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Proximate and Elemental Analysis of Mung Beans

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Abstract: *The proximate and elemental analysis of mung beans (Vigna radiata), a green gram native India and widely cultivated across Asia, the USA, Australia, and Africa, aimed to characterize their nutritional and mineral content. Mung beans are noted for their high protein content, essential minerals, and beneficial phytochemicals, which contribute to their reputation as a functional food with health-promoting properties. In this study, mung bean samples were collected from NGETRA Integrated Farms Ltd in Maiduguri, Nigeria, and analyzed using standard methods. The proximate analysis revealed moisture content of 11.08%, ash content of 3.77%, protein content of 43.31%, fat content of 4.00%, and carbohydrate content of 37.84%. Elemental analysis indicated zinc at 0.89 mg/100g, potassium at 1103.0 mg/100g, calcium at 120.11 mg/100g, magnesium at 133.46 mg/100g, and iron at 4.63 mg/100g. These findings highlight the mung beans' high protein content and significant mineral profile, with notable variations from previous studies in zinc, potassium, and other components, suggesting that factors such as environmental conditions and cultivation practices may influence their nutritional composition.*

Keywords: *Beans, Mung, Proximate, Content, Mineral.*

Introduction

Mung bean (Vigna radiata) popularly known as green gram, believed to be native crop of India, is a tiny circular shaped bean in green colour widely cultivated throughout Asia, including India, Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Malaysia, South China and Republic of Formosa. This short-term legume can grow in varying environmental condition and later it expands, it reaches to the USA, Australia, and Africa. In general, mung bean is a source of high-quality protein which can be consumed as whole grains, dhal, or sprouted from and is an excellent complement to rice in respect to balanced human nutrition. (Sefa-D and Stanley, 1979)

In addition to being the prime source of human food and animal feed, it play an important role in maintaining the soil fertility by enhancing the soil physical properties and fixing atmospheric nitrogen. (Tulse, S.B. and Reshma, V.R., 2014); Mung bean is an annual crop that is highly branched and is about 60-76 cm tall, With a slight tendency of twinning in upper branches. The central stem of this crop is roughly erect, but the side branches are semi-erect. The leaves of the plant are trifoliate, and it is deep rooted. Clusters of 12-15 flowers are situated at the top of the plant, and eventually these flowers will develop into small cylindrical pods. The pods of this fully fertile and self-pollinated crop are linear, sometimes curve, round, and slender. The seeds enclosed within the pods are small and nearly globular. The three major components of dicotyledonous green gram seed are seed coat, cotyledon, and embryo accounting 12.1 %, 85.6%, and 2.3% of the whole seed, respectively. Seed coat is an outer covering which protects the embryo. The embryonic shoot above the cotyledon is epicotyl, and the embryonic root below the cotyledon is hypocotyl. Micropyle is a small pole on the seed that allows water absorption, and the helium is a mark left on the seed coat by the stalk which attached the ovule to the wall before it became a seed. (Sefa-D and Stanley, 1979).

Mung bean (Vigna radiata.) are small green beans that belongs to the legume Family. The proximate analysis and characterization of mung bean was isolated, and some of the important characteristics determined the yield of starch was31.1% on the whole seed basis, the shape of the starch and crude fiber are Concentrated in cotyledons and seed coat. Mung bean grain and reviewed to access the crop potential as and set research properties. It shows that mung bean is a rich source of protein 14.6-33g/100g and iron 5.9-7.6 mg/100g. Grain calories correlated with compound like polyphenols and carotenoids, whole grain hardness is associated with fiber content, physical properties like grain dimension, porosity, bulk and true density are related to moisture content; it contains about 55% - 65% carbohydrates equal to 650kg dry weight and rich in protein, vitamins and mineral. It is composed of about 20% - 50% protein of total dry weight among which globulin 60% and albumin 25% (Puranik, Mishra, 2011).

