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EFFECT OF MOISTURE CONTENT ON NUTRITIONAL AND ANTI-NUTRITIONAL COMPOSITIONS OF MUCUNA SEED *(Mucuna Pruriens)*

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ABSTRACT The aim of this study was to determine the effect of moisture content on nutritional and anti-nutritional compositions of mucuna seed. The mature seed samples were used for proximate analysis, mineral composition, anti-nutrient, anti-oxidant and physiochemical properties of Mucuna seed at four moisture content levels. The Association of Official Analytical Chemist (AOAC,2002) was used to determine the proximate analysis, while Association of Official Analytical Chemist (AOAC,1984) was used to determine the anti-nutrient, anti-oxidant activity for 1,1-diphenyl-2-picryllydrazyl (DPPH) was estimated according to Baraca,2003, ferric ion reducing anti-oxidant power assay (FRAP) was estimated according to the method of Oyaizu, cupric ion reducing capacity assay (CUPRAC) was estimated in accordance to the method of Apal. Mineral analysis was determined using Jenway 6100 Atomic Absorption Spectrophotometer. The physical properties which were also analysed are mass, density, hydration capacity, hydration index, swelling capacity, swelling index. The four moisture content levels of the Mucuna seed indicates, ranging from 15% to 30% moisture content level, crude fibre (12.07%-12.34%), ash remains constant (5.01%), crude lipid (3.11%-3.50%), crude protein (24.91%-23.91), carbohydrate (54.9%-55.2%), caloric value (347.21Kcal/100g-348.12Kcal/100g). The minerals composition ranging from 15% to 30% moisture content level gave the data that mucuna seeds contained calcium (Ca) (5.28mg/g-5.30mg/g), iron (Fe) (0.96mg/g-0.97mg/g), potassium (K) (0.19mg/g-1.55mg/g), magnesium (Mg) (1.65mg/g-1.68mg/g), phosphorus (P) remains constant (0.02mg/g), zinc (Zn) (0.26mg/g-0.27mg/g). Anti-nutrient ranging from 15% to 30% moisture content level, hydrogen cyanide (HCN) (0.23mg/g-0.26mg/g), oxalate (Ox) 0.033mg/g-0.037mg/g), phytate (P) (0.81mg/g-0.63mg/g), tannin (Ta) (1.51mg/g-1.50mg/g). Anti-oxidant ranging from 15% to 30% moisture content level, 1,1-diphenyl-2-picryllydrazyl (DPPH) (0.57%-0.95%), cupric ion reducing capacity assay (CUPRAC) (1.09%-0.31%), ferric ion reducing anti-oxidant power assay (FRAP) (1.27%-1.17%). The result for physiochemical properties of the Mucuna seed showed that the mass of 34 seeds (253.78g), density of 34 seeds (0.829g/m^3), hydration capacity of 34 seeds (0.877kJ/m), hydration index (0.00346), swelling capacity of 34 seeds (0.0067g/mm^3), swelling index (0.000886g). This study concluded that the tested Mucuna seed contained highest amount of carbohydrate and lowest amount of fibre,

also it has highest amount of calcium in minerals, lowest amount of oxalate and highest amount of ferric ion reducing anti-oxidant power assay in anti-oxidant.

Keywords: Moisture Content, Nutritional, Compositions of Mucuna Seed

INTRODUCTION

Oil crops and their products have become very popular in the world today. Mucuna pruriens which belongs to the family of Fabaceae is an oil crop which has not been sufficiently put into use (Rajeshwar et al., 2005). It is commonly known as cowhage, velvet bean, cowitch, lacuna bean and fogarate. In south eastern Nigeria, it is known as "Agbala" while in the western parts of Nigeria, it is referred to as "Werepe" (demon seed). A major characteristic of this plant is its ability to cause extreme itchiness when touched. (Rajeshwar *et al*., 2005). The pods contain seeds that are black or white. Mucuna pruriens is traditionally used as food, feeds and in pharmaceuticals (Sridhar and Bhat, 2007). The pods and leaves are also used as vegetables in some ethnic groups in Nigeria (Adebowale and Lawal, 2003). Some rural communities in Enugu state consume the seeds during famine or scarcity of food (Onweluzo and Eilitta, 2003). The seeds of M. pruriens are also used as soup thickeners (Ukachukwu *et al*., 2002).

