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Evaluation of Physiochemical properties of Wheat and Mungbean from Bangladesh

Imtiaz Hussain[1], M.Burhanuddin[2] and Mohommad Kamrouj Jaman Bhuiyan [3]

[1] *Department of Food Science and Technology Faculty of Agriculture Rawalakot Azad Jammu and Kashmir, Pakistan*
[2]*Department of Food Technology and Rural Industries Bangladesh Agricultural University Mymensing Bangladesh*
[3]*Department of Agricultural Statistics Bangladesh Agricultural University Mymensing Bangladesh*.

Abstract: Physiochemical properties of wheat and mungbean were determined. 100 seed weight of wheat (4.373 +.0967) and mungbean (3.809±.0828). Seed volume recorded wheat was (0.0100±.00) and mungbean (0.00500±.00). Mungbean has higher seed density (7.910±.0200) than wheat (4.420±.0200). Bulk density was more for wheat (0.189±.0100) than mungbean (0.182±.0100). Water absorbance capacity value was higher for mungbean (109.890±.05) than wheat has (46.600±.05). Mungbean has high value (22.760±.04) for seed coat percentage than wheat (10.310±03). Leached was more in wheat grain (12.250±.03) than mungbean (9.370±.03). The moisture for wheat seed (13.42 ±.030), protein (12.23 ±.030), crude fat (1.63 ±.0200), ash (1.52 ±.0200) crude fiber (1.43 ±.0115) and Carbohydrate (69.76 ±.1006). The results of the proximate analysis of the mungbean seeds are moisture for wheat seed (13.42 ±.030), protein (12.23 ±.030), crude fat (1.63 ±.0200), ash (1.52 ±.0200) crude fiber (1.43 ±.0115) and Carbohydrate (69.76 ±.1006). Results regarding antinutritional content showed that phytic acid content more in mungbean (635.0 +5.0) than wheat (533.0 ±5.0) tannin content was also high in mungbean (452.66 ±7.637) than wheat (353.0 ±5.0).It was concluded that both wheat and mungbean from Bangladesh suitable for industrial processing.

Keywords: wheat, mungbean, physical, tannin, phytic acid, composition.

Corresponding author: Imtiaz Hussain Department of Food Science and Technology Faculty of Agriculture Rawalakot Azad Jammu and Kashmir Pakistan.
E-mail: imti_hussain2005@yahoo.com

Introduction

Pulses are a good source of protein, minerals, and energy in a human diet. The excellent nutritive value of pulses is highly complementary to a cereals-based diet in developing countries. Pulses are a cheaper source of protein than animal foods (Singh and Jambunathan, 1991). Mungbean is basically an Asian crop. It is one of the major caloric and protein sources in South Asia, especially for the vegetarian population. Many food items can be prepared from mungbean. The most popular food is dhal, which is consumed in almost every meal. Although mungbean primarily serves as a supplemental source of protein high consumption rate and improvement of its iron content and availability make it a significant contributor to the iron status in the South Asian diet. (Preheat, 1988). In Bangladesh mungbean (*Vigna radiata* L.) ranks third in acreage and production but ranks first in market price (Ahmed, 1978). About 70 percent of mung bean production is concentrated in the four southern districts of Patuakhali, Barisal, Bhola, and Noakhali. Patuakhali alone accounts for 30 percent of the area in which mung bean is grown. (BBS, 2001) In Bangladesh, a large number of people are suffering from malnutrition. For alleviating human malnutrition for the poorest segment of the country's population, pulses have been identified as crops with exceptional potential. The present per capita availability of pulses is only 12.5 g daily, which is far below the 45 g recommended for the Bangladeshi diet. The present production of pulses is only 420,000 tons. To meet demand, the government spends about 200 billion taka yearly to import pulses (CIDA July 1994). Mungbean grain contains 51%carbohydrates, 26% protein, 10% moisture, 4% mineral and 3% vitamins (Kaul, 1982).The Wheat (*Triticum* spp.)(Belderok,, et al.,2000) is a grass, originally from the Fertile Crescent region of the Near East, but now cultivated worldwide. In 2007 world production of wheat was 607 million tons, making it the third most-produced cereal after maize (784 million tons) and rice (651 million tons).(FAOSTAT, 2007). Globally, wheat is the leading source of vegetable protein in human food, having higher protein content than either maize (corn) or rice, the other major cereals. In terms of total production tonnages used for food, it is currently second to rice as the main human food crop, and ahead of

