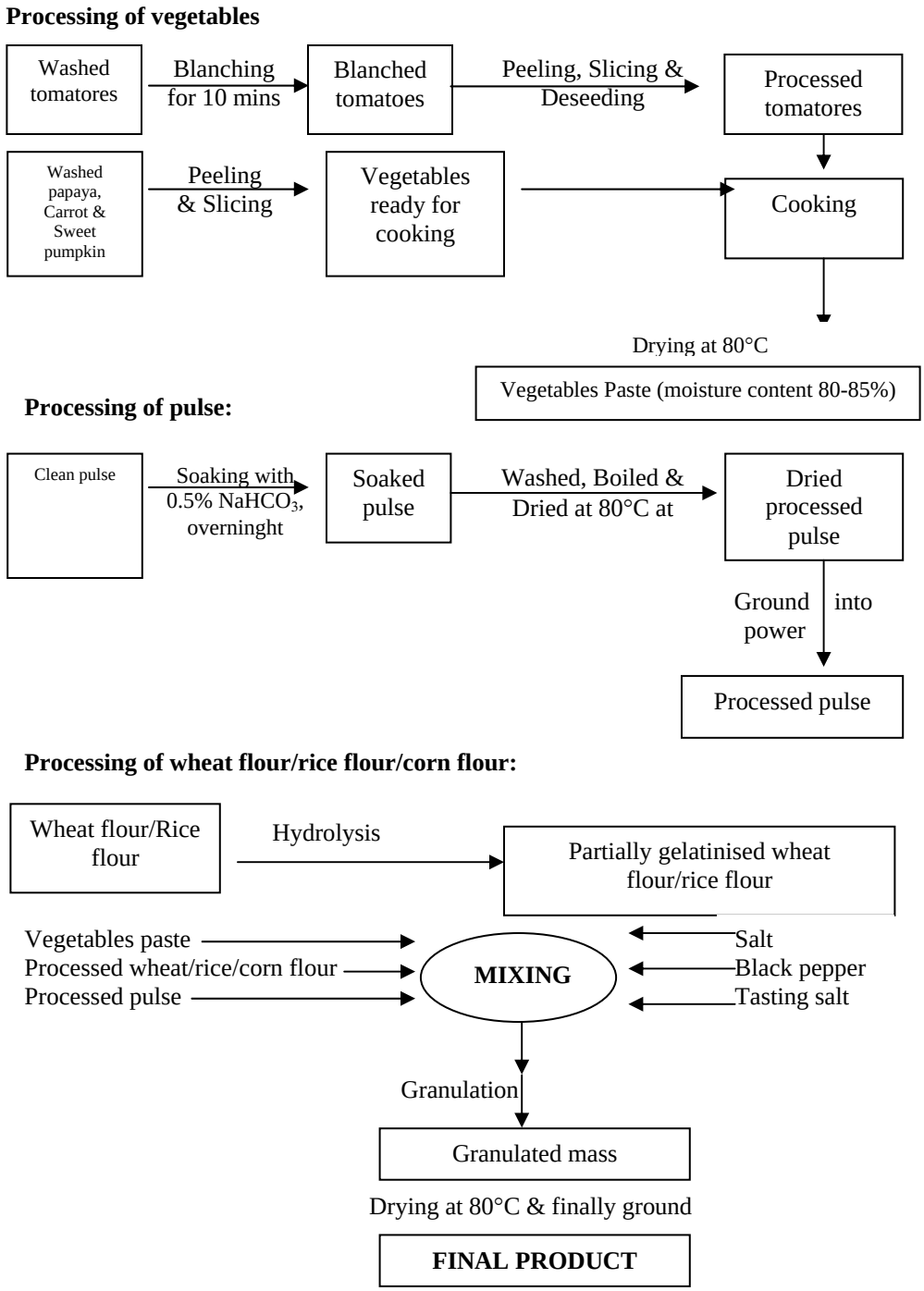

Fig. 1. The step wise operating procedure for the production of instant protein rice soup powder.

Table 2. Proximate composition of the prepared soup powders.

Commercially available soup.

Soup powder	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude fiber (%)	Carbohy drate (%)	Energy Kcal/10 0g
Corn based	7.00	19.00	1.26	4.5	1.87	66.37	3.53
Rice based	6.66	18.78	1.40	5.79	2.29	65.08	347
Wheat based	6.99	19.40	1.25	4.82	0.67	66.87	350
Commercial soup	11.32	7.77	1.53	14.9	1.35	63.13	297

Results and Discussion

The proximate composition of three different types of soup mix and the commercially prepared soup powder is presented in Table no 2. The protein of the soup powders prepared in the laboratory varies from 19.40 to 18.78 percent. The values are almost same as a common protein source was used. The purchased commercial soup powder have a much lower protein value which was only 7.77 percent and the nutritive value is also very poor in terms of calorie and protein.

The result (Table 3) shows a significant change in the moisture content during 180 days storage period. It is assumed that the poly packs having thickness of (0.1 mm) are not impermeable to air. As a result, there is an increase in moisture content. It is expected that if vaccum packing or high density polypropylene (HDPE) packets can be used the increase in moisture content can be inhibited.

Protein: No significant change was observed in the protein value during 180 days of storage period. (Payamo *et al*., 1979) developed mung bean soup which has a protein content of 20-24 percent. (Sgearbieri *et al*., 1981) also formulated a soup mix with soybean which contents protein 21.3 percent (Pikarsha *et al*., 1977) developed soup mixes with protein content 21.3 percent.