Figure 1: Mucuna Bean seeds (*image source: https://slowfoodnation.org/mucuna-pruriens/)*

Mucuna pruriens is an excellent cover crop and soil improver. In addition, it commonly produces 200 to 600kg of seeds per hectare which are very rich in protein.

However, the regular use of velvet beans for soil fertility enhancement is hampered by the lack of appropriate processing techniques of the seeds. Velvet beans have a long history of traditional use in Brazil and India as an aphrodisiac. Clinical studies in India have validated that the plant does indeed have aphrodisiac activities. Velvet bean is an annual climbing vine that grows 3-18m in height. It is indigenous to tropical regions, especially African, Indian and the West Indies. Its flowers are white to dark purple and hang in long clusters. The plant also produces clusters of pods which contain seeds known as M*ucuna* beans. The species name "*pruriens" (*from the latin, "itching sensation") refers to the result of itching when someone comes in contact with seed pod hairs (Shree, 2011).

Despite its potential, velvet bean is poorly adopted in agricultural systems due to the presence of anti-nutritional compounds which lower the nutrient value of grain legumes, reduce food intake and nutrient utilization in animals. Therefore, upon these reasons, the study of this research work became necessitated (Capo-chichi *et al.,* 2003).

MATERIALS AND METHOD

Materials

A large quantity of the seeds were obtained from local markets within Uyo, Akwa Ibom State, Nigeria. The seeds were manually cleaned to remove foreign matter, dust, dirt, broken and immature seeds. Sulphuric acid (H_2SO_4), copper sulphate ($CUSO_4$), sodium sulphate (Na_2SO_4), boric acid (H_3BO_3), hexane (C_6H_{14}), sodium hydroxide (NaOH) pellet was used in carrying out the proximate analysis of the samples.

For a successful execution of this research study, the equipment used were: Kjeldahl (soxhlet) apparatus, water bath, electric oven (model PVHB-90G2HA), fume cupboard, milling machine, desiccators, crucibles, Buckner funnel, measuring scale, muffle furnace (by Uhlg, Kern, U.S.A), sifter, JENWAY 6100 Spectrophotometer, Pearson Gallenkamp Flame analyzer, Buch Model 205 Atomic Absorption Spectrophotometer.

Methodology

Hundreds of sample were randomly selected for all experiments. Experiments were conducted at the Food and Agricultural Engineering laboratory, University of Uyo, Uyo, Akwa Ibom State, Nigeria.

Proximate Composition Analysis

The freshly prepared samples were immediately subjected to proximate nutrient composition analysis and components analyzed were moisture content, ash, protein, fat and carbohydrate. This was done in line with the standards of Association of Official Analytical Chemists.

Preparation of Samples

The seeds were cracked and the kernels obtained were subjected to different moisture levels prior to the analysis.

The sample were prepared to four (4) moisture content levels. The initial moisture content of the sample was determined by oven drying method at 105^0C until a constant weight was reached. The samples of desired moisture content were prepared by adding calculated amount of water, thoroughly mixed and sealed in separate polythene bags. The samples were kept in a refrigerator for at least seven days at temperature of 5±2^{o}C to enable the uniform distribution of moisture throughout the samples. The required quantities of the seed were allowed to warm at room temperature prior to each test (Aghkani *et al*, 2012). The quantity of water added was estimated from the equation used by (Hojat *et al*, 2009).

$$Q = \frac{\mathrm{W(Mf-Mi)}}{100-\mathrm{Mf}} \qquad (1)$$

where Q = the quantity of water added (g)

W = the initial weight of the sample (g), Mi = the initial moisture content of the sample (%db)

Mf = desired moisture content of the sample (%db), Mass for A = 5.011g

Mass for B = 5.071g

Determination of Moisture Content:

The sample weighed (W_1) were heated in an oven at 105^{o}C for 24hrs and cooled in a desiccator for 15 minutes then weighed, (W_2). The crucible was then returned into the oven and weighed after 3 hrs for many times as possible until a constant value was

obtained. The difference in mass was calculated as percentage (%) moisture content using Equation 2.

