

Phytochemicals, Heavy Metal and Proximate Analysis of *Parkia biglobosa* and Three Varieties of Bouillon Cubes (Purchased From Iyana Iba Market, Ojo Local Government Area in Lagos, Nigeria)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Despite the huge nutritional values and availability of local seasonings such as *Parkia biglobosa*, knorr chicken as food seasonings, some developing countries like Nigeria require more information on the needs for increasing their utilization. Analysis was done using standard analytical methods, to compare the nutritional and heavy metal composition of *P. biglobosa* seed and bouillon cubes (Knorr chicken, magi star and Tasty cubes). The specific focus was to find out the proximate analysis (carbohydrate, fat, protein and vitamin), heavy metals, Minerals and phytochemicals composition of *P. biglobosa* and bouillon cubes. Atomic absorption spectrometry was used in the determination of the levels of (Ca, Mg, K, Na, Mn, Fe, Cu and Zn). Phytochemicals, including phytic acid, tannins, carotenoids, phenols, saponins and hydrocyanic acid were also determined using method of Ola and Oboh [19]. The result shows that the seeds of *P. biglobosa* had

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significantly higher ($p < 0.05$) Moisture (17.530 ± 3.686) crude protein ($25.722 \pm 3.524\%$), crude fat ($27.536 \pm 2.273\%$) and Crude fiber ($6.540 \pm 1.795\%$) contents compared to the bouillon cubes (Knorr chicken, Maggi Star, tasty cubes). The bouillon cubes had significantly higher ($p > 0.05$) contents of ash (22.188 ± 0.950 , 24.092 ± 0.911 , 22.880 ± 0.736) which is found to be low in *P. biglobosa* seed. Carbohydrate level in bouillon cubes were also found to have higher means values of (28.87 ± 1.581 , 46.785 ± 2.243 , 38.035 ± 12.574). The minerals content of the analyzed samples shows that the *P. biglobosa* seeds have higher means value in Ca (126.285 ± 16.393), Na (150.820 ± 25.075), and K (1454.432 ± 199.575) and bouillon cubes were also found to be high in (Ca, Na, K, Fe), respectively. While the values of (Mn, Zn, Cr, Cb, Pb, pH) were found to have low mean value which were higher than WHO permissible limits. For the ANFs, *P. biglobosa* seeds recorded higher levels of Phytic acid (31.171 ± 8.369 mg/100g), saponins (15.767 ± 4.663 mg/100g) and tannins (55.772 ± 6.655 mg/100g), Total carotenoids (41.561 ± 2.632), Total phenols (65.689 ± 14.439), Hydrocyanic acid (7.618 ± 1.922 mg/100g) and Ascorbic acid (101.025 ± 11.670 mg/100g) while it was not detected (ND) in bouillon cubes on analysis. The heavy metal contents in *P. biglobosa* was found to be high in copper with mean value of (2.478 ± 2.077) while it was found to be insignificant in (Cr, Cb, and pb) and are not within the recommended value by WHO. The overall results are suggestive of higher nutritional quality of the *Parkia biglobosa* seeds than the bouillon cubes. It was therefore recommended that information concerning the use of local seasonings should be made available through public awareness campaign.

Keywords: *P. biglobosa*; proximate analysis; heavy metals; anti-nutritional contents.

1. INTRODUCTION

Continuous search for new sources of food nutrients especially from plants becomes imperative because 30% of the population in developing countries are currently suffering from one or more multiple forms of nutritional deficiencies, especially micro-nutrients [1]. Igbedioh [2] observed that improper food intake could be the possible cause of malnutrition among population groups. In order to arrest the situation, much attention has been given on the exploitation and utilization of unusual food plants especially edible flowers which can be a potential source of nutrient [3]. Just like other plant parts, it has been shown by Zhigang et al. [4] and Jiayi et al. [5] that some edible flowers contain appreciable amounts of phenolic compounds which are responsible for their antioxidant activities. These activities prevent oxidative damage of biological molecule in human body which causes aging, stroke, diabetes and cancer.