All these studies showed that soup mix prepared from bean source has a protein value in the range of 20-21 percent. The soup powder developed in this laboratory has a protein value of 19.40 percent which is very close to the values reported in various literature.

Fat: The amount of fat varies from 1.21 to 1.31 percent during the storage period (Table 3).

As crude fiber and calcium: No significant change was observed in the ash, crude fiber and calcium content during the storage period of 180 days (Table 3.).

Carbohydrate: The amount of carbohydrate varies from 62.95 to 65.85 percent. The Table shows two values differ significantly from other values. As carbohydrate was determined by difference, this significant difference may be due to other values.

Phosphorus: The phosphorus content changed slightly during 180 days storage period. The lowest value was observed in 180 days.

Iron: The iron content varies from 23.33 to 26.96 mg/100g during the storage period. The cause of this variation cannot be identified, may be due to oxidation.

Calorie content: The soup powder developed using wheat as a starch source have protein value compared to other sample was selected best organoleptically among the three soup powders.

The calorie content of the soup prepared by (Piekarsha *et al*., 1977) ranged from 89 to 429 percent. The calorie content of the soup developed in our laboratory is 360 Kcal/100g which is within the range reported by other scientists (Piekarsha *et al*., 1977).

The results of storage studies shows that the soup mix was organoleptically acceptable upto 180 days of storage period and after that the colour becomes fade and the taste is also not good as before. It is expected that better packaging condition will increase the shelf life of the product.

Table 3. Nutrient composition of wheat based soup powder during storage.

Storage period (Days)	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude fibre (%)	Carbohyd-rate (%)	Calcium (mg/100g)	Phosphorus (mg/100g)	Iron (mg/100g)
0	7.016^{g}	19.396^{a}	1.236^{b}	5.843^{a}	0.656^{a}	65.85^{a}	65.193^{a}	172.536^{a}	26.75^{a}
30	7.82^{f}	19.356^{a}	1.286^{a}	5.783^{a}	0.74^{a}	65.013^{b}	65.063^{a}	172.383^{a}	23.33^{d}
60	8.356^{e}	19.305^{a}	1.27^{a}	6.173^{a}	0.733^{a}	64.163^{c}	65.036^{a}	171.863^{a}	24.556^{d}
90	9.25^{d}	19.326^{a}	1.266^{a}	5.606^{a}	0.696^{a}	63.853^{c}	64.566^{a}	170.476^{b}	26.963^{a}
120	9.873^{c}	19.466^{a}	1.313^{a}	5.656^{a}	0.733^{a}	62.956^{c}	65.386^{a}	171.183^{b}	26.513^{b}
150	10.106^{b}	19.316^{a}	1.233^{b}	5.183^{a}	0.716^{a}	63.443^{c}	65.293^{a}	170.18^{b}	25.77^{c}
180	10.386^{a}	19.253^{a}	1.213^{b}	5.236^{a}	0.703^{a}	63.206^{c}	65.103^{a}	169.923^{a}	25.886^{c}

Means with the same letter in a column are not different at 5% level of significance.

Table 4. LSD value for pairwise comparison between different soup varieties.

Soup variety	Colour	Flavour	Texture	Overall acceptability
Rice-Corn	0.595	0.648	0.214	0.800
Rice-Wheat	0.458	0.071	0.115	0.00*
Rice-Commercial	0.75	1.00	0.496	0.104
Corn-Wheat	0.832	0.174	0.733	0.000*
Corn-Commercial	0.022*	0.648	0.057	0.168
Wheat-Commercial	0.13	0.071	0.026*	0.000*

*The mean difference is significant at the 0.05 level.

Conclusion

From the above study, it is evident that unconventional pulse like motor dahl (pea) can be effectively used in the preparation of protein rich soup powder by properly processing legume and optimizing the levels of other ingredients in appropriate proportions. Among the three soup powders prepared, wheat based soup powder was found to the acceptable and has a shelf life of 180 days as shown by the storage study. This soup powder is rich in protein and calorie and can act as a supplementary food for the malnourished or undernourished people of the country. The formulated soup prepared from legume flour requires only 5 minutes cooking. The techniques used here will make the legume more palatable. like all plant products it contains insignificant amount of cholesterol. So this soup will be suitable for hypertension patients, babies and for all classes of people. At a time when population pressures are straining available food supplies, the increase in availability of ready-to-eat food should be an important goal for all concerned food scientists.

References

Watts B.M., G. L. Ylimaki, L.E. Jeffrery and L.G. Elias. 1989. Basic sensory methods for food evaluation.

Patki P.E. and S.S. Arya. 1994. Indian Food packer, Defence food Research Laboratory.

Eslelita M Payumo; Castillo, Elvira S. 1979. *J. Nutrition.* **32**(2), 87-91.

Piekarsha, Janina, Szezygiel, Zywienie, Czlowicka. 1977. Chemical Abstract. 2(3) 189-94 (Pol).

Ronald S. Kirk and Ronald Sawyer. 1999. Pearson's composition and analysis of foods, 9th edition.

Steel R.G.D. and S.H. Torrie. 1960. Principles and Procedures of Statistics Mc. Graw Hill. Book Co. Inc. New York. p. 109.

Sidney William. 1984. Association of Official Analytical Chemist, 14th edition.

Sgarbieri VC Aarreeti R. E.C. Guzman. 1981. *J. American Oil Chem.* Soc. **58**(3) 522-6.