

# Performance of *Voandzela subterranea* nut rations in Broiler Chicks

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**Abstract:** *Vigna subterranean* also known as ‘Bambara nut’ is an under-utilized leguminous plant that is indigenous to some parts of Nigeria. In this study, Bambara ration was formulated and evaluated for its performance in 2 weeks old boiler chicks for a period of 10 weeks. The mean values of results revealed higher amounts of total protein (11.94%), total fat (22.73%) and carbohydrates (57.96%) than ash (2.16%), moisture content (3.76%) and crude fibre (1.45%) in its proximate composition. Higher amount of magnesium (77.50mg/g), moderate amount of iron (18.08mg/g) and low amounts of sodium (10.13mg/g) and zinc (6.29mg/g) were detected in the crude extract of *Voandzela subterranea* nut. Calcium (3.93mg/g) and cadmium (1.75mg/g) were trace while nickel (0.09mg/g) was almost unavailable. Alkaloids (4.40mg/dl) were in higher amount than other phytochemicals, cardiac glycosides (1.90mg/dl) were the least in concentration. There was a general increase in amounts of TC, LDL-C, TG and atherogenic index in group B fed Bambara nut only while these indices were significantly decreased ( $p>0.01$ ) in group A chicks fed conventional feed only. There was a significant increased in body weight gain in group A (12.20g) while group B (5.40g) showed least gain in body weight. The observed effects of the rations on body temperature were not statistically significant ( $p>0.01$ ). There was no hemorrhage, erosive perforation or ulceration in all the organs (gizzard, lung, heart and gastrointestinal lining) examined in chick groups A and C. However, Bambara nut fed group B showed bleeding of gastrointestinal lining surface. In conclusion, *Voandzela subterranea* nut may serve as a good source of crude fat, protein, magnesium, calcium, sodium and an important antioxidant due to the presence of zinc in its mineral constituent. Safety of consumption depends on concentration and exposure rate due to its bleeding effect on gastrointestinal lining.

**Keywords:** underutilization, ulceration, phytochemical, ration.

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## 1. INTRODUCTION

*Vigna subterranean* also known as Bambara is an underutilized plant; it is a leguminous plant which nut has gained relevance among the Nigerian populace given the prominence accorded its product - *Opaa* as a breakfast meal. *Opaa* is a common local Bambara cake that is mostly hawked in heavy traffic or go slow areas, notable areas that are characterized of such traffic are Mararaba, Masaka and New Nyanya axis in Karu Local Government Area Council of Nasarawa State, Nigeria.

Bambara nut is cultivated in sustainable agricultural systems in sub-saharan Africa and it is primarily grown for its seeds. The legume provides a source of protein in many regions of Africa where it is commonly grown by locals to sustain their families (Mwale *et al.*, 2007). The Bambara groundnut protein composition (16-25%) is highly comparable or superior to other legumes, providing an important supplement to cereal-based diets (Karunaratne *et al.*, 2010).

Aside the food meals from Bambara nut, there are also several benefits that can be attributed to this plant; such as economic, nutritional and pharmaceutical importance. There have been acclaimed uses of *Vigna subterranean* in Nigeria folklore tradition medicine, thus suggesting its health benefits and medicinal properties. According to Ajiboye and Oyejobi (2017),

medicinal plants contain a variety of bioactive compound having healing or therapeutic potential or a medicinal plant is any plant which one or more of its organ contain constituents that can be used for the synthesis of useful drugs. In addition, medicinal plants contain biologically active chemicals constituents or phytochemicals such as saponins, tannins, essential oils, flavonoids, alkaloids and other chemical compounds which have curative properties.

Bambara nuts are used as thickening agents, stabilizers, health ingredients as well as cryoprotectants in frozen dairy products (Maphosa and Jideani, 2015). The studies of Hardly and Jideani (2015) and Nyan *et al.*, (2015) reported that Bambara nut has potential to improve food security through its food products - milk, yoghurt, fibre and for use in the nutraceutical industry and its composition could possibly offer some health benefits.

Much has not been established on medicinal uses of Bambara nut with scientific validation. However according to Molgaard *et al.*, (2011), the traditional utilization of Bambara nut to treat several ailments is notable and therefore, creates an opportunity for detailed scientific study on the pharmaceutical value of the crop.

Bambara nut and its product are commonly consumed in Keffi and its environs in Nasarawa State, Nigeria where the study was carried out thus a dire need to carry out different studies on its potentials for a wide application.