Apart from fermented *Parkia biglobosa* seeds serving as a rich source of plant protein to man with low cost, It also serves as good source of protein for animal feeds, chick and fish [6]. In the quest of rural dwellers to increase the protein level of their food, many wild fruits have been found to be good alternative. Locust bean seed is widely used for its remarkable nutritional and dietary value. The seeds are rich in protein, lipids and vitamin B2 and when fermented are rich in lysine. The fat in the beans is nutritionally useful

(approximately 60% unsaturated). The fermented locust bean seeds are commonly used in soups and stews [7]. Alabi et al. [8] reported that African locust bean is rich in lipid, protein, carbohydrate, soluble sugars and ascorbic acid. The cotyledon according to them is very nutritious, has less fibre and ash contents. The oil content is suitable for consumption since it contains very low acid and iodine contents. Locust bean oil has high saponification value and hence would be useful in the soap industry [9]. African locust bean has essential acids and vitamins and serves as a protein supplement in the diet of poor families [10]. It is a culinary product that can be used to enhance or intensify meatiness in soups, sauces and other prepared dishes [11].

Bouillon cubes are compressed stock that needs to be dissolved before use. Stock is the strained liquid left from slowly cooking vegetable, meat or fish in water with intense flavour added [12]. There are a range of different flavours available as there are different brands. The different brands include Maggi star bouillon, Royco bouillon and Knorr bouillon cubes. These are produced by two international companies with a worldwide reputation: Nestle and Unilever companies.

Unilever was formed in 1929 by a merger between Lever Brothers, a pioneer of branded soap manufacturer founded by William Hesketh Lever and the Margarine Unit of the Netherlands [13]. In line with the global strategic direction of

business, unilever Nigeria plc was formed in 2001. It produces Knorr bouillon and Royco bouillon cubes [14]. (Bouillon cubes are generally used around the world as a seasoning agent and to add the base flavour to dishes such as sauces, soups and stews [15]. The cubes contain three primary ingredients: Monosodium glutamate (MSG), hydrogenated oil (trans fat) and sodium chloride [16].

1.1 Statement of Research Problem

Despite the huge nutritional values and availability of local seasonings such as *P. biglobosa*, knorr chicken cubes, Maggi star and Tasty cubes as food seasonings, some developing countries like Nigeria require more information on the needs for increasing their utilization. Most of the consumers do not know much about the nutritional values, therefore use them as functional ingredient in foods for the purposes of tastes or aromatic characteristics. Hence strong emphasis on the nutritional values of both "*P. biglobosa*" and "knorr chicken" Maggi star and Tasty cubes are required in Nigeria so as to reduce the intake of industrial seasonings.

1.2 Aims and Objective of the Study

It was designed to Analyze and compare the proximate, phytochemical, mineral and heavy metal concentration of fermented *P. biglobosa* seed (African solid locus beans) and three varieties of bouillon cubes (Knorr chicken, Maggi star, Tasty cubes).

2. MATERIALS AND METHODS

2.1 Sample Collection and Treatment

Fermented and processed *P. biglobosa* seed in three different forms namely (a)clumped/mushy (b)whole/solid (c) Dry and bouillon (Knorr chicken,Maggi star, Tasty cube) cubes with the manufacturing date of 28/10/20, 03/08/20 and 04/07/20 and expiring date of 28/04/22, 03/02/22 and 04/01/22 respectively were obtained from Iyana Iba Market, Ojo Local Government Area in Lagos state, Nigeria. Identification of the sample was carried out at Botany Unit, Lagos state University, Ojo. The sample was oven dried at 70oC, cooled in a dessicator and finely ground or used fresh for moisture analysis. The dried sample was used for the analysis except for moisture content determination in which fresh sample was used.

2.2 Proximate Analysis

Moisture content: Moisture content was determined by drying the sample to a constant weight at 105 oC according to AOAC [17].

Ash content: Ash content was measured by calcination at 550 oC to a constant weight, according to AOAC [17].