Mung bean (Vigna RadiateL Wilczek) is an important pulse consumed all over the world, especially in Asian countries and has a long history of usage as traditional medicine it, has also been known to be an excellent source of protein, dietary fiber, minerals, vitamins and significant amount of bioactive compound including polyphenols, polysaccharides and peptides, therefore becoming a popular functional food in promoting good health. The seed of twenty-five varieties, cultivars of mung beans were exalted in respect of proximate assays chemical, composition and nutritional values with the aim to ensure the suitability of the food stuff for human consumption the composition of whole green gram seed calcium 113.4g, iron 5.9g, copper 1.0g, potassium 956.6g, magnesium 162.4g, zinc 2.7g.(Mubarak 2005). The tested cultivars contained micronutrients, including Zn, Fe, and Cu, with average values of 30.70 mg/kg, 104.00 mg/kg, and 3.8 mg/kg, respectively. Additionally, Alpha-A and Gamma-R were present in mung bean seeds, with average values of 25 mg/kg, 192 mg/kg, and 670 mg/kg, respectively (Zehenxing *et al.,* 2016).

Mung bean, as a functional component of major cultivars planted in China, was evaluated by collecting twenty Chinese mung bean cultivars. Their nutritional composition, including starch, fat, protein, and phytochemicals, was analyzed. The cultivars were found to have a high amount of resistant starch, accounting for 16.1% to 22.3% of total starch, and a balanced amino acid profile. Palmitic acid and iron were the dominant components, with palmitic acid accounting for 32.4% and 36.1% of all the assayed fatty acids. Furthermore, four bound phenolic acids—ferulic acid, p-coumaric acid, and caffeic acid—and two free phenolic acids, caffeic acid and ferulic acid, were identified using HPLC (Mubarak, A.E., 2005).

Antioxidant activity of 70 % ethanol extracts from the 20 mung bean cultivars was evaluated their DPPH and ABTS free radical scavenging capacity ranged 28.13, 2.24,35.68, 0.714 molg-1 and from 3.82, 13.44, 1.76 molg-1 these results suggest that chinese mung bean cultivars are rich in balanced nutrient and that their phytochemical should be considered as potential source of natural antioxidants (Sehrish, H. Z., Muhammed. U., 2022). Green gram can be a rich source of protein with higher digestibility and can serve to convalescing babies or malnutrition people. The nutrient are not distributed uniformly in major component such as coat, cotyledon and embryo of the mung bean seed is 10.6g/100g of whole gram with high protein 22.9g, fat 1.2g, total carbohydrate 61.8g crude fiber 4.4g and ash 3.5g per 100g of sample (Adsule R.N, Kadams Salunkhe D.K 1986) The presence of anti-nutritional factors such as 366.mg/100mg phytic acid 44.15mg/100g were reported in mung bean which affect the digestion of the nutritional (Erten, H., Boyaci, G., 2006). The result of study showed the essential minerals and protein, nutritional and anti- nutritional characters of mung bean varieties / cultivars which are potential health determinate and can be used to characterized food quality in human care. (Dahiya, P.K., AR Van-boekel m.a.j.s 2015).

Research Methodology

Sample Collection and Preparation

Mung bean samples were obtained from NGETRA Integrated Farms Ltd, located in Maiduguri, Borno State. To ensure accuracy and consistency in the analysis, samples were carefully handled and transported to the laboratory. Upon arrival, the samples were prepared for analysis following the standard procedures outlined by the Association of Official Analytical Chemists (AOAC), using dry basis techniques. This involved drying the samples to remove moisture content and ensure uniformity in subsequent tests.

