STUDY ON NUTRITIONAL CONSTITUENTS AND PREPARATION OF BISCUITS USING MAT-PE FROM TAUNGOO UNIVERSITY CAMPUS

Nay Mar Soe[1], Myint Ngwe[2], Thet Thet Htwe[3]

ABSTRACT

This research paper deals with investigation on nutritional constituents in black gram (MatPe) and its application for food. Black gram sample was collected from Taungoo University Campus, Bago Region. The percent composition of the nutritional values of black gram was determined by AOAC method. According to the results, protein content, fat content, fiber content and carbohydrate content were observed 22.44%, 1.91%, 0.79% and 60.82% as nutrients in the sample. Total energy value was also calculated. Total observed energy value was 350.23kcal/100g. Preliminary phytochemical tests on the black gram sample showed the positive results of alkaloids, α-amino acids, cyanogenic glycosides, carbohydrates, glycosides, phenolic compounds, starch, saponins and tannins. The qualitative determination of minerals (Fe, Ca, Mg, Hg, Cd and Pb) was conducted by Atomic Absorption Spectroscopy (AAS) method. Fe (0.125ppm) Ca (7.290ppm) Mg (4.180ppm) Cd (0.009ppm) were observed and Hg and Pb were not detected. Vitamin A content in this sample was determined by UV-visible spectrophotometric method. It was found to be 0.061mg/100g. Vitamin C content (4.84 mg/100g) in this sample was determined by iodine titration method. The content of aflatoxin was identified by TLC and subsequent investigation under UV radiation. In black gram, aflatoxins B_2, G_1, and G_2 were not present in sample. Aflatoxin B_1 contained 4.434ppb. The hydrogen cyanide content was determined by titration method. From the observation, hydrogen cyanide which contain in black gram does not indicate harmful. Finally, the nutritional values of homemade biscuits which were made from black gram and flour were compared to studied.

Key words : black gram, nutritional constituents, phytochemical tests, AAS

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1. Dr, Professor, Department of Chemistry, Taungoo University

2. Dr, Professor, Department of Chemistry, Taungyi University

3. Dr, Lecturer, Department of Chemistry, Dagon University

INTRODUCTION

Black gram can be grown under low moisture and fertility conditions. It has high nutritive value and consist high content of proteins, vitamins and minerals. Black gram was most probably domesticated in India from its wild ancestral type, which is also found in Bangladesh, Pakistan and Myanmar. At present black gram cultivation is major importance in India only, but it is also grown to some extent throughout tropical Asia .Black gram is traditionally grown as a second crop after the harvest of monsoon rice in lower Myanmar. The major black gram producing regions are Ayeyarwaddy and Bago Regions. Black gram has not only high demand in the international market but also domestic use as a source of protein.

Black gram is a rich protein food. According to literature, it contains about 26 percent protein, which is almost three times that of cereals. Black gram compliments the essential amino acids provided in most cereals and plays an important role in the diets .Black gram supplies a major share of protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse, which is an essential supplement of cereal based diet. In addition, being an important source of human food and animal feed, it also plays an important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen. Being a drought resistant crop, it is suitable for dry land farming and predominantly used as an intercrop with other crops. At this present work, nutritional values, phytochemical test, vitamins, some minerals, aflatoxin and hydrogen cyanide which contain in the black gram seeds were studied. The comparison of nutritional values of biscuits which made black gram and flour were also studied.

Botanical Aspects of Black Gram

Botanical Name -*Vigna mungo* L. Hepper

Family Name -Fabaceae

Myanmar Name -MatPe

English Name -Black Gram

Distribution -India, Bangladesh, Pakistan and all over South - East Asia

It is an erect, suberect or trailing, densely hairy, annual herb. The tap root produces a branched root system with smooth, rounded nodules. The pods are narrow, cylindrical and up to six cm long. The plant grows 30–100 cm with large hairy leaves and 4–6 cm seed pods. Black Gram bears a sheen black color skin. Beneath the skin is a whitish portion which is oval in shape. The slender pods of black gram reach to a maximum height 6 cm. Black gram is cylindrical and vertical in shape. These pulses have a thick black shell which covers the whitish velvety interiors. These nutritious pulses have a very strong earthy flavor. Enriched with a smooth polished outer texture, black gram is a composed of a whitish creamy bland juice at its base.