Crude Protein content: Nitrogen content was determined according to the Kjeldahl method and nitrogen value was multiplied by 6.25 as a conversion factor [17].

Crude fibre content: Crude fibre was determined by Acid-alkaline-gravimetric method following the AOAC method [17].

Available carbohydrates: Available carbohydrate was estimated by difference using the relation: $100 - (\% \text{ crude proteins} + \% \text{ crude lipid} + \% \text{ Crude fibre} + \% \text{ ash})$ [17].

Energy content: Energy content was estimated in kcal/100g by the Atwater general factors system. The percentage available carbohydrate, crude protein and crude lipid were multiplied by 4, and 9 respectively [18].

2.3 Sample Extraction

5g each of the samples was weighed into a porcelain crucible and ashed in a muffle furnace at 550°C FOR 4hs. Thereafter the residue was allowed to cool, and then dissolved with 5ml of dilute nitric acid.The mixture was diluted to 25ml with distilled water and the solution filtered through whatman filter paper. The filtrate was saved for the determination of metals.

2.4 Digestion and Measurement of Heavy Metals (Cu,Cr,Cb,Pb)

Heavy metals, Cu, Zn, Cr, Mn, Co, and Pb were determined using atomic absorption spectrophotometer. The Ca, Mg, Fe Na and K contents of the sample were determined using atomic emission spectrometer and phosphorus by colorimetric method [17].

2.5 Determination of Phytochemicals

The method of Ola and Oboh [19] was adapted for the determination of Saponins, Tannins, phenol and phytate. Hydrocyanic acid was

determined by the AOAC [17] method. Oxalate and nitrate were determined by the methods of Krishna and Ranjhan [20].

2.6 Statistical Analysis

Data were computed using statistical package for social sciences (SPSS/ version 20). The difference in the means were tested using analysis of variance (ANOVA) while the significant level was calculated as $p < 0.05$.

3. RESULTS

3.1 Proximate Analysis

The concentrations of different proximate analysis in *P. biglobosa* seed and bouillon cubes are presented in Table 1, Fig. 1.

The table showed that the seeds of *P. biglobosa* had significantly higher ($p < 0.05$) Moisture (17.530±3.686) crude protein (25.722±3.524%), crude fat (27.536±2.273%), Crude fiber

(6.540±1.795%) and carbohydrate (17.415±6.579). It also showed that the bouillon cubes (Knorr chicken, Maggi Star, tasty cubes) has higher ash and carbohydrates and Crude protein as shown above.

From the Fig. 1, it can be seen that *Parkia biglobosa* has the highest carbohydrate mean value followed by tasty cubes and crude protein was high in Knorr chicken cubes and crude fiber was found to be very low.

3.2 Phytochemical Contents

The concentrations of different phytochemical contents in *P. biglobosa* seed and bouillon cubes are presented in Table 2, Fig. 2.

The phytochemical contents as shows in the Table 2 has significant ($P > 0.05$) *Parkia biglobosa* contents in both sugar brix, phytic acid, saponins tannins, carotenoids phenols Hydrocyanic ascorbic and ph, compared to bouillon cubes which are not detected on analysis (ND) apart from sugar brix and Ph.

Table 1. Proximate analysis of *P. biglobosa* seed and three varieties of bouillon cubes (Knorr chicken cubes, Maggi star, and Tasty cubes)

Proximate contents	Report			
	<i>Parkia biglobosa</i>	Knorr chicken	Maggi star	Tasty cubes
Moisture (%)	17.530±3.686	5.333±0.476	5.050±0.447	5.377±0.410
Crude pro (%)	25.722±3.524	33.795±0.948	17.178±0.580	23.770±11.882
Crude fat (%)	27.536±2.273	9.522±0.476	6.735±0.458	9.748±1.308
Crude fiber (%)	6.540±1.795	0.160±0.042	0.160±0.045	0.190±0.041
Ash (%)	4.450±1.317	22.188±0.950	24.092±0.911	22.880±0.736
Carbohydrate (%)	17.415±6.579	28.878±1.581	46.785±2.243	38.035±12.574