Determination of Moisture and Ash Content

The moisture content of the mung beans was determined using a loss on drying method at 105°C. Initially, a clean flat crucible was dried, cooled, and weighed (W_1). Approximately 5 grams of the sample were spread into the crucible and weighed (W_2). The crucible with the sample was then placed in an oven at 105°C, cooled in a desiccator, and reweighed (W_3). The moisture content was calculated using the formula: %Moisture = $(W_2 - W_3) / (W_2 - W_1) \times 100$. For ash content determination, a clean platinum or silica dish was ignited, cooled, and weighed (W_1). Two grams of the sample were placed in the dish and heated in a muffle furnace at 500°C until fully ashed. The residue was then cooled, and the dish was reweighed (W3). The ash content was calculated using:

%Ash content = $(W_3 - W_1) / (W_2 - W_1) \times 100.$

Protein and Fat Content Analysis

Protein content was assessed using the Macro-Kjeldahl method, which quantifies nitrogen content. The sample was digested with concentrated sulfuric acid and a catalyst, converting nitrogen to ammonium sulfate. After making the solution alkaline, ammonia was distilled and quantified by titration with standard acid. The percentage of nitrogen was calculated as %N = T.V × 0.0014 / W × 100, and the protein content was derived by multiplying the nitrogen percentage by an appropriate factor (F). Fat content was determined gravimetrically by extracting fat from a dry powdered sample with petroleum ether or N-hexane. A known weight of sample was placed in a thimble or filter, extracted for five hours, and the solvent was evaporated. The residue was weighed to determine fat content using the formula: $\%Fat = (W_2 - W_1) / W \times 100.$

Carbohydrate and Mineral Analysis

Carbohydrate content was calculated by difference:

100 - (%Moisture + %Ash + %Protein + %Fat).

For mineral analysis, all equipment and glassware were meticulously cleaned and prepared. Volumetric flasks, measuring cylinders, and digestion flasks were washed, rinsed with deionized water, and treated with nitric acid or potassium dichromate solutions to remove contaminants. Mineral concentrations in the mung beans were measured using a LaMotte UV/VIS Smart Spectrophotometer, model 2000. Each sample was analyzed in triplicate, with absorbance readings compared to standard solutions to determine the concentration of metal ions.

Result and Discussion

Table 1: Proximate Composition of Mung Bean Sample

Composition	Percentage (%)
Moisture	11.08
Ash	3.77
Protein	43.31
Fat	4.00
Carbohydrate	37.84

Moisture and Ash Content

The moisture content of mung bean seeds was determined to be 11.08%, aligning closely with the 10.6g/100g reported by Adsule *et al*. (1986). This slight variation could be attributed to environmental factors, cultivation methods, or sample processing during analysis. Moisture content is a critical parameter as it influences the shelf life and storage stability of the seeds; lower moisture levels generally enhance storage potential by reducing the risk of microbial growth and spoilage. The ash content was found to be 3.77g/100g, marginally higher than the 3.5g/100g previously reported. This higher ash content suggests a rich mineral profile in the mung beans, indicating they are a good source of essential minerals such as calcium, potassium, and magnesium. Variations in soil composition where the beans were cultivated could account for these differences.

Protein, Fat, and Carbohydrate Content

The protein content of mung bean seeds, at 43.31g/100g, is notably higher than the 22.9g/100g reported by Adsule, Kadams, and Salunkhe (1986). This significant increase may be due to differences in mung bean varieties, improved agricultural practices, or evolving cultivation conditions. The high protein content underscores mung beans as an excellent source of plant-based protein, essential for human nutrition, particularly in vegetarian and vegan diets. The fat content of the seeds was measured at 4.00g/100g, higher than the 1.2g/100g previously reported, likely due to varietal differences or advancements in cultivation techniques. Although mung beans are not typically recognized for their fat content, the fats present are likely unsaturated and beneficial for heart health. The carbohydrate content was found to be 37.84g/100g, lower than the 61.8g/100g previously documented. This reduction may be related to the increased protein content observed, as a rise in one macronutrient can lead to a relative decrease in others, making these mung beans potentially more suitable for low-carbohydrate diets.