Uses of Black Gram

Black gram seeds are eaten as a pulse, direct or in various preparations (whole or split, boiled or roasted, ground into flour for cake, bread or porridge). It is with the flour of black gram that in India the flat biscuits 'papadum' are made. Seed sprouts are also consumed. Green pods are eaten as a cooked vegetable. Small quantities of the pods and foliage are used to supplement cattle feed or as forage. Sometimes black gram is sown as a cover crop and for green manure. The pod walls are fed to cattle. Flour from the seed is used as a substitute for soap, it makes the skin soft and smooth. In traditional medicine, the seed is used for its suppurative, cooling and astringent properties, e.g. pounded and applied as a poultice on abscesses .Black gram treats digestive disorders and is crucial is curing gastric, catarrh, dysentery, dyspepsia and diarrhea. Black gram is well-known for being the excellent source of nutritional fiber which can be helpful inside decreasing the cholesterol degree of body system. Black gram is a nutrious bean and serves as a major ingredient in Indian culinary for preparing a healthy diet. Black gram is rich in sodium, phosphorous, potassium and calcium. Presence of large amounts of iron in black gram helps to boost the human memory. The calories and fats present in black gram prove essential for proper human body growth.


Figure.1 Field of black gram in Taungoo University Campus

MATERIALS AND METHODS

Sample Collection and Preparation

The seeds of black gram (*Vigna mungo* L. Hepper)were collected from Taungoo University Campus, Bago Region during March,2013.The seeds were ground with mortar and pestle and incinerated with mesh(100).The powdered samples were stored in air-tight containers to prevent moisture changes and other contaminations. The powdered samples from the seeds of black gram (*Vigna mango* L. Hepper) were used in this study.

Determination of Nutritional Values of Black Gram

The nutritional values of fiber content were determined at Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI), Yangon. The moisture content, ash content, fat content, fibre content and protein content were determined by AOAC method.

Preliminary Phytochemical Investigation for Black Gram by Test Tube Method

In order to find out the types of phyto organic constituents such as alkaloids, ∝-amino acids, cyanogenic glycosides, carbohydrates, glycosides, phenolic compounds, starch, saponins and tannins present in the black gram. Preliminary phytochemical tests were carried out according to the appropriate reported methods.

Determination of Vitamin content, Mineral content and of Black Gram

The content of vitamin A was determined by UV spectroscopic method and vitamin C present in black gram sample was determined by Titration method. Mineral contents such as (Fe, Ca, Mg, Hg, Cd and Pb) of the black gram sample were determined by using AAS method. Aflatoxin and hydrogen cyanide content were determined by AOAC methods.

RESULTS AND DISCUSSION

Sample Collection

Black gram is traditionally grown as a second crop after the harvest of monsoon rice in lower Myanmar. The major black gram producing regions are Ayeyarwaddy and Bago Regions in Myanmar. In this research, Black gram sample was selected to study. It was collected from Taungoo University Campus, Bago Region.

Determination of Nutritional Values of Black Gram

The percent composition of the nutritional values was determined by AOAC methods. Moisture assays can be one of the most important analyses performed on a food product. The moisture content of black gram sample was found to be 10.9%. Ash refers to the inorganic residue remaining after either ignition or organic matter in a foodstuff. The ash content was

observed to be 3.14% in black gram. Protein is needed in diet to help the body repair cells and make new ones. Protein is used to build muscle and fight infections. Fats are needed to keep cell membranes functioning property, to insulate body organs against shock, to keep body temperature stable and to maintain healthy skin, hair and heart disease. The protein and fat contents were found to be 22.44% and 1.91% respectively. Fiber helps with digestion. It can also reduce colon cancer and diabetes. The fiber content was observed to be 0.79%. Carbohydrates are broken down into sugar during digestion, most of which is used as energy for muscles and as essential fuel for the brain. Carbohydrate content was 60.82% in black gram. Calories give energy which needs them to be able to do work and be active. Energy value of black gram was found to be 350.23kcal/100g.

These observed data values nearly agreed with the reported values. The nutritional values of black gram sample are high especially in carbohydrate and protein contents according to these results. These data are shown in Table 1 and Table 2.