ND= Not detected. Mean ±SD value with different superscript across the row =significant difference ($p < 0.05$)

Table 2. Phytochemical composition of *P. biglobosa* seed and three varieties of bouillon cubes (Knorr chicken cubes, Maggi star, and Tasty cubes)

Phytochemicals contents	Condiments			
	Parki biglobosa	Knorr chicken	Maggi star	Tasty cubes
Sugar (Brix)	5.104±1.818	8.125±1.436	10.195±1.624	7.137±0.544
Phytic acid (mg/100g)	31.171±8.369	0.000±0.000	0.000±0.000	0.000±0.000
Saponins (mg/100g)	15.767±4.663	0.000±0.000	0.000±0.000	0.000±0.000
Tannins (mg/100g)	55.772±6.655	0.000±0.000	0.000±0.000	0.000±0.000
Carotenoids(mg/100g)	41.561±2.632	0.000±0.000	0.000±0.000	0.000±0.000
Phenols (mg/100g)	65.689±14.439	0.000±0.000	0.000±0.000	0.000±0.000
Hydrocyanic (mg/100g)	7.618±1.922	0.000±0.000	0.000±0.000	0.000±0.000
Ascorbic (mg/100g)	101.025±11.670	0.000±0.000	0.000±0.000	0.000±0.000
pH	5.629±0.312	6.080±0.032	5.460±0.082	6.230±0.298

ND= Not detected. Mean ±SD value with different superscript across the row =significant difference ($p < 0.05$)

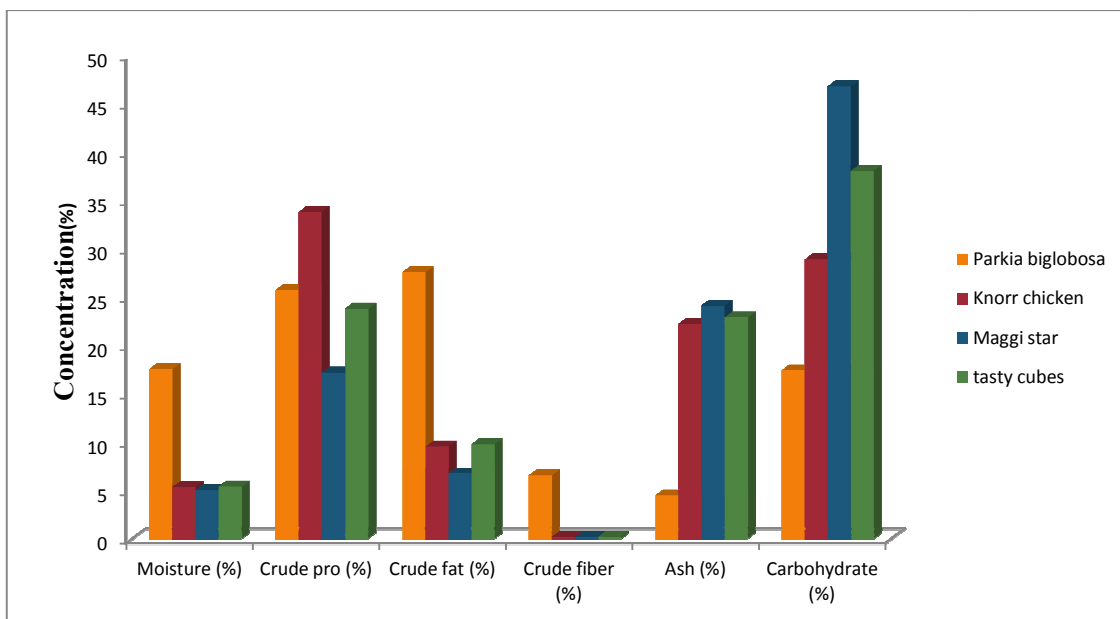


Fig. 1. Proximate analysis of *Parkia biglobosa* and three varieties of Boullion cubes