maize (corn), after allowing for maize's more extensive use in animal feeds. Raw wheat can be powdered into flour; germinated and dried creating malt; crushed or cut into cracked wheat; parboiled (or steamed), dried, crushed and de-branned into bulgur; or processed into semolina, pasta, or roux. Wheat is a major ingredient in such foods as bread, porridge, crackers, biscuits, Muesli, pancakes, pies, pastries, cakes, cookies, muffins, rolls, doughnuts, gravy, boza (a fermented beverage), and breakfast cereals (e.g., Wheatena, Cream of Wheat, Shredded Wheat, and Wheaties).Wheat, after rice is one the most important cereal crops in Bangladesh. It has versatile uses in making various human foods, such as bread, biscuits, cakes, sandwich, etc. But the production of wheat in the country is very insufficient to meet the increasing demand for food for the ever-increasing population. Bangladesh had to import a huge quantity of grain food, mainly wheat, to meet the deficit of cereals. In 1989/90 and 1990/91, the average supply of wheat was 2.35 million tons, of which 65% was imported (Ahmed *et al.,* 1996). 100 grams of hard red winter wheat contain about 12.6 grams of protein, 1.5 grams of total fat, 71 grams of carbohydrate (by difference), 12.2 grams of dietary fiber, and 3.2 mg of iron (17% of the daily requirement); the same weight of hard red spring wheat contains about 15.4 grams of protein, 1.9 grams of total fat, 68 grams of carbohydrate (by difference), 12.2 grams of dietary fiber, and 3.6 mg of iron (20% of the daily requirement).(USD,2006).Much of the carbohydrate fraction of wheat is starch. Wheat starch is an important commercial product of wheat, but second in economic value to wheat gluten.(ISI,2008).Physical properties often required for designing the equipments for planting, harvesting and postharvesting operations of seeds.(Karimi,2009). In the design of machines, structures, processing and controls to be used in productions, handling and processing of food and agricultural products, certain physical characteristics and engineering properties of the materials should constitute important and essential engineering data (Mohsenin, 1986). To design a machine for handling, cleaning, conveying, storing and milling, the physical properties of wheat at different moisture contents must be known (Tabatabaeefar, 2003). The objective of current study was to determine some physical properties of wheat and mungbean seeds at 13.42 and 9.20% moisture content.

Material and Method

Wheat Seeds (Sofabdy variety) were collected from Bangladesh Agricultural Development Corporation Balashpur Mymensingh. Mungbean seeds (BINA-5 variety) were collected from Bangladesh Institute of Nuclear Agriculture Mymensingh and biochemical, physical and antinutrinational properties were analyzed.

The crude fat was estimated by exhaustive extraction with petroleum ether (b.p. 40–60C) using a Soxhlet apparatus (AOAC, 2004). The microKjeldahl method was used for the determination of protein (N x 6.25). The moisture, ash and crude fiber contents were determined by the (AOAC, 2004) methods. The total carbohydrate was obtained by difference (100 – (% moisture + % crude protein + % crude fat + % ash).

Estimation of tannins: Tannins were estimated by Vanillin- HCl method of Price *et al*. (Price et al., 1978). Five gram of defatted seed material was used for extraction of tannins by using acidic methanol. One ml of suitably diluted extract was taken in a test tube and 5 ml of freshly prepared vanillin-HCl reagent was added slowly with mixing and colour developed was read at 500 nm. Catechin standards were run simultaneously along with sample. The results were expressed as mg/100 g dry wt.