$$\%\ moisture\ content = \frac{W_1 - W_2}{W_1} \times\ 100\ (dry\ basis) \qquad (2)$$

where; W_1 = initial weight of the ground sample, W_2 = weight of dried sample

Determination of Crude Protein Content

The Kjeldahl apparatus was used for the determination of crude protein. One half (0.5 g) gram of the dried sample was weighed and put into a Kjeldahl digestion flask containing 1.5 g of Cu_2SO_4 and 1.5 g of Na_2SO_4 and mixed with 10 ml of concentrated H_2SO_4. The mixture was heated using heating mantle under a fume cupboard to obtain a clear solution. The digest was then transferred to a 100ml volumetric flask and diluted with distilled water to mark. An aliquot of the digest (10 ml) was mixed with equal volume of 45% NaOH solution in a semi-micro kjeldahl distillation apparatus. The mixture was distilled and the distillate collected into 10ml of 2% boric solution containing two (2) drops of mixed indicator (methyl red and blue). The distillate was collected and titrated against 0.1M HCl solution. A blank experiment was set up involving digestion of all the materials except the sample. The titre value of the HCl was obtained when the colour of the digest changes. The difference obtained was used to calculate the crude protein. The percent nitrogen content was calculated using Equation 3.

$$\%\ nitrogen\ content = \frac{0.14\ \times titre\ value\ (sample)}{weight\ of\ the\ sample} \qquad (3)$$

$$\%\ protein = \%\ Nitrogen\ \times\ 6.2 \qquad (4)$$

Determination of Crude Fat Content:

This was done according to the method described by Janardharian and Lakshmanan, (1986). Fat analysis was performed using a soxhlet extractor. The apparatus consists of an extraction unit and a control unit. 5g of the sample to be analyzed would be weighed, wrapped in a filter paper. It was then placed in the thimble and inserted in the extraction unit. 80 ml of hexane solvent would be put into the extraction unit and the thimble would be closed. The thimble would be placed on an electric heating mantle to

heat the sample with extraction solvent. The 4-step extraction procedure consisting of boiling, rinsing, recovery, and pre-drying was carefully observed. Empty beaker was cleaned, dried in an oven, and cooled in the desiccator before weighing (W_1). After extraction, the solvent remnant was poured into the beaker and weighed again as (W_2). The beaker was placed in a water bath for the solvent to evaporate from the fat residue. The beaker and its contents would be cooled in a desiccator and weighed (W_3). The percentage fat content was calculated using Equation 5.

$$Percentage\ fat\ content = \frac{weight\ of\ fat\ extracted}{weight\ of\ flour\ sample} \times 100 \qquad (5)$$

Determination of Crude Fibre

This was done according to the method outlined by Association of Official Analytical Chemists (AOAC). 0.15g of the sample would be weighed and digested with 10ml of 1.25% H_2SO_4 solution under reflux for 30 minutes boiling. The digest was then allowed to cool and then filtered with Buckner funnel equipped with muslin cloth. The residue was washed thrice with hot water, scooped into a conical flask and digested with 200ml of 1.25% NaOH solution under reflux for 30 minutes boiling. The digest was cooled, filtered and washed thrice with distilled water. The residue was drained and scooped into the previously dried and weighed crucible and then put into the oven to dry at 105^{o}C to a constant mass. The dish with its content was reweighed after drying and then placed in the muffle furnace to ash at a temperature of 550^{o}C for 3 hours. The ash was carefully withdrawn at the end and put in a bell jar and reweighed. The difference in mass of the sample was used for the calculation of crude fiber and expressed as a percent of the initial mass.

$$Percentage\ crude\ fiber = \frac{W_1 - W_2}{W_0} \times 100 \qquad (6)$$

where; W_1 = Weight of crucible + Fiber + ash, W_2 = Weight of crucible + ash, W_0 = Weight of food sample.

Determination of Ash Content:

This was done following the standard method by Association of Official Analytical Chemist (AOAC, 2002). Two (2) grams of the sample would be weighed into the previously cleaned, dried crucible of known mass. The crucible with the content would be weighed and mass recorded. The crucible with content would then be placed into a muffle furnace at 550^{o}C for 3 hours until the sample turns white and free from carbon. At the end of incineration, the ash substance would be withdrawn and cooled in a crucible and reweighed. The mass of the residual incinerate was then be used to calculate the percentage ash content using Equation 7.

