

DEVELOPMENT OF A HEALTHY SOUP POWDER USING PHYTONUTRIENT ENRICHED MUSHROOM-MORINGA LEAF

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Abstract: Soup is widely consumed by different aged group people in our country. It is ready to drink and a way to provide nutrition to the people. But most of the available soups in our country are not up to the mark in their nutritional quality. Introducing nutrient enriched plant materials like mushroom and moringa leaf can be option to improve the nutritional quality in the soup preparation. Therefore, the present research was designed to develop economically convenient mushroom-moringa soup powder and to study its nutritional and sensory quality. Mushroom-moringa soup was developed mainly from corn starch, mushroom, moringa leaf and salt. Proximate analysis and sensory evaluation were performed by standard method. In this study, moisture, ash, protein, fat, fibre, carbohydrate and energy content were 2.93%, 16.05%, 10.85%, 1.46%, 1.12%, 67.59% and 326.9 (Kcal/100g), respectively. According to sensory analysis, the developed product showed higher acceptability among people. On the basis of biochemical and sensory evaluation, it can be recommended that mushroom-moringa soup is rich in protein, ash, fibre and low in fat value which can make the soup as suitable choice for the fulfillment of refreshment.

Keywords: Mushroom, moringa, soup, protein, fibre, minerals

Introduction

Soup is widely consumed by different aged group people in our country. It is ready to drink and a way to provide nutrition to the people. Dried soup has several advantages for its greater shelf life. But most of the available soups in our country are not up to the mark in their nutritional quality. Moreover, nutritional crisis is a major concern throughout the world. If it is possible to enrich our traditional soup with some nutrient enriched ingredients then this problem could be solved. In this regard plant sources are a well candidate because these are good sources of protein minerals, vitamins etc. (almost 70% of food proteins and more than 80% of food energy requirements are met by plants). Among the plant sources, mushroom and moringa (*Moringa Oleifera*) are drawing attention because of their remarkable nutrients availability.

Mushrooms is an excellent source of good quality protein approximately 20–40% on dry weight basis), Vitamins (Vitamin B-complex), and minerals¹. Mushroom is very low in carbohydrates because they cannot photosynthesis sugars, making them ideal for diabetic patents. Mushrooms contain low amount of fat. This makes it a suitable vegetable for obese people. Mushroom also has medicinal value. It also helps regulate blood sugar levels. Numerous scientific studies have indicated that the biologically active compounds contained in mushrooms may help to prevent the occurrence and aid the treatment of chronic diseases including heart disease and various cancers^{2, 3}. Therefore, mushrooms can be dried and converted into powdered form, which can be used for fortification in baked products like bread, biscuits, etc.

Moringa oleifera is found almost in every region of the country, now drawing a great attention throughout the world for its nutritional and medicinal value. Its seeds, leaves, bark are being used for

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the preparation of various foods like salads, juices, soups and medicine⁴. Moringa leaves are an excellent source of proteins (essential sulfur containing amino acids which are rarely found in daily diets), vitamins β -carotene, minerals, and tocopherols⁴⁻⁶. Moringa leaves are good source of antioxidants^{7, 8} and it also has anti-inflammatory properties as well⁹. Moringa leaf also can effectively reduce serum cholesterol¹⁰⁻¹² may protect from arsenic toxicity^{13, 14}. Quercetin, a powerful antioxidant that is rich in moringa leaf help in lowering blood pressure¹⁵. Moringa leaf can be dried and can be used in many supplementary foods like soups owing to these beneficial properties.

In view of this consideration, the present research was designed to formulate and develop economically convenient mushroom-moringa soup powder and to study its nutritional and sensory quality to give a support of regular diet.

Materials and methods

The study was carried out in the laboratory of Quality Control Research Section of Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Bangladesh.

Preparation of raw materials

Oyster mushroom (*Pleurotus ostreatus*) was collected from the National Mushroom Development and Extension Center, Savar, Bangladesh and was processed according to the procedure described previously¹⁶. Other ingredients were collected from the local market.

Processing of moringa leaf

Moringa oleifera leaves were obtained from the residential area of Bangladesh Council of Scientific and Industrial Research (BCSIR), Bangladesh. The processing of moringa leaf was carried out by modifying the method described by Gernah and Sengev¹⁷. After washing, the leaves were boiled with 0.1% (v/v) sodium meta-bi-sulfite for 5 minutes and then spread out on racks for 10 to 15 minute to drain out water. The leaves were then spread thinly on mesh and dried in solar dryer for about 4 hours (temperature range was 35°C–55°C on a very sunny day). The leaves were found very brittle. The dried leaves were grinded into powder and then packaged in a translucent or coloured polythene bag and kept in a plastic container with cover and stored at room temperature at 30°C \pm 2 for chemical analysis.