Estimation of phytic acid: Phytic acid was estimated by the method of Davies and Reid (Davies, and Reid, 1979). One g of material was ground and extracted with HNO by continuous shaking, filtered and made up to suitable volume with water. To 1.4 ml of the filtrate, 1 ml of ferric ammonium sulphate solution (21.6 mg in 100 ml water) was added, mixed and placed in a boiling water bath for 20 min. The contents were cooled and 5 ml of isoamyl alcohol was added and mixed. To this, 0.1 ml ammonia solution was added, shaken thoroughly and centrifuged at 3000 rpm for 10 min. The alcoholic layer was separated and the colour intensity was read at 465 nm against amyl alcohol blank after 15 min. Sodium phytate standards were run along with the sample. The results were expressed as mg phytic acid/100 g dry wt.

Physical Analysis

Seeds of mungbean and wheat will be analyzed for following physical characteristics.

Seed Weight: One hundred randomly selected seeds of mungbean and wheat will be weighed separately and recorded as 100-seed weight.

Seed Volume: In a graduated cylinder containing water, 20previously weighed seeds of mungbean and wheat will be immersed, and the amount of water displaced will be recorded as volume of seeds in ml. and per seed volume will be calculated as: (Phirke et al,1982) Seed Volume/seed= Volume increased/ No. of seeds.

Seed Density: Seed density will be calculated from the values obtained for weight (g) and volume (g/mL) (Giami and Okwechime, 1993). Seed density = weight of seeds in grames/ Volume of Water.

Bulk Density: Bulk density (BD) will be determined using the method of Wang & Kinsella (1976). Ten g of the seed material of mung bean and wheat will be placed in a 25 ml graduated cylinder and packed by gentle tapping of the cylinder on a bench top ten times from a height of 5–8 cm. The final volume of the test material was recorded and expressed as g/ml. (Narayana and Narasinga, 1984) BD= weight of seeds seeds/ Volume of bulk seed.

Water Absorption Capacity: The water absorption will be determined by soaking 10 g of whole seed beans at room temperature (25 ℃) in a distilled water ratio of 1:5. After 12 h the beans were removed from the soaking water, drained, surface-dried with filter paper, and reweighed. Gain in weight was taken as the amount of water absorbed and expressed as a percentage of initial dry weight of the seeds. (Hincks & Stanley.1986).

Seed Coat Percentage: For the determination of seed coat percentage, the procedure described by (Phirke et al., 1982) as modified by (Giami & Okwechime, 1993) will be followed. Fifty seeds of each mungbean and wheat weighed and soaked in 100 ml distilled water for 1 hour at room temperature (28• 1) The seed coats will be removed manually, drained on filter paper, weighed wet and re-weighed after drying to constant weight (60 - 24 hours) by the air oven method (AOAC, 2000).The final weight will be expressed as a percentage of total initial seed weight.

Leached Solids of Seed:Leached solids capacity will be determined using a modification of the method described by (Akinyele et al., 1986).Ten gram pre weighted dry seeds of mung bean and wheat will be soaked in 50 ml distilled water for 12 hours at room temperature. Seeds will be drained from water and will be dried till constant weight. The loss in weight will be leached soils from seeds.

Statistical Analysis: Results are presented as mean values and standard deviations. Data were subjected to analysis of variance (ANOVA) where applicable.