Percentage of carbohydrate

Percentage carbohydrate was calculated by subtracting the sum of lipid, crude protein, fibre and ash from 100. Thus, % Carbohydrate = 100% - (% protein + % fats + % moisture + % ash + % fibre)

Energy calculation:

The percent calories in selected samples was calculated by multiplying the percentage of crude protein and carbohydrate with 4 and crude fat with 9. The values were then converted to calories per 100gm of the sample.

Analyses of Mineral composition

The Mucuna bean seed was analyzed to determine its mineral content. The minerals analyzed were nitrogen, potassium, sodium, calcium and magnesium. Sodium and potassium were determined using Gallenkamp Flame analyzer, while calcium, magnesium, iron, zinc and copper were determined using Buch Model 205 Atomic Absorption Spectrophotometer.

ANTI-NUTRIENTS

Hydrogen Cyanide

Extraction of hydrogen cyanide was done using Wang and filled method. The sample (1g) was ground into paste and dissolved in distilled water (50 ml) using a conical corked flask. The extract was allowed to stay overnight and the filtered solution was used for the cyanide determination.

Alkaline picrate 4ml was added to 1m of the filtrate in a corked testube and incubated in water bath for 15minutes. Reddish colour developed and the absorbance was taken using a spectrometer at 490nm (AOAC, 2002). Also, the absorbance of the blank containing only 1ml distilled water and 4ml alkaline picrate solution was taken and the extrapolation of the cyanide content from the cyanide standard curve

Concentration of hydrogen cyanide is thus as follows;

Determination of oxalate by Titration Method

The oxalate content of the sample was determined using titration method. It involves three general steps which include digestion, precipitation and $KMnO_4$ titration.

Digestion: .5g of the sample was introduced into a 250ml beaker suspended in 95ml of distilled water and 5ml 6N HCl was added to the beaker. The mixture was heated on a water bath at 50^0C for 2 hours. The digestion was filtered and diluted with distilled water to 126ml.

Precipitation: 50ml of the filtrate was placed in a 100ml beaker and drops of methyl red indicator was added which evaporated on eating to 250ml in volume. The sample was filtered to remove the precipitate containing ferrous irons. The filtrates were again treated with 5ml NH_4OH and heated to 90^0C and 10mn of 5% CaCl solution was added and stirred constantly as heat was applied and allowed to cool overnight at 5^0C. the solution was then centrifuged (filtered) at 2500rpm for 5 minutes. The supernatant was decanted and he precipitate were obtained which was washed into a beaker with H_2SO_4 (10ml of 20% v/v) and diluted with 125ml of distilled water.

Titration: The 125ml aliquot solution was heated near boiling point (90^0C) and was titrated against 0.05N standardized $KMnO_4$ solution to a faint pink color which persists for 10seconds.

The calcium oxalate content is calculated using the formular 0.05N $KMnO_4$ = 2.2g Oxalate.

Determination of Tannin

Procedure: 0.2g each of the samples was weighed into beaker and each was soaked with solvent mixture (80ml of acetone and 20ml of glacial acetic acid) for 5hours to extract tannin. The filtrate was removed and the samples were filtered through a double layer

filter paper to obtain the filtrate. A set of standard solution of tannic acid was prepared ranging from 0 to 10ppm. The absorbance of the standard solution as well as that of the filtrate were read at 720nm on a spectrophotometer.

Tannic = Abs x 0.65 x 1000 (8)

where abs = absorbance, 0.065 = slope from the standard curve.

Determination of phytate

Procedure: Phytate was determined using method of Mega 1986. 2g of each sample was weighed. 100ml of 2% concentrated hydrochloric acid was used to soak each sample into conical flask for 6hours and filtered through a double layer of hardened filter paper. 50ml of each filtrate was placed in 250ml beaker and 107ml of distilled water was added in each case to give proper cidity. 10ml of 0.3% ammonium thiocynate solution was titrated with standard iron (110) chloride solution which contain 0.00495g iron per ml. the end point was slightly brownish-yellow which persisted for 5minutes.

%phytate = Y x 1.19 x 100

where; Y = titration x 0.00195

0.00195 = mw of phytic acid, 1.19 = extract constant for phytate.

