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New Food Product Development by Incorporation of P. vulgaris to produce Instant Soup Powder Mix for cardiac and diabetic protection

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Abstract

This study is aimed to produce a new dehydrated instant soup powder mix by using red kidney beans and white kidney bean (Phaseolus vulgaris) flour blend, and the nutritional analysis was compared with commercially available corn based soup powder. Standard methods were applied for sensory analysis and physicochemical (proximate) analysis. Among the various combinations, the newly developed soup powder containing white kidney beans and red kidney beans in a ratio of 11:4 was found to be better for its nutritional quality and sensory evaluation. Both of the products, control and newly established soup have been found highly acceptable according to sensory evaluation. The moisture, ash, protein, fat, fiber, carbohydrate, and energy content of newly developed soup powder were found to be 7.77%, 14.9%, 9.65%, 0.39%, 1.5%, 48.25 and 131kcal/100 g, respectively. On the sensory and microbiological point of view, the presently developed soup powder was found highly acceptable up to 4 months. The total yeast, aerobic plate count and mold count were found to be the acceptable according to food standards. After 4 months, the microbial counts were increased and deterioration in the product quality was observed. High protein and fiber; low fat, less carbohydrates and low energy content make this soup powder a healthy nutritional choice for diabetic, gut and heart health. The calorific values indicate that the newly developed soup powder contains only 4.85% of the daily calories needs of an adult man and 5.95% of the calories a woman needs in a day. Therefore, it can be easily utilized with the confidence for losing weight. The newly developed soup also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

Keywords: Instant soup powder, Beans, Cardio-protective, Glycemic Index

Introduction

To prevent diseases and to improve health, the consumers' demand of functional/nutraceutical food has been increased in a current era. Although urbanization, increase in working population has increased per capita income but also created hectic schedule of working which results in unavailability of time for the consumer to prepare their food, hence promoting the consumption of readymade food products. Most of these foods have low nutrients value and high in salt, sugar and fat which make them junk foods (Kaushik, Sachdeva *et al.* 2014). Such nutrient deficient food became the major cause of various diseases on consumption, which was overcome by introduction of value added food products. Those food products have attracted the mind of the quality conscious urban population to use ready to eat foods. Soup powders are one of the easy to cook foods available in the market to fulfill the consumer requirements (Krejčová, Černohorský *et al.* 2007).

Initially corn soup was only prepared in the area where corn was cultivated. Now availability of corn made this product popular among the world (Harrington 1908). The soup powders available in the market were not supposed to improve the health. The nutraceutical quality could be improved by introducing medicinally important plant sources. Red and white kidney beans would be good

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choice of sources due to their high nutritional quality as well as their significance towards health improvement.

The white bean flour considered to be a great source of weight loss and decrease blood sugar. White kidney beans flour is very low in carbohydrates and work as *a*-amlyase inhibitor. It has been reported that the *P. vulgaris* has tendency to reduce glycemia and body weight (Fantini, Cabras *et al.* 2009). The results in another study indicate the capacity of a *P. vulgaris* preparation to reduce the reinforcing properties of a highly palatable fluid in rats (Maccioni, Colombo *et al.* 2010). Kidney beans are reported to be the best protein source. The kidney beans are capable of controlling blood sugar and colon health due to its high fiber contents. Kidney beans are reported to contain minerals and vitamins (Tharanathan and Mahadevamma 2003, Kasera, Singh *et al.* 2011, Hattori, Ashida *et al.* 2004, Ojeda, Wrobel *et al.* 2015).

Materials and Method

Chemicals and Glassware

Analytical grade chemicals were used for analysis. All glassware was pre-rinsed with 10% HCl followed by deionized water.

Raw Materials

Corn flour (locally available), red kidney beans (locally available), white kidney beans (locally available), wheat flour (locally available), chicken powder (Knorr, Unilever Pakistan Food Limited), vegetables (locally available), onion powder (Chef's Choice Onion Powder), garlic powder (Shan Foods Pvt. Ltd.), salt (Shan Foods Pvt. Ltd.) and black pepper (Shan Foods Pvt. Ltd.) were purchased from local market.