Table 1: Nutritional Values of Black Gram

No.	Parameters	Contents (%)	Reported Value*(%)
1	Moisture	10.90	10.90
2	Ash	3.14	3.22
3	Protein	22.44	24.01
4	Fat	1.91	1.41
5	Fiber	0.79	0.92
6	Carbohydrate	60.82	54.60

* Best – home– remedies, 2011

Table 2 : Energy Value of Black Gram

Sample	Energy (kcal/100g)
Black gram	350.23

Preliminary Phytochemical Tests of Black Gram

Phytochemical constituents are bioactive, naturally occurring plant compounds found in vegetables, fruits and seeds. In this paper, preliminary phytochemical constituents were investigated by test tube method. It revealed the presence of alkaloids, α-amino acids, cyanogenic glycosides, carbohydrates, glycosides, phenolic compounds, starch, saponins and tannins. These results are shown in Table3.

Table 3: Preliminary Phytochemical Investigation of Black Gram by Test Tube Method

No.	Constituent	Extract	Reagent	Observation	Results
1	Alkaloids	1%HCl	(i) Mayer's reagent	white ppt.	+
			(ii) Dragendorff's reagent	orange ppt.	+
			(iii) Wagner's reagent	reddish ppt.	+
			(iv) Sodium Picirate sol^{n}	yellow ppt.	+
2	α - Amino acid	H_2O	Ninhydrin	pink colour	+
3	Cyanogenic Glycosides	H_2O	Sodium picrate sol^{n}	brick-red colour	+

4	Carbohydrates	H_2O	10% α –naphthol + conc: S /A	brown ring	+
5	Glycosides	H_2O	10%lead acetate	whiteppt.	+
6	Organic acid	H_2O	Bromocresol green	no colour	-
7	Phenolic Compounds	EtOH	1% $FeCl_3$	dark blue colour	+
8	Reducing sugars	H_2O	Fehling sol^{n} A and B	no ppt.	-
9	Starch	H_2O	Iodine	blue colour	+
10	Saponins	H_2O	Distilled water	frothing	+
11	Steroids	PE	Acetic anhydride +conc: S/A	no colour	-
12	Tannins	EtOH	2%gelatin	white ppt.	+
13	Terpenoids	$CHCl_3$	Acetic anhydride +conc:S/A	no ppt.	-

(+) = present (-) = absent ppt = precipitate

Determination of Vitamin A Content in Black Gram

The content of vitamin A in black gram sample was determined by UV-visible spectrophotometric method. It was found to be 0.061mg/100g. Vitamin A is a group of unsaturated nutritional organic compounds. It helps to maintain healthy skin, hair and mucus membranes. It is also needed for the formation of some hormones and for cholesterol synthesis. The experimental data value was nearly agreement with the reported value. This result was shown in Table 4.

Table 4: Vitamin A Content in Black Gram

No.	Vitamin A (mg / 100g)	Mean Value	Reported value* (mg / 100g)
1.	0.0618	0.0610 ± 0.0002	0.0684
2.	0.0617		
3.	0.0620		

* Best – home –remedies, 2011

Determination of Vitamin C Content in Black Gram

Vitamin C is an essential nutrient for humans and certain other animal species. Vitamin C helps in maintaining a healthy immune system. Low level of vitamin C causes gallbladder disease, hypertension and cancer. The content of vitamin C in this sample was determined by iodine titration method. It was found to be 4.84 mg/100g. This value was found to be identical with the reported value. This result was shown in Table 5.

Table 5: Vitamin C Content in Black Gram

No.	Vitamin C (mg/ 100g)	Mean Value	Reported value* (mg / 100g)
1	4.84	4.84 ± 0.01	4.80
2	4.83		
3	4.84		

* Best – home- remedies, 2011

Determination of Some Mineral Contents by using AAS Method

Fe, Ca, Mg, Hg, Cd and Pb contents in black gram sample were determined by AAS method and were obtained 0.125ppm, 7.290ppm, 4.180ppm, ND, 0.009 ppm and ND respectively. Decreasing order of mineral contents were Ca, Mg, Fe and Cd in black gram sample. Ca help the body perform numerous functions, such as building strong bones, transmitting nerve impulses, making hormones and maintaining a regular heartbeat. Mg plays a role in the active transport of calcium and potassium ions across cell membranes, a process that is important to nerve impulse conduction, muscle contraction and normal heart rhythm. In black gram, Ca and Mg amount are higher than other minerals. These observed results were shown in Table 6.