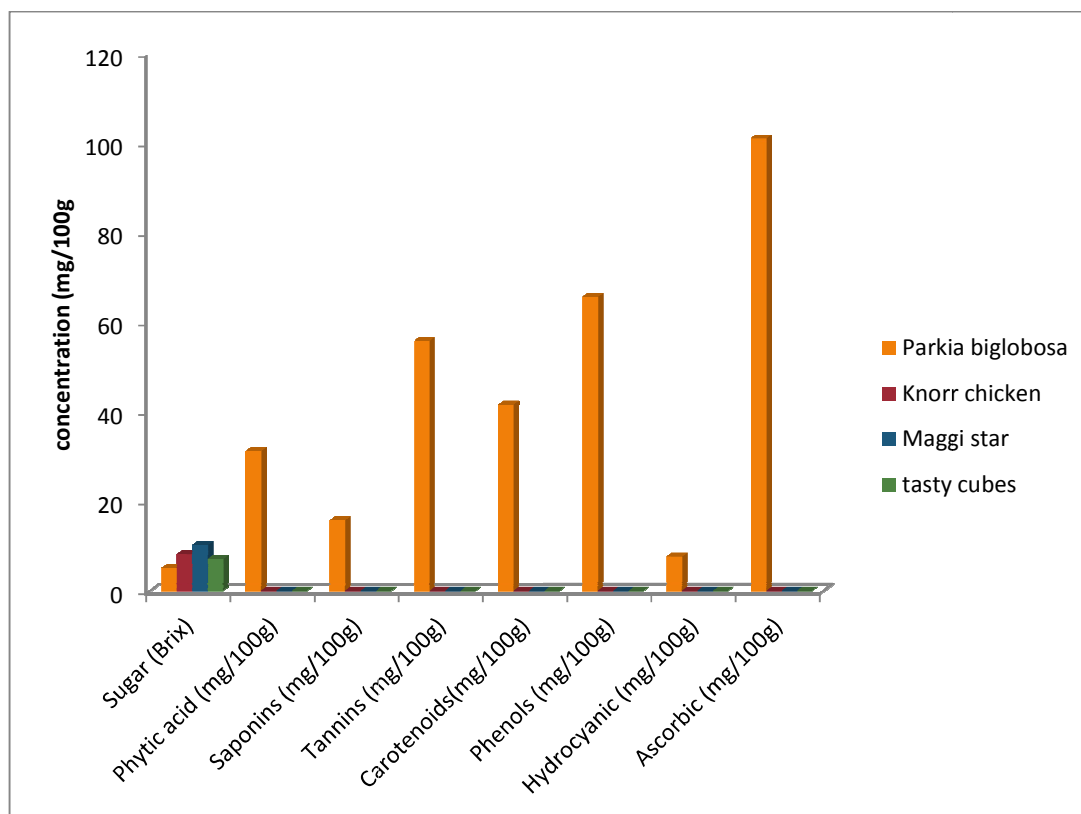


Fig. 2. Phytochemical composition of *Parkia biglobosa* and three varieties of boullion cubes

Table 3. Showing mineral composition of *Parkia biglobosa* seed and three varieties of bouillon cubes

Mineral contents	Report			
	<i>Parkia biglobosa</i>	Knorr chicken	Condiments	
			Maggi star	Tasty cubes
Calcium (mg/100g)	126.285±16.393	26.795±1.537	23.565±3.203	22.378±6.679
Magnesium (mg/100g)	3.737±0.776	2.185±0.193	2.450±0.523	2.623±0.371
Sodium (mg/100g)	150.820±25.075	24008.887±119.294	20439.800±13628.316	24111.078±358.573
Pottasium (mg/100g)	1454.432±199.575	7.910±0.926	9.083±0.846	4.858±2.468
Iron (mg/100g)	6.373±1.093	59.478±1.499	60.875±1.124	34.468±30.112
Manganese (mg/100g)	2.534±0.814	0.483±0.074	0.770±0.179	0.520±0.149
Zinc (mg/100g)	13.280±3.484	0.500±0.090	0.643±0.082	0.353±0.124
Phosphorus (mg/100g)	9.312±3.778	1.310±0.229	1.987±0.263	1.275±0.678

The Fig. 2 shows that *Parkia biglobosa* has the highest mean value in Ascorbic acid followed by phenols and tannins while bouillon cubes were very low.