ANTI-OXIDANT

DPPH Radical Scavenging Assay

The free radical scavenging capacity of the extracts from different plant samples were estimated according to Bressani (2002), with slight modification using the stable DPPH radical which has an absorption maximum at 515nm. A solution of the radical is prepared by dissolving 2.4mg DPPH in 100ml methanol. A test solution (100-500µl) was added to 3.95ml (4ml) of temperature for 30 minute in the dark. Absorbance of the reaction mixture was measured at 515nm spectrophotometric absorbance of the DPPH radical without antioxidant i.e blank was also measured. All the determinations were performed in triplicates. The capacity to scavenge the DPPH radical was calculated using Equation 9.

$$\text{DPPH Scavenged (\%)} = \frac{(AB-AA)}{AB*100} \quad (9)$$

where AB is absorbance of the antioxidant at t = 30 min.

A calibration curve was plotted with % DPPH scavenged versus cone of standard of antioxidant.

Ferric Ion reducing antioxidant power assay (FRAP)

Ferric ion reducing power was measured according to the method of Oyaizu with a slightest modification.

Procedure: Hydroalcoholic extract of the sample in different concentration ranging from 100nl to 500nl were mixed with a 2.5mM phosphate buffer and 2.5ml, 1%, w/v potassium ferric cyanide, and then the mixture was I incubated at 50*c for 30minutes. Afterward, 2.5ml of 10%, w/v trichloroacetic acid and 0.5ml 0.1%, w/v ferric chloride were added to the mixture, which was kept aside for 10min. finally, the absorbance was measured at 700nm. Ascorbic acid was used as positive reference standard. All assays were run in duplicates and averaged.

Cupric ion reducing capacity assay (CUPRAC)

Cupric ion reducing capacity was measured in accordance to the method of Apal.

Procedure

1ml, 10mM cupric chloride, 1ml 7.5mM neocuproine and 1ml, 1M ammonium acetatate buffer of PH 7 solutions were to test tubes containing 2ml of distilled water. Hydroalcoholic extract of the sample in different concentration ranging from 100nl to 500nl were added to each test tube separately. These mixtures were incubated for half an hour at room temperature and measured against blank at 450nm. Ascorbic acid was used as positive reference standard. All methods were repeated in duplicates in order to get a mean value.

Physicochemical Analysis

Density

One hundred seeds of each leguminous was weighed individually. The average weight of a seed (W) was reported in grams. Density (g mL^{-1}) was determined by the ratio of weight of seeds to the volume of displaced water.

$$Density = \frac{weight\ of seeds\ (W)}{volume\ of water\ displaced} \quad (10)$$

Hydration Capacity

In determining hydration capacity, the number of seeds (N_S) in 100g of weighed seeds (W_S) would be determined, and the seeds would be transferred to a test tube containing 100mL of distilled water. The seeds would be soaked at room temperature (25 ± 2 °C). After 15 hours, the seeds were drained; superfluous water was removed with filter paper and the swollen seeds were separated and reweighed.

Hydration capacity was calculated using Equation 11.

$$Hydration\ capacity\ (HC) = \frac{weight\ of\ swollen\ seeds - weight\ of\ seeds}{number\ of\ seeds} \quad (11)$$

Hydration Index

Hydration index was calculated using Equation 12.

$$Hydration\ index\ (HI) = \frac{Hydration\ capacity}{weight\ of\ seeds} \quad (12)$$

In addition, the volume of 100g seeds were measured in a test tube in mL (V_S). After 15 hours in distilled water, the volume of soaked seeds was measured.

Swelling Capacity

Swelling capacity, (SC), per seed was determined as follows:

$$SC\ = \frac{Vol.of\ seeds\ before\ soaking - Vol.of\ seeds\ before\ soaking}{Weight\ of\ seeds} \quad (13)$$

Swelling Index

Swelling index would be determined using Equation 14.

$$Swelling\ index\ (HI) = \frac{Swelling\ capacity}{Vol.of\ seed\ (in\ mL)} \quad (14).$$

Proximate Analysis on Different Moisture Content Level of Mucuna Seed

Table 1 presents the varying of different moisture content level on the proximate analysis of Mucuna seed per 60 grammes. Crude fibre was the highest in the 20% moisture content level sample (12.55%) while it was lowest in 15% moisture content level sample (12.07%). Ash content were all the same in all different moisture content level (5.01%).