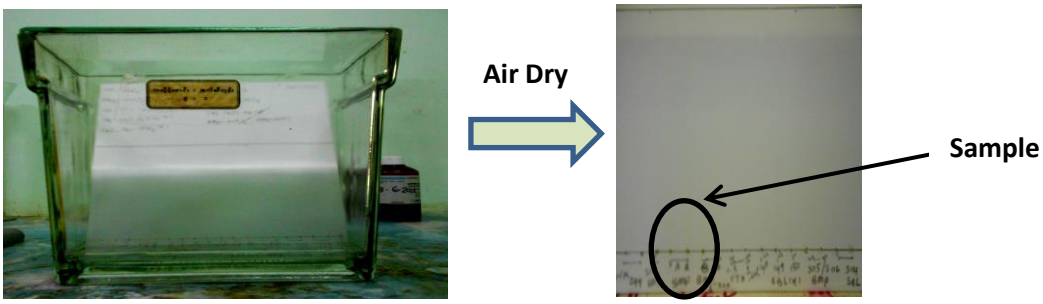
Table 6: Mineral Contents in Black Gram by AAS Method

No.	Minerals	Contents (ppm)
1	Fe	0.125
2	Ca	7.290
3	Mg	4.180
4	Hg	ND
5	Cd	0.0096
6	Pb	ND

ND = Not Detected

Extraction and Identification of Aflatoxin by TLC and Subsequent Investigation under UV Radiation

Aspergillus is a common mold in tropical and sub tropical countries, it was found to cause aflatoxin contamination as a result of molding of badly stored commodities, such as groundnuts, cereal seeds, cotton and a wide range of nuts, seeds, cereals and other agricultural products.Aflatoxin is a naturally occurring mycotoxin produced by two types of mold: *Aspergillus flavus* and *Aspergillu sparasiticus*. Aflatoxin is a potent human carcinogen. It is a naturally occurring toxic metabolite. The occurrence of aflatoxins is influenced by the weather, (temp and humidity-warm and wet is worst); so the extent of contamination will vary with geographic location, agricultural and economic practices and the suspect of the peanuts (etc.) to fungus before they are harvested, and during storage, or processing periods. Analysis for aflatoxins contamination in black gram was studied during storage time for six month. According to observation, aflatoxins B_2, G_1, and G_2 were not present in sample. Aflatoxin B_1 contained 4.434ppb.So, this value does not indicate harmful levels of aflatoxin and it means that the potential for aflatoxin production does not present. These results are shown in Figure 2,3 and in Table 7.



Solvent system = CH_2Cl_2 : acetone : n-hexane (85 : 15 : 20)

Figure 2 Extraction of aflatoxin by TLC

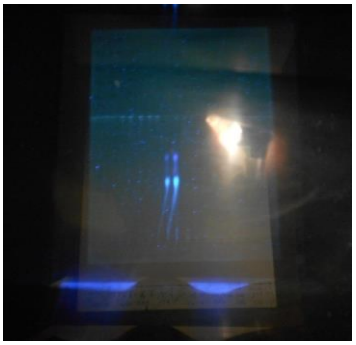


Figure 3 Aflatoxins in TLC plate under UV light

Table 7 Analysis for Aflatoxins Contamination in Black Gram (Storage time = six month)

Sample	Aflatoxins	Contents (ppb)
Black Gram	B_1	4.434
(MatPe)	B_2	ND
	G_1	ND
	G_2	ND

ppb = parts per billion
ND = Not Detected

Determination of Hydrogen Cyanide

The effect of hydrogen cyanide will depend on the concentration of exposure, length of time and way the person is exposed. It is extremely poisonous, because it binds irreversibly to the iron atom in hemoglobin, making it unavailable to transport the vital oxygen the body's cells and tissues. It also interferes with ATP (adenosine tri- phosphate) the main energy storage molecule in the body. Hydrogen cyanide acts as cellular asphyxiant. By binding to mitochondrial cytochrome oxidase, it prevents the utilization of oxygen in cellular metabolism. Hydrogen Cyanide content in Black Gram was determined during storage time within six month. From the results, hydrogen cyanide content was less than (10 mg /100g) safe enough to consumption. Therefore, hydrogen cyanide which contain in black gram does not always indicate harmful. This result is shown in Table 8.