Development of mushroom-moringa soup powder

Mushroom-moringa soup powder was prepared by mixing of mushroom and moringa leaf powder with other ingredients (corn starch, salt). The prepared soup powders were then sealed in packet and used for sensory evaluation. The preparation and formulation of the product has been depicted in Figure 1 and Table 1.

Sensory analysis

The sensory attributes including flavor, taste, texture, consistency, color and overall acceptability were evaluated using the 9 point hedonic scale scorecard by a trained 10 member panelist selected from the staff members of the Institute of Food Science and Technology (IFST), Bangladesh Council

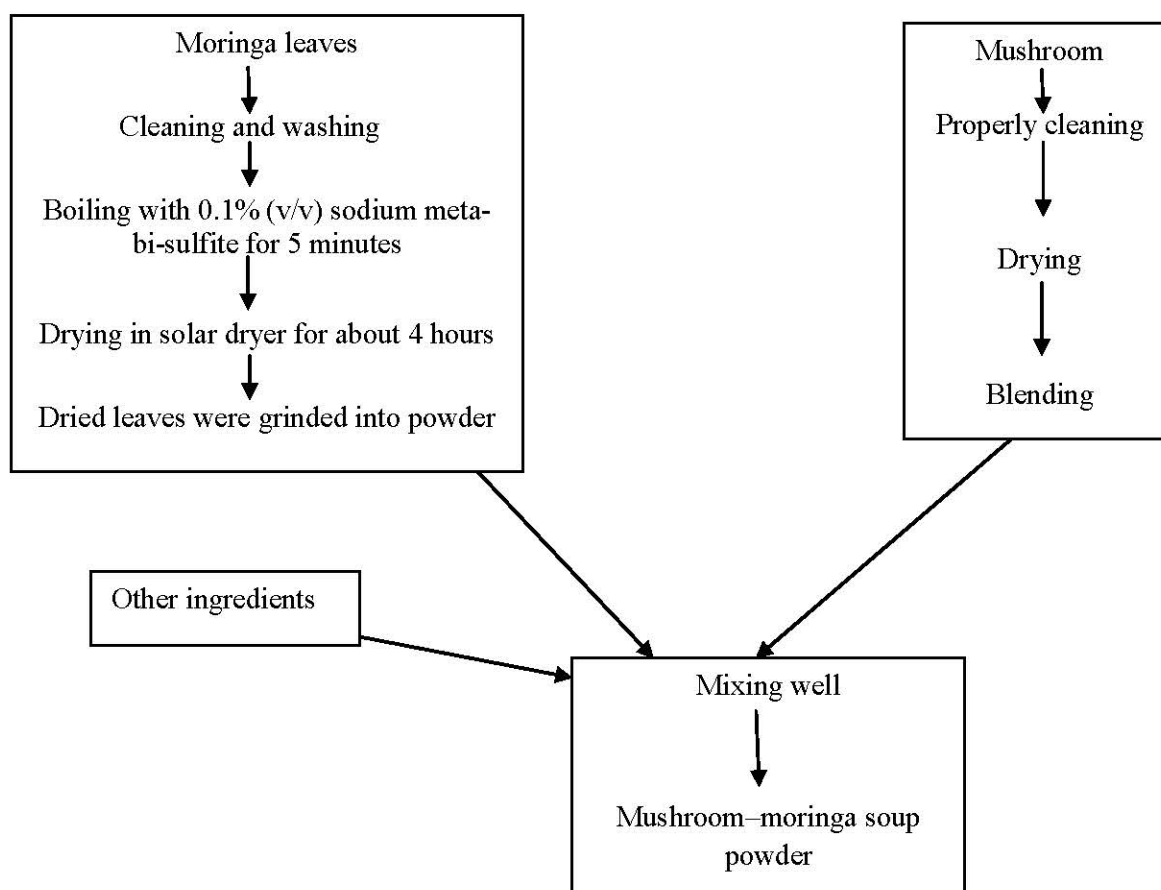


Figure 1: Flow chart for the preparation of mushroom-moringa soup powder.

of Scientific and Industrial Research (BCSIR). Each attribute was scored based on its intensity scaled on a 9- point hedonic scale (9 = liked very extremely, 8 = liked very much, 7 = like moderately, 6 = liked slightly, 5 = neither liked or disliked, 4 = disliked slightly, 3 = disliked moderately, 2 = disliked very much, 1 = disliked extremely) for color, flavor, texture and taste.