Kidney Beans Processing

Kidney bean was soaked in water (1:3) for about 24 hours. The soaked beans were cooked to become soft in water. Hot air oven at 80°C was used to dry the cooked kidney beans were milled in a blender. The Processing of beans is illustrated in Figure 1.

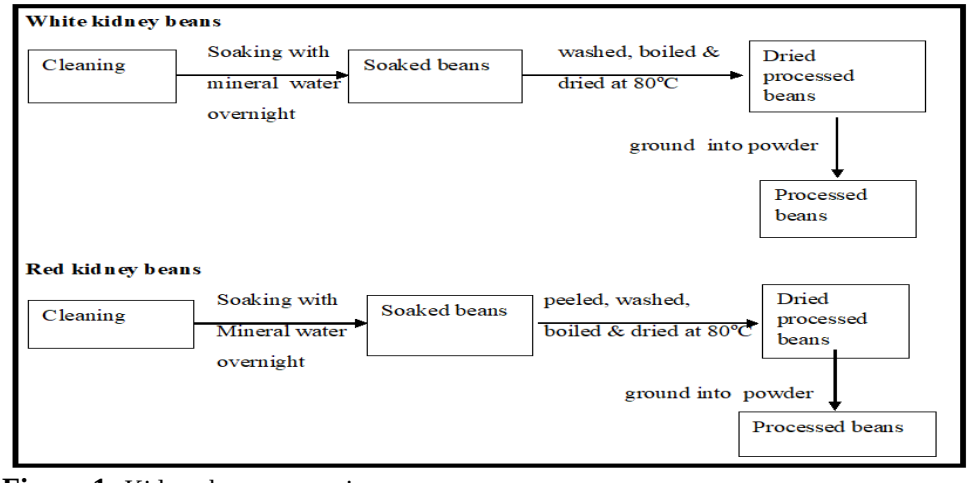

Figure 1: Kidney bean processing

Processing of vegetables

The Processing of vegetable is illustrated in Figure 2.

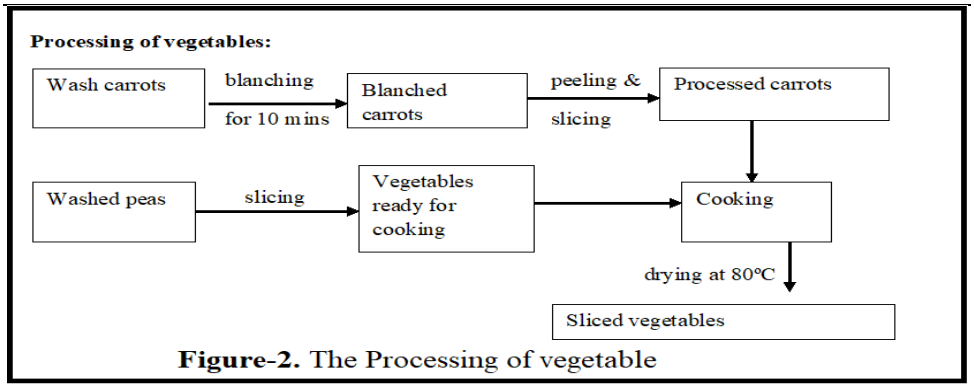

Figure 2: The processing of vegetable

Preparation and formulation of soup powder

Kidney bean soup powder was formulated to mix the ingredients i.e. red kidney bean flour, white kidney bean flour with other ingredients i.e. chicken powder, wheat flour, dried vegetable, onion powder, garlic powder, salt and black pepper in a proportion mentioned in Table 1. The preparation of the kidney bean soup powder is illustrated in Figure 3.

