Effect of Different Domestic Processing Methods on Nutritional Value of Mothbean (*Vigna aconitifolia* L.) Grains

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Abstract

Legumes are important constituent for the human diet, it increases the nutritional status of the cereal-based diets. Mothbean (*Vigna aconitifolia* L.) grains are appreciated due to its high quality of protein content. Hence, the current study carried out with the purpose to assess the effect of different domestic processing methods on nutritional value of Mothbean grains. Mothbean grains procured in the local markets were cleaned and soaked in clean tap water for 12 h in 1:3 ratio. The soaked grains were tied in muslin cloth and allowed to germinate at ambient temperature. The nutritional and mineral composition of raw and domestically processed Mothbean grains were determined. Results revealed that moisture (%) and protein (%) were increased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (Moisture (%): 11.28 vs. 7.94; Protein (%): 23.01 vs. 19.32. Whereas, carbohydrate (%) was slightly decreased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (54.33 vs. 59.28). The magnesium and iron contents were increased in the domestically processed Mothbean grain samples as compared to raw Mothbean samples (Magnesium (mg/100g): 230.69 vs. 218.56; Iron (mg/100g): 9.72 vs. 7.59). Whereas, calcium and phosphorus contents were decreased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (Calcium (mg/100g): 178.40 vs. 190.53; Phosphorus (mg/100g): 194.05 vs. 206.18). In conclusion, domestically practiced processing methods like soaking followed by germination could be suggested to improve the nutritional value of Mothbean grains.

Keywords: Mothbean, *Vigna aconitifolia*, Soaking, Germination, Protein, Magnesium, Iron

Introduction

Legumes are a wide variety of crops that are enclosed in flowering plants producing seeds in pods and frequently raised for food and feeds. They were ranked as the third-largest family of flowering plants with species over 19,500 and genera of range higher than 750. Legumes are generally grown throughout the world and their own dietary as well as economic importance is worldwide. Legumes or pulses are regarded as a very important group connected with plant foods stuffs, particularly in the developing globe. A significant section of human population relies upon legumes since staple foods for subsistence, particularly in combination with cereals.[1]

Mothbean (*Vigna aconitifolia* L.), is a leguminous plant known for its ability to withstand in drought like conditions which belongs to the Fabaceae family (Figure 1 and Figure 2). It is typically grown in arid and semi-arid regions of India. It is a versatile plant, and it is known by various names such as mat bean, matki, turkish gram, or dew bean. The state of Rajasthan, recognized as India's driest region, holds a significant role in Mothbean cultivation and contributes to approximately 86% of the total cultivation area in the country.[2]

Figure 1: Showing Mothbean (*Vigna aconitifolia* L.) plant

Figure 2: Showing Mothbean (*Vigna aconitifolia* L.) grains

Legumes are generally consumed after processing into various products like milling into "dhal" puffing or roasting into snack foods, grinding into flour for different food preparations.[3] It is widely accepted that simple and inexpensive traditional processing techniques are effective methods of achieving desirable changes in the composition of seeds. Processes like soaking, cooking, fermentation and germination may improve the quality of legumes due to the removal of some anti-nutritional factors. Germination is one of the most common processes for improving the nutritional quality of pulses, not only by the reduction of antinutritive compounds also increase protein content, dietary fiber, vitamin, and bioavailability of trace elements and minerals.[4]

Nutritional content given rise to many health benefits to the human being. Mothbean grains are usually traditionally taken pertaining to breakfast every day, soon after currently being sprouted along with cooked properly. Fried splits chips makeup some sort of ready-to-eat solution with of India referred to as Dalia.[5] The seeds can be cooked and eaten as a vegetable and can also be processed as dhal to preserve them for a long time. Mainly sprouted seed along with dhal are used in preparation associated with various kinds of curries.[6] With this scenario, in the present study we aimed to study the effect of different domestic processing methods on nutritional value of Mothbean grains.

Materials and Methods

Procurement of Mothbean Grains

About 1 kg of local varieties of Mothbean grains were purchased from local markets in Chikkaballapur, Karnataka, India. The Mothbean grains procured from local market were manually cleaned to eliminate any dust, stones, twigs or other extraneous materials.

Sample Preparation

Mothbean grains were soaked in clean tap water for 12 h in 1:3 ratio. The soaked grains were tied in muslin cloth and allowed to germinate at ambient temperature. Grains were sprinkled with water. It took 24 hr. for grains to germinate (Figure 3). When the sprouts were 1-2 cm long germinated grains were dried in cabinet drier at 50 ± 3°C for 12 h. The dried samples were milled to pass through a 40-mesh sieve. After grinding samples were kept in refrigerator in air tight plastic containers till further analysis was done.

Figure 3: Showing sprouted of Mothbean grains

Analytical Methods

The samples were analyzed for the nutritional composition *viz.* moisture, protein, fat, ash, crude fiber and minerals composition *viz.* calcium, phosphorus, magnesium and iron as per the methods described in Association of Official Analytical Chemists (AOAC, 2000).[7] Nutrients were expressed on dry weight basis.

Moisture content

Moisture content was determined as per the method described in AOAC (2000).[7] It was calculated using following formula.