Table 1: Formulation of mushroom-moringa soup powder

Ingredients	Amount (%)
Corn starch	70.5
Mushroom	5
Moringa leaf powder	8.5
Salt	16

Proximate analysis of mushroom-moringa soup powder

The proximate composition (i.e., moisture, ash, protein, fat, fiber) of the mushroom-moringa soup was estimated according to the standard analytical methods¹⁸. At least four samples of each category were analyzed.

Determination of moisture

Moisture content was determined by drying a sample in an oven at 105°C for 5 hours, the weight loss incurred was calculated as:

$$\text{Moisture content (\%)} = (\text{Weight loss on drying} / \text{Weight of the sample}) \times 100$$

Determination of crude protein

Crude Protein content of the samples was determined using the Kjeldahl method. The method consists of three basic steps: 1. digestion of the sample in sulfuric acid with a catalyst, which results in conversion of nitrogen to ammonia; 2. distillation of the ammonia into a trapping solution; and 3. quantification of the ammonia by titration with a standard solution.

According to this method, crude protein content of the sample (%) = % nitrogen x 6.25.

Determination of total ash

To determine Ash content, a dried and ground sample was ignited in a furnace at 600°C for 4 hours to oxidize all organic matter. Crucibles were first dried for about 2 hours at 100°C in an oven and placed in a desiccator. They were cooled and 2.0g of sample was weighed into the crucible. The samples were then placed in a furnace at 600°C for four hours. Percentage ash content was determined by weighing the resulting inorganic residue.

Weight of ash, g

$$= \{[(\text{Weight of the crucible + ash}) - (\text{Weight of the crucible})] / \text{Weight of the sample}\} \times 100$$

Determination of fat

Fat content was determined using Soxhlet extraction method. In this method, fat was determined by extracting the dried materials (food samples) with a light petroleum fraction in a continuous extraction apparatus. The solvent was distilled off and extract was dried and weighed.

Determination of crude fiber

Moisture and fat free sample was boiled with 0.255N H₂SO₄ and 0.313N NaOH consecutively for 30 minutes under a reflux condenser and each time the sample was washed with boiling water properly to remove acid and alkali residue. The sample was then transferred in a crucible, dried overnight at 100°C and weighed (W₁) in an analytical balance. The crucible was heated in a muffle furnace at 600°C for 20 minutes, cooled and weighed again (W₂). The difference in the weights (W₁ - W₂) represents the weight of crude fiber.

$$\text{Crude fiber (g/100g)} = [(W_1 - W_2) \times 100] / \text{Weight of the dried sample}$$

Determination of total carbohydrate

The content of the available carbohydrate was determined by the following equation:

$$\text{Total carbohydrate (g/100g of sample)} = \{100 - (\text{moisture} + \text{ash} + \text{protein} + \text{fat} + \text{crude fiber})\}$$

Determination of energy content: Metabolizable energy was calculated following the formula below:

$$\text{Energy (kcal/100g)} = (\text{carbohydrate in g} \times 4) + (\text{protein in g} \times 4) + (\text{Fat in g} \times 9)$$

Results and discussion

Chemical composition of mushroom powder, moringa leaf powder (on dry basis):

The moisture, protein, fat, ash, fibre and total carbohydrate of the oyster mushroom (*Pleurotus ostreatus*) powder were found 4.0%, 31.8%, 2.5%, 7.0%, 12.5% and 42.2%, respectively in dry weight (Table 2) which was supported by similar study¹⁹.

In case of moringa leaf powder, the moisture, protein, fat, ash, fibre and total carbohydrate were found 4.5%, 31.64%, 6.95%, 9.29%, 11.37%, 60.75%, respectively in dry weight (Table 2) which was supported by other studies^{20, 21}.

Table 2: Proximate analysis mushroom and moringa leaf powder

Sample	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
Mushroom	4.0	7.0	31.8	2.5	12.5	42.2
Moringa	4.5	9.29	31.64	6.95	11.37	60.75

Chemical composition of the developed mushroom-moringa soup powder (on dry basis):

Moisture

The moisture content of the mushroom-moringa soup was found 2.93% (Table 3) which is lower than the reports of other studies²²⁻²⁴. The lower moisture content may be due to the incorporation of mushroom and moringa leaf powder in the preparation of soup which is supported by the findings of the study²⁰ that increase of moringa leaf powder decrease moisture content of bread. Furthermore, low moisture content of *Moringa* leaf powder used in the blends may also substantiate our study and might have implications in terms of the texture and microbiological quality of soup processed with added *Moringa* leaf powder²⁰. Moisture content is an important factor in maintaining food quality because increase moisture facilitates the growth of microbes and ultimately decrease the quality²⁵. Microorganisms cannot grow when moisture content is below 8%. On the other hand, when moisture is above 18%, some microorganisms may be reproduced gradually. In addition, El Wakeel²⁶ stated that in case of dried materials, moisture content less than 10% is considered as more proper for keeping quality of soup ingredients.