Table 1: Formulation of Soup Powder

S.No	Ingredients	Commercial corn based	Sample1	Sample2	Sample3
1	Corn flour	15gm	Nil	Nil	Nil
2	Red kidney bean flour	Nil	7.5gm	11gm	4gm
3	White kidney bean flour	Nil	7.5gm	4gm	11gm
4	Chicken powder	1.5gm	1.5gm	1.5gm	1.5gm
5	Wheat flour	3gm	3gm	3gm	3gm
6	Dried vegetable	2gm	2gm	2gm	2gm
7	Onion powder	0.5gm	0.5gm	0.5gm	0.5gm
8	Garlic powder	0.3gm	0.3gm	0.3gm	0.3gm
9	Salt	3gm	3gm	3gm	3gm
10	Black pepper	1.5gm	1.5gm	1.5gm	1.5gm

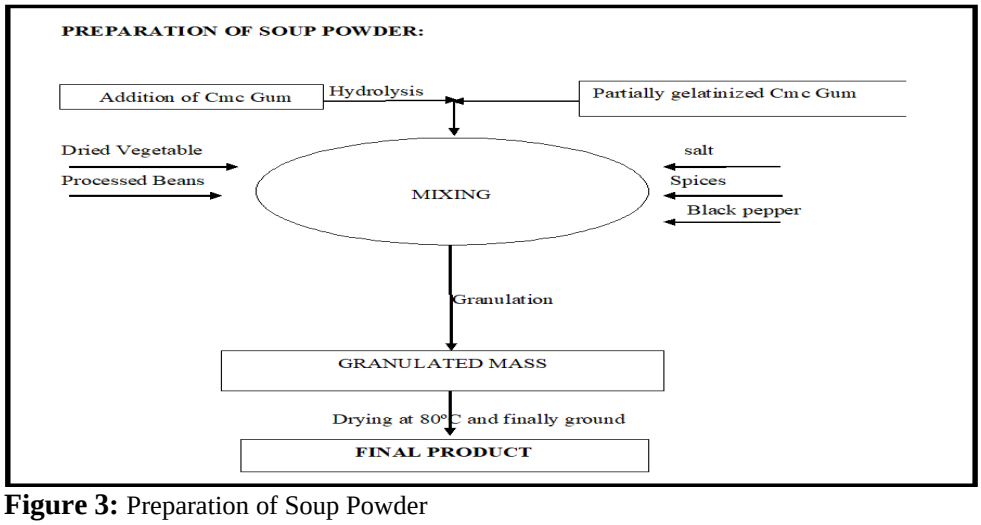

Figure 3: Preparation of Soup Powder

Organoleptic Evaluation

Standard 9-point hedonic scale procedure was used to carry out the sensory (organoleptic) evaluation. The organoleptic score of each parameter such as appearance, taste, flavor, and overall acceptability was analyzed by 20 trained/and semi trained panelist. Soup was presented to the panel with coding, and with water to rinse their mouth between samples (Amerine, Pangborn *et al.* 1965).

Proximate Analysis

Physical tests of the final product such as moisture, ash, pH, colour, bulk density and chemical analysis such as sucrose, reducing sugar and fat contents, titrable acidity, peroxide value, protein, fiber and carbohydrates were carried out according to the standard methods of AOAC (Chemists and Horwitz 1975). The calorific value was estimated by Bomb Caloriemeter. Antioxidants were analyzed by DPPH method (Amin and Lee 2005).

Microbial analysis

Microbial analysis especially Total Viable Count, Coliforms and E. coli, Yeast and Molds of newly developed soup powder were carried out according to the procedure prescribed earlier (Maturin 2001, Feng, Weagant *et al.* 2013).

Storage studies

The best-identified sample of soup powder weighing 24 g each was packed in pouches laminated with aluminum. The dried soup was stored for 4 months and microbiological assessment was carried out after every month.

Statistical analysis

Statistical analysis was carried out by ANOVA. All the results were the average of three replicates (Gomez and Gomez 1984).

Results and Discussion

The sensory score of freshly prepared soup powder has been summarized in Table 2. The sensory analysts recommended the sample3 on the basis of overall acceptability, which was found to be above average. The sample3 contains the highest amount i.e 73.33%w/w of white kidney beans.