3.3 Mineral Contents

The concentrations of different mineral elements in *P. biglobosa* seed and bouillon cubes are presented in Table 3, Fig. 3.

The minerals content of the analyzed samples showed that the *P. biglobosa* seeds have higher means value in Ca (126.285±16.393), Na (150.820±25.075), and K (1454.432±199.575) and bouillon cubes were also found to be high in (Ca, Na, K, Fe). Na was found to have the highest mean values in all the condiments.

Fig. 3 showed that Maggi star contents in Iron was the highest followed by Knorr chicken cubes and Tasty cubes.

3.4 Heavy Metal Contents

The concentrations of different heavy metal elements in *P. biglobosa* seed and bouillon cubes are presented in Table 4, Fig. 4.

The heavy metals contents in *P. biglobosa* was found to be high in copper with mean value of (2.478±2.077) while it was found to be insignificant in (Cr, Cb, and pb).

The value of copper in *Parkia biglobosa* seed has the highest mean value followed by Cobalt and Chromium.

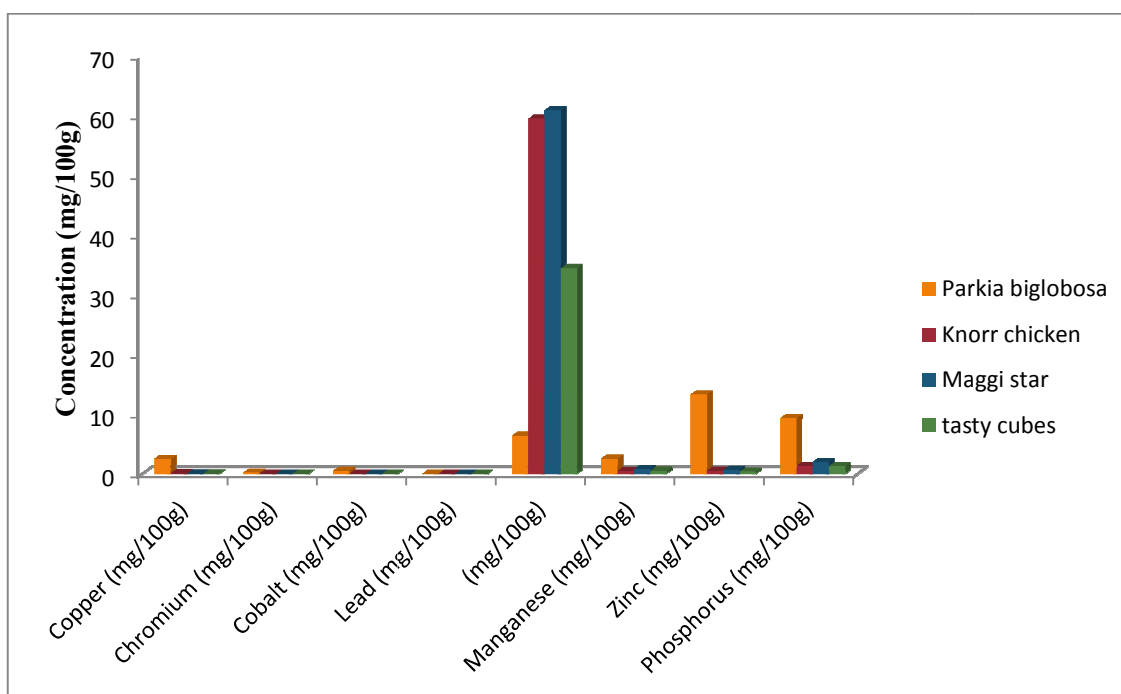


Fig. 3. Mineral composition of *Parkia biglobosa* and three varieties of Bouillon cubes