Table 3: Proximate analysis of mushroom-moringa soup

Sample	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)	Energy (Kcal/100g)
Mushroom-moringa soup	2.93±0.05	16.05±0.03	10.85±0.05	1.46±0.04	1.12±0.04	67.59±0.21	326.9±0.23

Ash

The ash content of the mushroom-moringa soup was 16.05% (Table 3). In the present study, the ash content of our developed mushroom-moringa soup was found higher than the study of others^{22, 24, 27} that was supported by a study²⁸ where higher percentage of ash (13.5%) content was found during the development of mushroom-whey soup powder. The high drink mineral content of the present mushroom-moringa soup may be due to incorporation of mushroom and moringa leaf powder in the soup preparation as mushroom and moringa leaves are a good source of minerals and supported by other studies^{16, 20, 21}. The higher ash content of the present developed soup suggests that it is a better source of minerals.

Protein

In case of mushroom-moringa soup, protein content was found 10.84% (Table 3) which is higher than that of the results of other studies^{22, 24, 28, 29}. The increase in protein content of mushroom-moringa soup may be due to incorporation of mushroom and Moringa leaves in the preparation of soup. The result is supported by the finding of other studies where incorporation of mushroom and moringa leaves increase the protein content^{20, 28}. Mushroom is a good source of high-quality protein (20–40%

on dry weight basis)¹. Therefore, mushrooms can be dried and converted into the powdered form, which can be used for fortification in soups and other baked products. Moringa leaves are also good sources of protein (26.2%)²¹. Owing to higher protein content it could be assumed that addition of mushroom and moringa leaves powder in soup has a greater potential in overcoming protein-calorie malnutrition in the world.

Fat

In the present study, the fat content of the mushroom-moringa soup was found 1.45% (Table 3) which is lower than the studies of others^{22, 27, 28}. The lower fat content of our developed mushroom-moringa soup may be due to lower fat content of mushroom (1.61–2.55%)¹⁹ and moringa (2.4%)²¹. The lower fat of this soup will make it an appropriate choice as a food for everybody. Moreover, a low-fat diet can help us ward off serious medical conditions, including heart disease, high cholesterol and diabetes.

Fibre

In case of mushroom-moringa soup, fibre content was found 1.12% (Table 3). The fibre content of our mushroom-moringa soup is almost similar to the study of others^{22,24,30}. The higher fibre content in the present developed soup may be due to inclusion of mushroom and moringa leaf powder which have higher fibre content^{19,20,21}. This makes the present developed soup a great choice of fibre. According to well-documented studies, it is now accepted that dietary fiber plays a significant role in the prevention of several diseases such as cardiovascular diseases, diverticulosis, constipation, irritable colon cancer, and diabetes^{31, 32}. Therefore, our developed soup may be helpful in preventing these cases.

Carbohydrate

The carbohydrate content of mushroom-moringa soup was found 67.59% (Table 3). The lower carbohydrate content of the present developed mushroom-moringa soup may be due to the lower carbohydrate content of mushroom (42.2%) and moringa leaf powder (38.20%) that was used in the preparation of soup^{19, 20}.

Energy value

In the present study, the energy value of mushroom-moringa soup was found 326.9kcal for each 100g (Table 3). The lower value of energy of the present developed mushroom-moringa soup may be due to lower fat and carbohydrate content.

Organoleptic Evaluations

In the present study, sensory score of developed mushroom-moringa soup with regard to flavor, taste, texture, color, consistency and overall acceptability was found very much acceptable (Table- 4).

Table 4: Organoleptic properties of our developed mushroom-moringa soup

Sample	Color	Texture	Flavor	Taste	Consistency	Overall acceptability
Mushroom-moringa soup	8.3±0.01	8.2±0.02	8.1±0.02	8.3±0.01	8.4±0.01	8.3±0.01

Conclusion

On the basis of biochemical and sensory evaluation, it can be recommended that the present developed mushroom-moringa soup is rich in protein, ash, fibre and low in fat and energy value which make the soup as suitable choice for the refreshment. The high fibre and low fat of the present developed soup make it an ideal choice for diabetic people. The use of moringa and mushroom in the soup preparation not only increase the nutritional value but also enhance its sensory quality and make

the soup very much acceptable in quality. This could play a great role in alleviating the protein energy malnutrition of the people of Bangladesh.

Acknowledgement

The authors would like to acknowledge Bangladesh Council of Scientific and Industrial Research for the funding of Research and Development work.

Conflict of interest

No conflict of Interest

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