Nutritional Composition, Minerals and Microbiological Analysis of Soybean from Nan Yun Township in Naga Self-Administration Zone

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Abstract

The present research aimed to analyze the nutritional composition, minerals and microbiological results of soybean from Naga Self-Administration Zone intended for human consumption, for selection purposes regarding their nutritional properties. The standard procedures were followed to analyze the nutritional compositions of soybean seed powder. The minerals (calcium, magnesium and potassium) contents were determined by Atomic Absorption Spectrophotometer. Microbiological properties were also determined. The result showed that soybean contained highest amount of protein 50.34% and lowest amount of ash 6.75%. Among the minerals tested sovbean contained the highest amount of potassium 48716 mg/L at all. Microbiological results showed that acceptable value $(<10^3 \text{ cfu/g})$. Considering the nutrient contents and microbiological analysis of the sample, soybean should be an inexpensive source of nutrients that could be used in the management of protein-energy malnutrition and to improve status of functional foods.

Keywords: soybean, nutritional composition, minerals, microbiological results

1. Introduction

Plant protein products are gaining increased interest as ingredients in food systems throughout many parts of the world; the success of utilizing plant proteins as additives depends greatly upon the favorable characteristics that they impart to food. The partial replacement of animal foods with legumes is claimed to improve overall nutritional status [1].

Soybean is the basis of human diets in many Eastern countries, due to its high nutritional value and low cost. The relationship between soybean intake and human health has been widely investigated due to the nutritional characteristics of this grain, including its high quality protein, significant content of minerals and fibers, small amounts of saturated fat, and absence of cholesterol [2].

More food of greater nutritional value, such as soy milk and tofu, is produced from soybeans with higher protein content. Users of these products prefer less oil and more protein. Soybean is an important source of San Naung

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macro- and micro minerals, such as P, K, Ca, Mn, Zn, Fe and B, which are indispensable in human food. A lack of these elements can lead to human malnutrition and health issues [3].

Soybean is consumed in Hawah Lower Village, Nan Yun Township, Naga Self Administration Zone as soy milk, the cake is used for livestock feeding and the seed powder is added to pap as food for infant and children. Soybean is cultivated from August to December in this region. The present study was initiated to know the nutritional composition, minerals and microbiological results of soybean and to evaluate its nutritional importance.



Figure 1. Map of Nan Yun Township

2. Materials and Methods

2.1. Sample Collection and Preparation

Soybean seeds were collected from Hawah Lower Village, Nan Yun Township, Sagaing Region, Naga Self-Administration Zone in Myanmar. The seeds were handpicked to remove extraneous materials. They were soaked in water to remove shaft after which it was dried and grounded into a fine powder using an electric mill.



Figure 2. Location of Hawah Lower Village and soybean farm



Figure 3. Plant and seed of soybean

2.2. Sample Analysis and Methods

This study was carried out at Chemistry Laboratory (University Research Center, Myitkyina University) and Department of Small Scale Industries (Ministry of Agriculture, Livestock and Irrigation, Yangon, Myanmar) from December, 2019 to March 2020.

2.2.1. Determination of Nutritional Composition and Energy Value

Moisture, ash, protein, fat and fiber were determined by standard methods. Moisture content was determined by oven drying method, ash content was determined by combustion, protein content was determined by Kjeldahl method, fat content was determined by Soxhlet extraction method and fiber content was determined by acid base treatment method. Total percentage carbohydrate was determined by the difference method. Energy content was obtained by multiplying the mean values of protein, fat and total carbohydrate by the Atwater factors of 4, 9, 4 respectively, taking the sum of the products and expressing the result in kilocalories per 100 g sample [4],[5].

2.2.2. Determination of Mineral Composition

The mineral contents of soybean seeds were determined by atomic absorption spectroscopic technique. The sample (5.0 g) was ashed in a preweighed porcelain crucible by firstly allowing smoking off the fat without burning. Then the crucible was placed in the furnace (Electric Muffle Furnace (Model L-3333, Australia)) at 550°C for 16 h stilled a white ash of constant weight was obtained.

The ash was treated with 10 mL concentrated hydrochloric acid and then digested in a digestion unit (max. temp.3000°C Gallenkamp) for 2 h. After complete digestion, 10 mL of distilled water was added and the ash solution was filtered through a filter paper (Whatman No.1) and the solution was made up to 100 mL with distilled water in a volumetric flask. For the determination of calcium, 10-fold dilution was used.