Table 4. Showing heavy metals contents in *Parkia biglobosa* and three varieties of bouillon cubes

Heavy metals	Condiments			
	<i>Parkia biglobosa</i>	Knorr chicken	Maggi star	Tasty cubes
Copper (mg/100g)	2.478±2.077	0.032±0.045	0.006±0.001	0.008±0.003
Chromium (mg/100g)	0.201±0.065	0.001±0.001	0.001±0.001	0.001±0.001
Cobalt (mg/100g)	0.506±0.265	0.001±0.001	0.001±0.001	0.002±0.001
Lead (mg/100g)	0.001±0.001	0.001±0.000	0.001±0.001	0.001±0.001

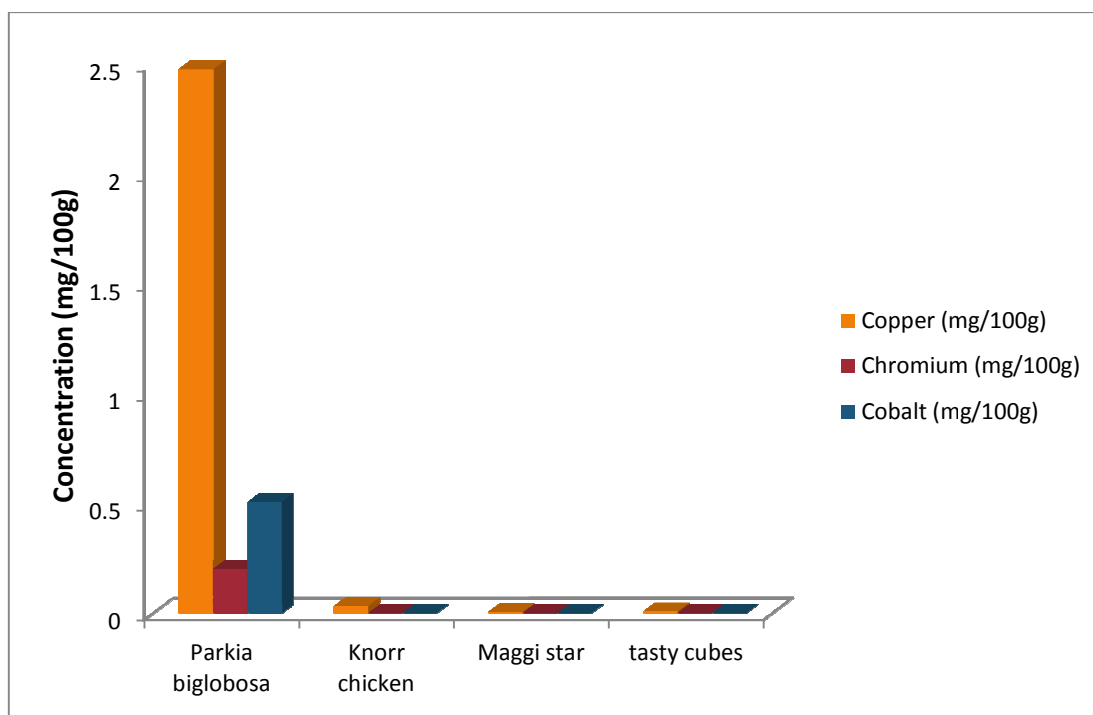


Fig. 4. Heavy metal composition of *Parkia biglobosa* and three varieties of Boullion cubes

4. DISCUSSION

The moisture content in *P. biglobosa* (African solid locus beans) takes for the study was high with the mean value of (17.530 ± 3.686) , followed by Tasty cubes, Knorr chicken cubes and Maggi star which has a low mean value of (5.377 ± 0.410) , (5.333 ± 0.476) and (5.050 ± 0.447) respectively. High moisture content of vegetable materials is responsible for their perishable nature due to association with the rise of microbial activities [21], (Ruzainah et al., 2009). Odebunmi et al., (2010) published that the nutritional components of fermented locust beans (except ash) are significantly higher than those of the raw beans. Their result showed that about 79% increase was observed in the moisture content from 8.67% in raw to 41.85% in fermented.