Crude lipid increased significantly varying of different of 30% moisture content level sample (3.50%) while it decreased significantly ($p<0.05$) in 20% moisture content level sample (2.97%). The 25% moisture content level sample had the lowest Crude protein (23.09%) but highest in the 20% moisture content sample (25.38%). Total carbohydrate was the highest in 25% moisture content level sample (56.30%) while 20% moisture content level sample was the lowest (54.08%). 30% moisture content level sample (348.12KJ) was the highest while 20% moisture content level sample (346.71KJ) was the lowest.

Table 1: Proximate analysis

Moisture Content (%)	Crude Fibre (%)	Ash Content	Crude Lipid	Crude protein
Sample A (15%)	12.0750 ±0.10607[a]	5.0100±0.01414 *	3.1100±0.00000 *	24.9100±0.01414*
Sample B (20%)	12.5500±0.07071[a]	5.0100±0.01414*	2.9700±0.00000 *	25.3850±0.02121*
Sample C (25%)	12.3500±0.14142 [a]	5.0100±0.01414 *	3.2500±0.00000 *	23.0900±0.07071[a]
Sample D (30%)	12.3288±0.19606 [a]	5.0100±0.01414 *	3.5050±0.06364[a]	23.9100±0.05657*

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determinations.

Table 2: Proximate analysis

Moisture Content (%)	Carbohydrate	Caloric value
Sample A (15%)	54.8950±0.10607 *	347.2100±0.48083 *
Sample B (20%)	54.0850±0.06364 [a]	346.7100±2.63044 [a]
Sample C (25%)	56.3000±0.08485 [a]	346.8100±0.62225 [a]
Sample D (30%)	55.2350±0.20506 [a]	348.1250±0.02121 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determination

Mineral Composition on Different Moisture Content Level of Mucuna Seed

In Table 3 among all the minerals elements analyzed, calcium exhibited the highest value (5.3000mg/g). Calcium is essential for bone and teeth formation and development, blood clothing and for normal functioning of heart, nervous system and muscles. Calcium deficiency can lead to rickels, Oesteomalacia and tooth decay.

Table 3: Minerals composition

Moisture Content (%)	Zn	Ca	K	P
Sample A (15%)	0.2650±0.02121 *	5.2800±0.01414 *	0.1900±0.00000 *	0.0200±0.00000*
Sample B (20%)	0.2550±0.02121 *	5.2800±0.01414*	0.1350±0.00500 *	0.0200±0.00000*
Sample C (25%)	0.2100±0.01414 *	5.2900±0.01414 *	0.1650±0.00500 *	0.0200±0.00000*
Sample D (30%)	0.2500±0.02878 *	5.3000±0.00000 *	0.1550±0.00500*	0.0200±0.00000*

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determination

Table 4: Minerals Composition

Moisture Content (%)	Mg
Sample A (15%)	1.6500±0.04243 *
Sample B (20%)	1.6050±0.00707 *
Sample C (25%)	1.6800±0.01414 *
Sample D (30%)	1.6800±0.01414 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of

significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determination

Anti-Nutrient on Different Moisture Level of Mucuna Seed.

Table 5 presents the various moisture content level of the Mucna seed on the anti-nutrient.. It shows that the various moisture content levels had a greater effect on anti-nutrients and their composition. Hydrogen cyanide was highest in 25% moisture content level sample (0.269mg) while it was lowest in 15% moisture content level sample (0.232mg). Oxalate was the highest in 30% moisture content level sample (0.037mg) while it decreases significantly ($p<0.05$) in 20% moisture content level sample (0.031mg). The 25% moisture content level sample had the lowest Phytate (0.54mg) but highest in the 15% moisture content sample (0.81mg). Tannin was the highest in 15% and 20% moisture content level sample (1.51mg) while 25% and 30% moisture content level sample was the lowest (1.50mg).

Table 5: Anti-nutrient

Moisture Content (%)	HCN	Oxalate	Phytate	Tannin
Sample A (15%)	0.23250±0.000707 *	0.03300±0.002828 *	0.81000±0.000000 *	1.51000±0.014142 *
Sample B (20%)	0.26250±0.002121 *	0.03100±0.000000 *	0.73000±0.000000 *	1.51000±0.014142 *
Sample C (25%)	0.26950±0.000707 *	0.03650±0.002121 *	0.54000±0.000000 *	1.50000±0.000000 *
Sample D (30%)	0.26600±0.022627 *	0.03750±0.002121 *	0.63000±0.000000 *	1.50000±0.000000 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determination.