The wavelength were set up at 422.7 nm for the determination of calcium, 285.2 nm for magnesium and 766.5 nm for potassium using their specific hollow cathode lamps of the Atomic Absorption Spectrometer (AA-6300 SHIMADZU)[6].

2.2.3. Microbiological Examination

Analysis of yeast & mold and total plate count were done using standard methods of ISO: 7954 [7]. This experiment was carried out at the Department of Small Scale Industries, Ministry of Agriculture, Livestock and Irrigation, Yangon.

3. Results and Discussion

3.1. Nutritional Composition and Energy Value of Soybean Seed

The nutritional contents and energy value of the soybean seed are presented in Table 1. The percentage of moisture content was 17.03% in soy bean powder. The variations in moisture content may be due to the conditions of drying the grain after harvest and storage period. The ash content 6.75% is indicative that the powder sample could be important sources of minerals. The protein in our diet provide the amino acids from which body synthesize its own proteins, the major constituents of tissues. The protein content was found to be 50.34% in soy bean sample.

The fat content in soy bean sample was 9.66%. Most legumes contain 1.5% crude fat. Soya bean crude fat is very high compared to most legumes because it is an oilseed. The sample contained 8.33% fiber though relatively low, but the presence of fiber in foods is known to be beneficial. Fiber has some physiological effects in the gastrointestinal, tract. The high carbohydrate contents 16.31% of the sample suggests that the powdered sample could be used in managing protein-energy malnutrition since there is enough quantity of carbohydrate to derive energy from in order to spare protein so that protein can be used for its primary function of building the body and repairing worn out tissues rather than as a source of energy [8].

The energy content of soybean powder was 319.86 kcal/100g. The result shows that the soy bean seed is rich in nutrient especially protein content 50.34%, fat content 9.66% and carbohydrate content 7.89%.

 Table 1. Nutritional composition and energy value of soybean seed

Nutritional	Experimental	USDA
Parameter	Result	Standard
Moisture (%)	17.03	8.45
Ash (%)	6.75	-
Protein (%)	50.34	36.49
Fat (%)	9.66	19.94
Fiber (%)	8.33	9.00
Carbohydrate (%)	7.89	30.16
Energy value	319.86	446
(kcal/100g)		

USDA = United States Department of Agriculture

3.2. Mineral Composition of Soybean Seed

Table 2 shows the mineral (calcium, magnesium, and potassium) contents of the powdered sample of the soybean. Potassium had the highest (4871.6 mg/100g) followed by calcium 270.1 mg/100g, magnesium had the lowest value of 0.028 mg/100g. The variation in results may be due to the difference in specie used and the dictates of environmental conditions. The high potassium content of 4871.6 mg/100g suggests that the powdered sample could be used in complementary foods to help essential nutrient needed for maintenance of total body fluid volume, acid and electrolyte balance and normal cell function [9].

Table 2. Mineral composition of soybean seed

Minerals	Experimental	USDA
	Result	Standard
Calcium	270.1	277
(mg/100g)		
Magnesium	0.028	280
(mg/100g)		
Potassium	4871.6	1797
(mg/100g)		

USDA = United States Department of Agriculture

3.3. Microbiological Results in Soybean Seed

Yeast & mold count and total plate count results of soybean seed powder are shown in Table 3. The acceptable microorganism level in soybean sample was ($<10^3$ cfu/g). According to the experimental results, it was observed that good microbiological quality and satisfactory for food safety.

Table 3. Microbiological analysis of soybean seed

Test	Experimental Results	*Codex Standard
Yeast & Mold (cfu/g)	$< 10^{3}$	<10 ⁵
Total Plate Count (cfu/g)	$< 10^{3}$	<10 ⁵

*Codex = Codex Alimentarius, International Food Standards, FAO/WHO

4. Conclusion

In this research, it was observed that maximum results of protein and potassium content. The results of this study indicate that the soybean seed powder sample is rich in proteins, fats and carbohydrates and are therefore inexpensive source of macronutrients which can be used in intervention program aimed at alleviating protein-energy malnutrition. The soybean seed powder has good protein contents and could be used to fortify flours with low protein content such as maize and rice. The microbial load of powdered sample found acceptable and the mineral contents indicate that the powdered sample could be important sources of minerals for humans and farm animals. Therefore, this research may be contributed to soybean cultivars in Naga-Self Administration Zone.

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