Results and Discussion

Legumes and cereals are commonly used as a source of protein and carbohydrates in the human diet in Bangladesh as well as in many other countries. The mean and standard deviations of wheat and mungbean determination of the physical properties are presented in Table 1. 100 seed weight of wheat (4.373 +.0967) and mungbean (3.809±.0828). Seed volume recorded wheat was (0.0100±.00) and mungbean (0.00500±.00). Mungbean has higher seed density (7.910±.0200) than wheat (4.420±.0200). Bulk density was more for wheat (0.189±.0100) than mungbean (0.182±.0100). Bulk density can indicate the degree of kernel filling during growth and therefore an indicator of quality and predicated in breakage susceptibility and hardness studies, milling and baking qualities (Chang, 1988) Kernel and bulk density have been used in research on determining the dielectric properties of cereal grains (Nelson and You, 1989). Water absorbance capacity value was higher for mungbean (109.890±.05) than wheat has (46.600±.05). Mungbean has high value (22.760±.04) for seed coat percentage than wheat (10.310±03). Leached was more in wheat grain (12.250±.03) than mungbean (9.370±.03) this shows that mungbean has less water soluble proteins than wheat. Wheat hardness has the greatest influence on the grinding, especially in the wheat milling process. Millers can find real problems when they attempt to grind very soft wheat on a mill designed for harder wheat or they attempt to make hard wheat flour on a mill designed for softer wheat. The differences between soft wheat flour milling and hard wheat flour milling concern the conditioning, grinding and sifting (Posner, Hibbs 1997). Hard wheat cultivars, especially durum wheat cultivars require more power to grind the grain than soft wheat cultivars (Kilborn et al. 1982, Dziki and Laskowski 2000). The results on the proximate analysis of the wheat and mungbean seeds are presented in Table 2. The moisture for wheat seed (13.42 ±.030), protein (12.23 ±.030), crude fat (1.63 ±.0200), ash (1.52 ±.0200) crude fiber (1.43 ±.0115) and Carbohydrate (69.76 ±.1006). The results of the proximate analysis of the mungbean seeds are moisture for wheat seed (13.42 ±.030), protein (12.23 ±.030), crude fat (1.63 ±.0200), ash (1.52 ±.0200) crude fiber (1.43 ±.0115) and Carbohydrate (69.76 ±.1006). The results of the proximate analysis of the mungbean seeds are moisture for wheat seed (13.42 ±.030), protein (12.23 ±.030), crude fat (1.63 ±.0200), ash (1.52 ±.0200) crude fiber (1.43 ±.0115) and Carbohydrate (69.76 ±.1006). Mungbean protein is easily digestible.

Table 1: Physical Property of Wheat and Mungbean Seed

Sr. No	Physical Properties	Wheat	Mungbean
1	Weight of 100 seeds (g)	4.373 ±.0967	3.809±.0828
2	Seed volume mL/seed	0.0100±.000	0.00500±.0000
3	Seed Density g/ml	4.420±.0200	7.910±.0200
4	Bulk Density g/ cm^{-3}	0.189±.0100	0.182±.0100
5	Water absorbent Capacity (%)	46.600±.0500	109.890±.0500
6	Seed coat Percentage (%)	10.310±0300	22.760±.0400
7	Leached loss (%)	12.250±.0300	9.370±.0300

It has a chemical score of 32% limited by sulfur-containing amino acids. Rat-feeding experiments demonstrated that the protein efficiency ratio (PER) of a mixed diet of mungbean (25%) and rice (75%) could be enhanced from 1.7 to 2.6 through methionine and lysine enrichment (Tsou and Hsu 1978). Improvement of the protein quality of mungbean is desired to make it a more effective protein source to supplement cereal and rice. Anti-nutrients are chemical substances in food that do not offer nourishment to the body. *e.g*. phytic acid and tannins . The effect of these antinutrients in the body depends on the type and the concentration in which it is present in the food material. Results regarding antinational content showed that phytic acid content more in mungbean (635.0 +5.0) than wheat (533.0 +5.0) tannin content was also high in mungbean (452.66 ±7.637) than wheat (353.0 +5.0). Tannins inhibit the digestibility of protein and phytic acid reduces the bioavailability of some essential minerals (Duhan et al., 1989; Van der Poel, 1990).

Table – 2: Biochemical Analysis Wheat and Mungbean Seed

Sr. No.	Name of Components %	Wheat	Mungbean
1	Moisture (%)	13.42 ±.030	9.2000 ±.2000
2	Proteins (%)	12.23 ±.030	25.430± 0.30
3	Fat (%)	1.63 ±.0200	1.5300 ±.0300
4	Ash (%)	1.52 ±.0200	3.2200 ±.2000
5	Fiber (%)	1.43 ±.0115	2.2200 ±.2000
6	Nitrogen free extracts (Carbohydrate) (%)	69.76 ±.1006	58.400 ±0.300
Antinutrinational Factors			
1	Phytic acid mg/ 100g	533.0 ±5.000	635.0 ±5.000
2	Tannin mg/ 100g	353.0 ±5.000	452.66 ±7.637

Conclusion: The various properties measured will serve as a useful tool in process and equipment design and this will go a long way in assisting to improve yield and quality of wheat grains. The following conclusions are drawn from this investigation into the properties of wheat and mungbean grains. It was concluded that both wheat and mungbean from Bangladesh suitable for industrial processing

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