It is therefore the interest of this study to evaluate the performance of *Voandzela substerranea* nut rations in Broiler Chicks

## 2. MATERIALS AND METHODS

### Broiler Chicks

Broiler chicks (30) aged 2 weeks of mean weight  $400.0 \pm 2.1$ g were from Keffi market, Nasarawa State, Nigeria.

### Bambara nut and Commercial Feed

Matured and healthy Bambara nuts (2kg) were obtained from Masaka market, Keffi – Nasarawa state. The commercial feed is obtained from Allwell Poultry Feed Store, Mararaba, Nasarawa State, Nigeria.

### Preparation of Bambara nut sample

The Bambara nuts were cleaned by handpicking dirt and foreign materials; this was followed by washing the nuts thoroughly with potable water. The washed nuts were sundried for 5 days and grinded using mortar and pestle to coarse particles. The grinded samples were passed through a sieve of 250 $\mu$ m mesh size. The particles that passed through the sieve were used to formulate the rations used in the experiment.

### Phytochemical screening

Phytochemical screening: Standard procedures described by Harborne, (1998); Sofowora, (1993) and Mshelia *et al.*, (2007) were used to identify and quantify the phytochemical constituents of *Voandzela substerranea* nut crude extract.

### Determination of mineral content

Mineral: The Atomic Absorption Spectrophotometry (AAS) method of AOAC (1990) was used to determine calcium, magnesium, iron and zinc contents of *Voandzela substerranea* nut while flame photometry method was used to determine the sodium and potassium contents.

### Formulation of Bambara rations

Three different rations were used for the experiment. These include ration 1, this comprised of only commercial feed; ration 2 comprised of only Bambara nut and ration 3 comprised of both commercial feed and Bambara nut sample in equal amount (50%).

### Experimental

The broiler chicks were grouped into three different groups of ten (10) chicks in each group. Formulated rations were administered as given below:

A: group administered commercial feed only

B: group administered bambara nut sample only

C: group administered 50% commercial feed + 50% bambara nut sample

The rations administration was carried out for 10 weeks between August 2<sup>nd</sup> and October 16<sup>th</sup>, 2021 at the animal house behind Research Laboratory Block, Nasarawa State University Keffi – Nigeria. At the end of week 10 rations administration, the following determinations were carried out on the chicks:

Determination of body temperature and weight

Individual chick was monitored for weekly gain in body weight and weekly body temperature using digital electronic balance ( ) and a thermometer ( ) respectively.

Gain in weight was obtained from the relationship given below:

Weekly gain in weight = Final Week Weight – Initial Week Weight

Cytological examination

At the end of tenth week, the chicks were sacrificed and dissected for the presence of blood haemorrhage and ulceration in some organs like heart, gizzard, lung and gastrointestinal lining. The presence of blood clot or burst vein was used to determine haemorrhage while deep erosive perforation was used to determine ulceration.

Preparation of Serum

The procedures described by Yakubu *et al.*, (2010) were used to prepare serum. Blood was collected after slaughtering the chicks in different clean containers. The blood samples were centrifuged at 224 x g for 10 minutes using Uniscope laboratory centrifuge (model SM 800B, Suygfriend medicals, Essex, England). Thereafter, the sera were aspirated with Pasteur pipette into clean, dry, sample bottles and kept frozen overnight before being used for the assays.

Determination of lipid profile

Pardo *et. al.*, 2008

Total cholesterol, triacylglycerol, HDL-cholesterol and LDL-cholesterol concentrations were determined in the sera of experimented Chicks according to the procedures described (Burstein *et. al.*, 1970; Foster and Dunn, 1973; Friedwald *et al.*, 1972; Zlatkis *et al.*, 1953). Atherogenic index TG/LDL-c molar ratio was calculated from the values of TG and LDL-c.

Statistical analysis  
The mean results were calculated and presented as Mean±SEM using Microsoft 2007 excel package. Student's t-test was used to test for significance at 99% confidence level.