Anti-Oxidant on Different Moisture Level of Mucuna Seed

Table 6 presents the various moisture content level of the Mucna seed on the anti-oxidant activity. Their anti-oxidant activity was significantly different at 0.05 significant level

among their mean. In DPPH (from 100ml to 500ml) showed that the highest is the 500ml of 30% (0.958mg) while the lowest is 100ml of 15% (0.572mg). In Cuprac (from 100ml to 500ml) showed that the highest is the 500ml of 15% (1.116mg) while the lowest is 100ml of 30% (0.300mg). In Farap (from 100ml to 500ml) showed that the highest is the 500ml of 15% (1.373mg) while the lowest is 100ml of 20% (0.931mg).

Table 6: Anti-oxidant (DPHH)

Moisture Content (%)	100ml	200ml	300ml	400ml
Sample A (15%)	0.5720±0.001411 *	0.61000±0.000000 *	0.62750±0.002121 *	0.62600±0.001414 *
Sample B (20%)	0.7795±0.00495 *	0.78150±0.002121 *	0.79350±0.002121 *	0.79600±0.000000 *
Sample C (25%)	0.8310±0.001411 *	0.84700±0.001414 *	0.85400±0.001414 *	0.85250±0.003536 *
Sample D (30%)	0.9220±0.001411 *	0.90300±0.028284 *	0.94500±0.001414 *	0.95350±0.006364 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determination

Table 7: Anti-oxidant (DPHH)

Moisture Content (%)	500ml
Sample A (15%)	0.68200±0.001414 *
Sample B (20%)	0.79850±0.000707 *
Sample C (25%)	0.86750±0.000707 *
Sample D (30%)	0.95800±0.000000 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determinations.

Table 8: Anti-oxidant (Cuprac)

Moisture Content (%)	100ml	200ml	300ml	400ml
Sample A (15%)	1.09150±0.002121 *	1.10350±0.002121 *	1.10700±0.001414 *	1.10650±0.002121 *
Sample B (20%)	0.77000±0.001414 *	0.77350±0.000707 *	0.78100±0.001414 *	0.78250±0.002121 *
Sample C (25%)	0.43100±0.001414 *	0.44150±0.000707 *	0.44550±0.000707 *	0.44800±0.001414 *
Sample D (30%)	0.30000±0.001414 *	0.31000±0.000000 *	0.31400±0.001414 *	0.31800±0.004141 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determinations.

Table 9: Anti-oxidant (Cuprac)

Moisture Content (%)	500ml
Sample A (15%)	1.11600±0.001414 *
Sample B (20%)	0.79550±0.000707 *
Sample C (25%)	0.48200±0.046669 *
Sample D (30%)	0.31800±0.001414 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determination

Table 10: Anti-oxidant (Farap)

Moisture Content (%)	500ml
Sample A (15%)	1.37350±0.000707 *
Sample B (20%)	1.14400±0.000000 *
Sample C (25%)	1.12550±0.000707 *
Sample D (30%)	1.17050±0.000707 *

Values with asterisk (*) showed significance difference in their mean at 5 % level of significance. Values with same alphabet in the same column did not differ in their mean at 5% level of significance. All values are of means of two determinations.

Physiochemical Analysis

Table 11 shows the density, hydration capacity, hydration index, swelling capacity, swelling index of Mucuna seeds.

Table 11: Physical Properties of Mucuna seed

Properties	Values
Mass of seeds	253.78 g
Density of seeds	0.829 g/m^3
Hydration capacity	0.877 kJ/m
Hydration index	0.00346
Swelling capacity	0.0067 g/mm^3
Swelling index	0.000886

CONCLUSION

The research demonstrated that, there were significance differences among the various moisture content level of Mucuna seed. Decrease in moisture content resulted in low fibre,, lipid, high protein. Carbohydrate and caloric value increases as moisture content increases. Mineral compositon increases as there was a reduction in moisture content except for calcium and magnesium. Anti-nutrient increases as moisture content increases for Hydrogen cyanide and oxalate, but anti-nutrient decreases re content for phytate and tannin. Anti-oxidant activity increases as moisture increases for DPPH while CUPRAC and FRAP reduces as moisture content increase. And it is rich in calcium which helps for bone and teeth formation and development.

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