The colour was observed to be 8.0 and 8.6 for control and sample3 (the selected sample). The score for mouth feel for control and sample3 was 8.1 to 8.5. Flavour score for control and sample3 was found to be 8.0 to 8.7. The taste scores for control and sample3 was observed as 8.0 and 8.7. Sample3 was found to be more consistent then the corn based control sample. Both of the products, control and sample3 were found to be highly acceptable.

Table 2: Standardization of Soup Recipe Developed by *P. Vulgris*

Parameters	**Corn based Commercial**	**Sample1**	**Sample2**	**Sample3**
Colour	8.0±0.02	8.1±0.01	7.5±0.02	8.6±0.02
Mouth Feel	8.1±0.04	8.2±0.03	7.7±0.04	8.5±0.02
Flavour	8.0±0.03	7.9±0.02	7.6±0.03	8.7±0.03
Taste	8.0 ±0.04	8.1 ±0.03	7.5 ±0.04	8.7±0.02
Consistency	7.9±0.01	8.0±0.02	7.7±0.01	8.6±0.01
Overall acceptability	8.0±0.04	8.06±0.03	7.6±0.02	8.62±0.02
Remarks	Control	Not Selected	Not Selected	**Selected**

The proximate analysis of soup developed by incorporating *P. vulgaris* is summarized in Table 3. The sample3 selected by the sensory panel was found to contain the lowest moisture content (7.7%) and highest was found in corn based commercial soup sample (11.32%). The moisture content estimated in the current study is found to be higher than the reported earlier (Rubilar, Morales *et al.* 2012, Singh and Chaudhary 2015, Rekha, Yadav *et al.* 2010). Food quality can be maintained by maintaining less moisture content in the food commodities; that will reduce the deterioration of food by decreasing microbial growth. For quality of dried products, moisture content <10% is believed to be more appropriate (El Wakeel 2007).

The ash content of the selected sample of newly developed soup powder was found to be the maximum 14.9% among all samples. Sample1 (14.0%), Sample2 (14.2%) and corn based commercial soup powder contains the lowest (10.9%). The results of ash contents of present study are found higher to the reported earlier (Rekha, Yadav *et al.* 2010, Rubilar, Morales *et al.* 2012). The replacement of corn flour with kidney beans might be the reason, as white and red kidney beans flour are good sources of minerals.

The protein content of the selected sample3 soup powder found to contain highest protein (9.65%) whereas sample2 contain 9.35% and ample3 contains 9.04%. The corn based commercial soup powder sample (7.77%) showed the least protein content. The results of protein content are found to be higher to the results reported earlier (Rekha, Yadav *et al.* 2010, Rubilar, Morales *et al.* 2012, Singh and Chaudhary 2015). The replacement of corn with white kidney bean in the newly developed soup powder might be the basic reason behind it. Kidney beans are not supposed to be a good source of protein but in comparison with the corn flour it contains more protein in it (El Wakeel 2007, Maccioni, Colombo *et al.* 2010).

The fat content was found highest in the commercial corn based soup powder sample (0.53%), whereas newly developed soup powder found to contain the least fat content i.e 0.39%. It is pertinent to mention that the results of fat contents are found to be lower than that of the results of other studies (Rubilar, Morales *et al.* 2012, Singh and Chaudhary 2015). The newly developed soup powder contains the maximum amount of white kidney beans which contains the lowest fat contents. The newly developed soup powder is expected to be chosen to reduce heart disease, diabetes and high cholesterol patients due to its low fat contents.

The fiber content was found highest in the currently developed soup powder sample3 (1.5%), whereas least amount in commercial soup powder (1.35%). The fiber content found in the present study were similar to the results reported earlier (Rekha, Yadav *et al.* 2010, Rubilar, Morales *et al.* 2012). The inclusion of white kidney bean flour in the newly developed soup powder makes it to contain high fiber; which is believed to prevent colon cancer, cardiovascular disease and diabetes (Elleuch, Bedigian *et al.* 2011, Slavin 2005).

10In this study, the carbohydrate content of the five soups varied significantly. It ranged from 48.25% to 63.13%. The lowest carbohydrate content was found in sample3 (48.25%), whereas highest amount in corn based commercial soup

powder (63.13%). The lower carbohydrate contents of the presently developed soup powder possibly as a result of lower carbohydrate contents of both red and white kidney beans flour that are used in the preparation of soup.