### 3. RESULTS AND DISCUSSION

Phytochemicals determined in crude extract of *Voandzela substerranea* nut were presented in Table 1. A total of nine phytochemical were determined, six phytochemicals which were alkaloids, flavonoids, saponins, terpenoids, tannins and cardiac glycosides were detected present while anthraquinones, resins and anthocyanins were absent in *Voandzela substerranea* nut

**Table 1: Phytochemical determined in crude extract of *Voandzela substerranea* nut**

Phytochemical	Detection
Alkaloids	+
Flavonoids	+
Saponins	+
Terpenoids	+
Anthraquinones	-
Tannins	+
Cardiac glycosides	+
Anthocyanins	-
Resins	-

Key: + = present; - = absent.

Concentration of phytochemical detected in the crude extract of *Voandzela substerranea* nut were presented in Table 2. Alkaloids (4.40mg/dl) were in higher amount than other phytochemicals, cardiac glycosides (1.90mg/dl) were the least in concentration. The order of amount of these phytochemicals was alkaloids> saponins > terpenoids = flavonoids > tannins > cardiac glycosides. at  $p>0.01$ , there was a significant difference between the concentration of alkaloids and other phytochemicals. Flavonoids did not differ significantly ( $p>0.01$ ) in concentration from saponins and terpenoids but differ in concentration from tannins and cardiac glycosides.

**Table 2: Concentration of phytochemical detected in crude extract of *Voandzela substerranea* nut**

Phytochemical	Concentration (mg/dl)
Alkaloids	4.4 <sup>a</sup> ±0.01 <sup>a</sup>
Flavonoids	3.30±0.03 <sup>b</sup>
Saponins	3.40 ±0.00 <sup>b</sup>
Terpenoids	3.30±0.01 <sup>b</sup>
Tannins	2.23±0.03 <sup>c</sup>
Cardiac glycosides	1.90±0.01 <sup>d</sup>

Results were mean values of triplicate determinations And were presented as Mean±SEM

Proximate composition of phytochemical detected in the crude extract of *Voandzela substerranea* nut were presented in Table 3. The mean results revealed higher amounts of total protein (11.94%), total fat (22.73%) and carbohydrates (57.96%) than ash (2.16%), moisture content (3.76%) and crude fibre (1.45%). Carbohydrate was the most abundant while crude fibre was the least composition of the proximate. All the proximate indices differed significantly ( $p>0.01$ ) from one another in term of composition.

**Table 3: Proximate composition of *Voandzela substerranea* nut**

Composition	%
Moisture content	3.76±0.01 <sup>d</sup>
Ash content	2.16±0.03 <sup>e</sup>
Crude fibre	1.45±0.03 <sup>f</sup>
Total protein	11.94±1.05 <sup>b</sup>
Total fat	22.73±1.11 <sup>c</sup>
Carbohydrates by difference	57.96±2.62 <sup>a</sup>

Results were mean values of triplicate determinations And were presented as Mean±SEM

Mineral content of crude extract of *Voandzela substerranea* nut were presented in Table 4. The mean results revealed higher amount of magnesium (77.50mg/g), moderate amount of iron (18.08mg/g) and low amounts of sodium (10.13mg/g) and zinc (6.29mg/g) in the crude extract of *Voandzela substerranea* nut. Calcium (3.93mg/g) and cadmium (1.75mg/g) were trace while nickel (0.09mg/g) was almost unavailable. All the minerals differed significantly ( $p>0.01$ ) from one another in term of constituent.

**Table 4: Mineral content of *Voandzela substerranea* nut**

Mineral	Concentration (mg/g)
K	1.64±0.01 <sup>f</sup>
Ca	3.93±0.11 <sup>e</sup>
Mg	77.50±3.33 <sup>a</sup>
Fe	18.08±1.13 <sup>b</sup>
Zn	6.29±0.17 <sup>d</sup>
Ni	0.09±0.00 <sup>g</sup>
Na	10.12±0.31 <sup>c</sup>
Cd	1.69±0.01 <sup>f</sup>

Results were mean values of triplicate determinations And were presented as Mean±SEM

Body temperature and gain in body weight of chicks fed with different rations of *Voandzela substerranea* nut were presented in Table 5. The mean results revealed higher gain in body weight in group A chicks (12.20g) fed with only conventional feed while group B (5.40g) fed with only bambara ration showed least body weight. The ration formulated from 50% each of conventional feed and bambara nut flour showed moderate gain in body weight in group C chicks (10.6g). Gain in body weight was significantly different ( $p>0.01$ ) among all the groups fed with different rations of *Voandzela substerranea* nut.

The observed effects of the rations on body temperature were not statistically significant ( $p>0.01$ ). Difference in body temperature observed in mean values obtained for groups A to C was less than 1°C.