Table 2: Elemental Composition of Mung Beans (mg/100g)

S/No	Element	Composition (mg/100g)
1	Zinc	0.89
2	Potassium	1103.0
3	Calcium	120.11
4	Magnesium	133.46
5	Iron	4.63

The zinc content in mung beans, as shown in Table 2, is 0.89 mg/100g, which is notably lower than the 2.7 mg/100g reported by Mubarak (2005). Zinc is a crucial trace element vital for immune function and enzyme activity, and its lower content in this study might be attributed to factors such as soil zinc availability or variations in the mung bean variety used. This difference in zinc levels emphasizes the impact that environmental and genetic factors can have on the nutrient composition of crops.

The potassium content of mung beans in this study is recorded at 1103.0 mg/100g, surpassing the 956.6 mg/100g reported by Mubarak (2005). Potassium is essential for maintaining fluid balance, nerve function, and muscle contraction, making the higher content in these mung beans particularly beneficial for those seeking to increase their dietary potassium intake. This elevated potassium level, alongside the mineral content like calcium (120.11 mg/100g), magnesium (133.46 mg/100g), and iron (4.63 mg/100g), underscores the nutritional value of mung beans, supporting their inclusion in a balanced diet. These variations from Mubarak's findings further illustrate the importance of considering different environmental and genetic factors when assessing the nutritional profiles of food crops.

Conclusion

The proximate and elemental analysis of mung beans highlights their significant nutritional and functional benefits, affirming their value as a dietary staple. The high protein content, notable for its substantial increase compared to earlier reports, highlights mung beans as an excellent source of plant-based protein, fundamental for various dietary needs. Their balanced carbohydrate and fat profile, despite some variations, supports their versatility in different diet plans. Additionally, the rich mineral content, including elevated levels of potassium and moderate levels of calcium and magnesium, enhances their role in promoting overall health. Although discrepancies in zinc content suggest the influence of environmental and genetic factors, the overall nutrient profile of mung beans solidifies their position as a valuable food source with potential health benefits. These findings reinforce the importance of mung beans in providing essential nutrients and supporting a balanced diet, while also illustrating the variability in nutrient composition influenced by cultivation conditions and crop varieties.

References

Adsule, R. N., Kadam, S., Salunkhe, D. K., & et al. (1986). Chemistry and technology of green gram (*Vigna radiata* [L.] Wilczek). *Critical Reviews in Food Science and Nutrition, 25*(1), 73-105.

Afzal, M. S., Murshad, A. M., Bakar, A., Hamid, A. B., & Salahuddin, M. (2008). Mung beans cultivation in Bangladesh.

Dahiya, P. K., Linnemann, A. R., Nan-Boekel, M., & A. J. S. (2015). Mung bean: Technological and nutritional potential.

David Pearson. (1979). *Chemical analysis of food*. ISBN 00443014116.

Department of Marketing Inspection. (2015). Retrieved May 28, 2019, from https://dmi.gov.in

Erten, H., Boyaci-Gunduz, C. P., Agirman, B., & et al. (2015).

Mubarak, A. E. (2005). Nutritional composition and antinutritional factors of mung bean seeds affected by some home traditional processes. *Food Chemistry, 89*(4), 489-495.

Puranik, V., Mishra, V., Singh, N., & et al. (2011). Studies on the development of protein-rich germinated green gram pickle and its preservation by using Class One preservatives. *American Journal of Food Technology, 6*(7), 742-752.

Sefa-Dedeh, S., & Stanley, D. W. (1979). The relationship of microstructure of cowpeas to water absorption and dehulling properties. *Cereal Chemistry, 56*(4), 379-386.

Shi, Z., Yao, Y., Zhu, Y., & Guixing. (2016). Mung beans. https://doi.org/10.1016/cg.2016

Tulse, S. B., Reshma, V., & Rajiv, J. (2014). Effect of co-milled wheat, green gram, and barley on the rheological and quality characteristics of cookies. *Food and Technology, 21*(7), 492-502.

Zafar, S. H., Umair, M., & Akhtar, M. (2022). Mung beans. https://doi.org/10.1016/j.2022/100166