Table 8 Hydrogen Cyanide Content in Black Gram (Storage time = six month)

Sample	Content (mg/100g)
Black Gram (Mat-Pe)	2.16

Comparison between Nutritional Values of Homemade Biscuits of Black Gram and Flour

Black gram and flour samples were prepared for homemade biscuits and nutritional values of two homemade biscuits were compared to study in this research. Homemade biscuits of black gram and flour were shown in Figure 4.

Nutritional values of some homemade biscuits of black gram and flour were determined by AOAC method. The moisture contents of black gram and flour biscuits were found to be 10.75%, 9.45% and the ash contents were observed to be 0.92% and 0.38% respectively. From this comparison moisture and ash contents of black gram biscuits are more than flour. The protein contents of black gram and flour biscuits were found to be 8.88%, 3.05% and the fiber contents of two samples were observed to be 0.42% and 0.01% respectively. From this observation, protein and fiber contents of black gram biscuits are much more than flour. The fat, carbohydrate and energy contents of black gram biscuits were observed to be 1.24%,

77.79% and 357.84kcal/100g and that of flour biscuits were 1.31%, 85.80% and 367.19kcal/100g.These results are shown in Table 9 and Table 10.

Figure 4 Homemade biscuits of black gram and flour

Table 9 Nutritional Values of Homemade Biscuits of Black Gram and Flour

No.	Parameter	Contents (%)	
		Black Gram Biscuits	Flour Biscuits
1	Moisture	10.75	9.45
2	Ash	0.92	0.38
3	Protein	8.88	3.05
4	Fat	1.24	1.31
5	Fiber	0.42	0.01
6	Carbohydrate	77.79	85.80

Table 10 Energy Value of Black Gram and Flour

No.	Parameter	Black Gram Biscuits	Flour Biscuits
1	Energy values (kcal/100g)	357.84	367.19

CONCLUSION

The percent composition of the nutritional values indicated the presence of moisture, ash, protein, fat and fiber. The moisture content of black gram sample was determined by oven-drying method and found to be 10.95%.The ash content of black gram sample was determined by ashing method and found to be 3.14%.Protein content, fat content, fiber content and carbohydrate content were observed as 22.44%, 1.91%, 0.79% and 60.82% respectively. Total energy value was observed to be 350.23kcal/100g.Nutritional values of black gram sample are high especially in carbohydrate and protein contents.

Preliminary phytochemical investigation of black gram sample revealed presence of alkaloids, α-amino acids, cyanogenic glycosides, carbohydrates, glycosides, phenolic compounds, starch, saponins and tannins.

The content of vitamin A (0.061mg/100g) in this sample was determined by UV-visible spectrophotometric method. Vitamin C content (4.84 mg/100g) in this sample was determined by iodine titration method. Vitamins A and C help to carry out chemical changes within cells. Most vitamins are needed by a human body in a very small amount for the growth and maintenance.

Fe, Ca, Mg, Hg, Cd and Pb contents in black gram sample were determined by AAS method and were obtained 0.125ppm, 7.29ppm, 4.18ppm, ND, 0.009ppm and ND respectively. This finding indicated that the black gram contains high contents of protein, carbohydrate, Ca, Mg, vitamin A and vitamin C. So, it is a nutritious food.

Aflatoxin content in black gram sample identified by TLC and subsequent investigation under UV radiation was found to be 4.434 ppb. At high enough exposure level (20 ppb), aflatoxin can cause acute toxicity, and potentially death, in mammals, birds and fish as well as in humans. Hydrogen cyanide content in black gram sample determined by titration method

was observed to be 2.16 mg/100g.Hydrogen cyanide content was less than (10 mg / 100g) safe enough to consumption.

Nutritional values of some homemade biscuits of black gram and flour were determined by AOAC method. The moisture contents of black gram and flour biscuits were found to be 10.75%, 9.45% and the ash contents were observed to be 0.92% and 0.38% respectively. The protein contents of black gram and flour biscuits were found to be 8.88%, 3.05% and the fiber contents of black gram and flour biscuits were observed to be 0.42% and 0.01%. According to observation the resultant values of two samples are not quite different. Therefore, black gram sample can be replaced in the food which flour is prepared.

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