Moisture content (%) = (Initial weight (g) – Final weight (g)/Weight of sample (g) X 100

Crude fat

The fat content was determined as per procedure described in AOAC (2000),[7] using Soxhlet apparatus was used to determine crude fat content of the sample. The percentage of crude fat was calculated using the following formula;

Crude fat (%) = Weight of ether extract (g)/Weight of sample (g) X 100

Protein

Protein content was determined as procedure described in AOAC (2000).[7]. Percentage of nitrogen and protein was calculated by the following equation;

$$Nitrogen\ (\%) = T_S - T_B \times Normality\ of\ acid \times 0.014)/\ Weight\ of\ sample\ (g) \times 100$$

Where,

T_S - Titre volume of the sample (ml)

T_B - Titre volume of Blank (ml), 0.014= M eq. of N

$$Protein\ (\%) = Nitrogen \times 6.25$$

Ash content

Drying the sample at 100°C and churned over an electric heater. It was then ashes in muffle furnace at 550°C for 5 hrs.[7] Ash content was calculated using the following formula:

Ash content (%) = Weight of ash (g)/Weight of sample (g) X 100

Total carbohydrate

The total carbohydrate content of the samples was determined as total carbohydrate by difference, calculated by subtracting the measured protein, fat, ash and moisture from 100.[7]

Estimation of minerals

Two grams of defatted sample was weighed and heated at 550ºC. Then, the obtained ash was digested with concentrated Hydrochloric acid (HCl) on hot plate. The digested material was then filtered using Whatman No. 42 filter paper and the final volume made to 100ml with distilled water that was further used for analysis with respects to minerals contents by using methods of AOAC (2000).[7]

Results

Nutritional composition

The results of effect domestic processing of Mothbean grain on nutritional composition was represented in Table 1. Results revealed that moisture (%) and protein (%) were increased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (Moisture (%): 11.28 vs. 7.94; Protein (%): 23.01 vs. 19.32. Whereas, carbohydrate (%) was decreased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (54.33 vs. 59.28).

Table 1: Effect of domestic processing on nutritional composition of Mothbean grains

Nutrient Composition	Raw Mothbean Grains	Processed Mothbean Grains
Moisture, %	7.94 ± 1.15	11.28 ± 1.13
Crude fat, %	1.16 ± 0.21	1.06 ± 0.18
Carbohydrate, %	59.28 ± 0.64	54.33 ± 0.47
Protein, %	19.32 ± 0.98	23.01 ± 0.64
Ash, %	3.18 ± 0.89	3.05 ± 0.45

Crude fiber, %	4.08 ± 0.28	3.68 ± 0.32

Values were expressed as Mean ± SD; n=3

The results of effect domestic processing of Mothbean grain on mineral composition was represented in Table 2. Results depicted that magnesium and iron contents were increased in the domestically processed Mothbean grain samples as compared to raw Mothbean samples (Magnesium (mg/100g): 230.69 vs. 218.56; Iron (mg/100g): 9.72 vs. 7.59). Whereas, calcium and phosphorus contents were decreased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (Calcium (mg/100g): 178.40 vs. 190.53; Phosphorus (mg/100g): 194.05 vs. 206.18).

Table 2: Effect of domestic processing on mineral composition of Mothbean grains

Mineral Content (mg/100g)	**Raw Mothbean Grains**	**Processed Mothbean Grains**
Calcium	190.53 ± 1.15	178.40 ± 1.13
Phosphorus	206.18 ± 0.21	194.05 ± 0.18
Magnesium	218.56 ± 0.64	230.69 ± 0.47
Iron	7.59 ± 0.98	9.72 ± 0.64

Values were expressed as Mean ± SD; n=3

Discussion

Legumes are important constituent for the human diet, it increases the nutritional status of the cereal-based diets. They are the efficient source of energy, carbohydrates, proteins and fiber. Legumes are also the good source of B-group vitamins, and they are rich source of bioactive compounds i.e., phenolic and flavonoid content which have a very beneficial impacts on the human health. Moreover, Mothbean are appreciated due to its high quality of protein content and carbohydrates associated with an adequate amount of minerals like (Fe, Zn, Ca, Mg, and Mn), and vitamins like (ascorbic acid and niacin). Therefore, the current study was performed with the main objective to study the effect of different domestic processing methods on nutritional quality of Mothbean grains.

Results of our study delineated that moisture (%) and protein (%) were increased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (Moisture (%): 11.28 vs. 7.94; Protein (%): 23.01 vs. 19.32. Whereas, carbohydrate (%) was decreased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (54.33 vs. 59.28). The magnesium and iron contents were increased in the domestically processed Mothbean grain samples as compared to raw Mothbean samples (Magnesium (mg/100g): 230.69 vs. 218.56; Iron (mg/100g): 9.72 vs. 7.59). Whereas, calcium and phosphorus contents were decreased in domestically processed Mothbean grain samples as compared to raw Mothbean samples (Calcium (mg/100g): 178.40 vs. 190.53; Phosphorus (mg/100g): 194.05 vs. 206.18). These findings were comparable with findings of studies reported by various other research investigators in the literature.[8-10]

Negi et al., reported that *in-vitro* carbohydrate and protein digestibility was enhanced by 19–36% and 1–8%, respectively.[8] The increase in moisture content in our study was due to the uptake of water during soaking, and decrease in ash content could be accredited to leaching losses during soaking.[11] Furthermore, it was also possible that the increase in protein was due to the uptake of water during germination. The decrease in fat in Mothbean during germination may be due to increased activity of lipase.[12]

Legumes serve as a valuable phosphorus source, with phytate phosphorus being the main stored form. As germination progresses, there is a consistent decline in phytate phosphorus levels. This reduction in the phytate phosphorus caused development of phytase activity during germination. The enhancement of phytase activity promotes the breakdown of phytic acid into inositol and inorganic phosphate, as observed in the study by Reddy et al.

Phytate ions forms complexes with divalent or trivalent metal ions, resulting in the formation of insoluble compounds.[13]

Conclusion

The findings of our study depicted that domestically practiced processing methods like soaking followed by germination of Mothbean grain improved nutritional and mineral composition especially moisture, protein, magnesium, and iron contents of Mothbean. Hence, soaking followed by germination could be suggested to improve the nutritional value of Mothbean grains.

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