The energy value of the four soups powder ranged from 297 to 131(kcal/100 g). The highest content was found for the commercial soup powder (297 kcal/100 g), whereas least in the presently developed soup powder (131 kcal/100 g). The lower value of energy in the newly developed soup may be owing to lower fat and carbohydrate content. The calorific values indicate that the newly developed soup powder contains only 4.85% of the daily calories needs of an adult man and 5.95% of the calories a woman needs in a day. Therefore, it can be easily utilized with the confidence of not gaining weight.

Table 3: Proximate Analysis of Soup Developed by *P. vulgris*

Parameters	**Corn based**	**Sample1**	**Sample2**	**Sample3**
Moisture **(%)**	11.32±0.12	7.8±0.05	7. 9±0.04	7.7 ±0.05
Ash **(%)**	10.9±0.04	14.0±0.02	14.2±0.02	14.9±0.02
Protein **(%)**	7.77±0.05	9.35±0.04	9.04±0.04	9.65±0.04
Fat **(%)**	0.53 ±0.03	0.425±0.02	0.46±0.02	0.39±0.01
Fiber **(%)**	1.35±0.02	1.4±0.03	1.4±0.03	1.5±0.03
Carbohydrate	63.13±0.15	52.35±0.12	55.73±0.12	48.25±0.10
Energy (Kcal/100g)	297.0±0.05	134.5±0.05	138.0±0.05	131.0±0.05

In this study the microbial load of the presently developed soup was assessed up to 4 months. According to Food Standards, the total aerobic plate count, total yeast, and mold count were within the acceptable limit, whereas no Coliform or E. coli was found up to 4 months. After 4 months, the hygienic indicator organisms were gradually increased and the product quality became deteriorating (Table 4).

Table 4: Microbiological Quality Assessment of *P. vulgris* Soup Powder

S. No	**Test Parameters**	**0 days**	**30 days**	**60 days**	**90 days**	**120 days**
1.	Total aerobic bacteria, cfu/g	2.1×10^2	3.9×10^3	6.9×10^3	$1.2\text{x}10^4$	2.7×10^4
2.	Total Coliform,MPN/g	<0.3	<0.3	<0.3	<0.3	<0.3
3.	E. coli, MPN/g	<0.3	<0.3	<0.3	<0.3	<0.3
4.	Total yeast and molds, cfu/g	<10	<10	<10	2.3×10^2	9.3×10^2

<10 indicates absence of test organism in 1g of sample; MPN<0.3 indicates absence of test organism in 1g of sample

The cost of newly developed soup powder was calculated as per existing prices at the time of the study. It has been observed that the newly developed soup also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

Conclusion

A healthy dehydrated instant soup powder mix by using red kidney beans and white kidney bean (*Phaseolus vulgaris)* flour blend was developed in the current study. Among the various combination, the newly developed soup powder containing white kidney beans and red kidney beans in a ratio of 11:4 was found

to be better for its nutritional quality and sensory evaluation. Both of the products, control and newly established soup have been found highly acceptable according to sensory evaluation. The moisture, ash, protein, fat, fiber, carbohydrate, and energy content of newly developed soup powder were found to be 7.77%, 14.9%, 9.65%, 0.39%, 1.5%, 48.25 and 131kcal/100 g, respectively. On the sensory and microbiological point of view, the presently developed soup powder was found highly acceptable up to 4 months. The total yeast, aerobic plate count and mold count were found to be the acceptable according to food standards. After 4 months, the microbial counts were increased and deterioration in the product quality was observed. High protein and fiber; low fat less carbohydrates and low energy content make this soup powder a healthy nutritional choice for gut and heart health. The calorific values indicate that the newly developed soup powder contains only 4.85% of the daily calories needs of an adult man and 5.95% of the calories a woman needs in a day. Therefore, it can be easily utilized with the confidence for losing weight. The newly developed soup also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

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