**Table 5: body temperature and gain in body weight of chicks fed with different rations of *Voandzela substerranea* nut**

	Gain in body weight (g)	Body temperature (°C)
A	12.20±0.10 <sup>a</sup>	40.50±0.01 <sup>a</sup>
B	5.40±0.02 <sup>c</sup>	41.00±0.03 <sup>a</sup>
C	10.60±1.02 <sup>b</sup>	40.70±0.01 <sup>a</sup>

Results were mean values of triplicate determinations And were presented as Mean±SEM

The results of cytological examination of organs of chicks fed with different rations of *Voandzela substerranea* nut were presented in Table 6. There was no hemorrhage, erosive perforation or ulceration in all the organs (gizzard, lung, heart and gastrointestinal lining) examined in chick groups A and C. However, bambara nut fed group B showed bleeding of gastrointestinal lining surface.

**Table 6: Cytological examination of organs of chicks fed with different rations of *Voandzela substerranea* nut**

	Gizzard	Lung	Heart	Gastrointestinal lining
A	-	-	-	-
B	-	-	-	+
C	-	-	-	-

- = Absent; + = present.

The results of lipid profile and atherogenic index of chicks fed with different rations of *Voandzela substerranea* nut were presented in Table 7. The mean results revealed higher concentration of TC, LDL-C, TG and atherogenic index in group B chicks fed bambara ration only than other groups A and C. while the indices were generally low in group A chicks fed conventional feed only.

**Table 7: Lipid profile and atherogenic index of chicks fed with different rations of *Voandzela substerranea* nut**

Atherogenic index

Group	Total cholesterol	HDL-C	LDL-C	Triacylglycerol (TG)	TG/LDL-C
A	7.60±0.03 <sup>b</sup>	6.00±0.01 <sup>a</sup>	0.75±0.03 <sup>c</sup>	1.10±0.00 <sup>c</sup>	1.46±0.01 <sup>b</sup>
B	9.80±0.02 <sup>a</sup>	2.70±0.03 <sup>c</sup>	4.32±0.02 <sup>a</sup>	7.90±0.05 <sup>a</sup>	1.73±0.01 <sup>a</sup>
C	8.00±0.00 <sup>b</sup>	3.81±0.01 <sup>b</sup>	2.09±0.01 <sup>b</sup>	3.15±0.01 <sup>b</sup>	1.51±0.03 <sup>b</sup>

Results were mean values of triplicate determinations And were presented as Mean±SEM

Low amounts of phytochemicals in *Voandzela substerranea* nut shows the safety of the fruit from alkaloids and other phytochemicals poison. High fat content of bambara nut is an indication that it is a good source of vegetable oil, and can also be regarded as a good source of protein due to its crude protein content. The higher amount of carbohydrates follows the trend of similar and earlier studies on proximate composition determination. Magnesium activates enzymes involved with body function; iron is Important to oxygen-carrying capacity of the blood and sodium maintains body fluid volume, forms tissue, transmits nerve and contracts muscle. The high amounts of magnesium, iron and sodium in *Voandzela substerranea* nut show its potential in carrying out these metabolic processes.

Low body weight gain in group B fed with only bambara nut may be due to low response of chicks to *Voandzela substerranea* nut ration, in other word adaptation to *Voandzela substerranea* nut inclusion in the diet is gradual and not

total. Non-alteration of the chicks' body temperature suggests the edible acceptability and digestibility of *Voandzela substerranea* nut. The non-ulcerating potential of *Voandzela substerranea* nut may be concentration dependent, lower amount may not be a cause for alarm if adopted in poultry nutrition. Haemorrhage, erosive perforation and ulceration may result from choking effect from consumption of high amount of *Voandzela substerranea* nut. High amounts of all the lipid indices are indication of high lipid profile of the nut; this finding correlates positively with the total fat content in proximate composition in the present study.

#### 4. CONCLUSION

*Voandzela substerranea* nut may serve as a good source of crude fat, protein, magnesium, calcium and sodium. It may also serve as an antioxidant due to the presence of zinc in its mineral constituent. Safety of consumption depends on concentration and exposure rate due to its bleeding effect on gastrointestinal lining.

#### 5. RECOMMENDATIONS

Isolation and purification of bioactive agents and extraction of vegetable oil in order to increase the source of vegetable oil are hereby recommended.

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