Crude protein was found to have a high average mean value of (33.795 ± 0.948) and was found in Knorr chicken cubes followed by *Parkia biglobosa* seed with mean value of (25.722 ± 3.524) and Tasty cubes were found to be (23.770 ± 11.882) , while (17.178 ± 0.580) was found within the Maggi star cubes samples after the crude protein determination. High protein content of fermented locust beans (35.73%)

is similar to those reported by Alabi et al., (2005).

In a study by Gernmah, Atolagbe, and Echegwo [22] mentioned by Bot [23], it was stated that African locust beans is more than adequate to meet the Food and Agriculture Organization (FAO)/ World Health Organization (WHO) recommended daily allowance of protein of 0.59g/kg body weight for an average healthy individual and 0.88g /kg body weight for children aged between 1 to 10 years. This indicates that *Parkia biglobosa* seed can be favourably compared with animal proteins as well as some major vegetables such as nuts and beans. More so, it is readily available on the markets and inexpensive as well. And the species are dangerous to consume.

Fat and oil is known to be the main source of energy needed by the body. As such *P. biglobosa* is a good source of energy. A higher mean value of (27.536 ± 2.273) percentage of Crude fat was found in the *P. biglobosa* and both Knorr chicken cubes, Maggi star and Tasty cubes were found to be low with the mean values (9.522 ± 0.476) , (6.735 ± 0.458) , and (9.748 ± 1.308) respectively after fat and oil determination. According to Ndamitso et al. [24] the values of

the results obtained for the proximate analysis crude fat in *P. biglobosa* is (6.36%).

Fibre is known for its essential benefits for good bowel movement and helps in preventing constipation. Several researches have shown that the fibre obtained is much higher than for most food legumes, such as groundnuts and kidney beans. However the value As indicated by Table 1, shows that average mean of (6.540±1.795), (0.160±0.042), (0.160±0.045) percent was detected in the *P. biglobosa*, Knorr chicken cubes and Maggi star respectively and (0.190±0.041) was found in Tasty cubes samples. According to Gernmah, Atolagbe, and Echegwo [22], the rich source of dietary fibre in *Parkia biglobosa* is essential for good bowel movement and helps in preventing obesity, diabetes, and cancer of the colon and other ailments of the gastro-intestinal tract of man. Gernmah et al. [22] also reported that the pulp contained a crude fibre 11.75 %. Based on the results obtained from the two samples it can be recommended that both *P. biglobosa* and Knorr chicken cubes are still at normal permissible limit which is safe for consumption.

Ash content, a higher mean ash value of (24.092±0.911) was found within the Maggi star followed by Tasty cubes and Knorr chicken cubes with the mean values of (22.880±0.736), (22.188±0.950) and the *Parkia biglobosa* seed was found to be low with the mean value (4.450±1.317) of the sample used for the ash determination after it has been oven dried. Recently, Akoma et al. [25] reported that the pulp contained 3Sg /100g ash. Based on the result gotten the ash content of the *Parkia biglobosa* seed is still at normal permissible limit which is safe for the body.

An average mean percentage of (17.415±6.579) from Table 1 shows the carbohydrate constituent in *P. biglobosa*, (28.878±1.581) was found in Knorr chicken cubes and a higher mean value was detected in Maggi star and Tasty cubes (46.785±2.243), (38.035±12.574). Recently, Akoma et al. [25] reported that the pulp contained 85.5g carbohydrate, even though it was little higher than 49.0% carbohydrate composition reported by Elemo, Elemo, Olufunmilola, Oladunmoye and Erukainure [26] and the 42.73% indicated by Pelig-Ba (2009). The values gotten are within the normal limit and which are safe for consumption.

The sugar content of *P. biglobosa* seed and Knorr chicken cubes on analysis was found to be (5.104±1.818% Brix), (8.125±1.436), while Maggi cubes and Tasty cubes values were found to be (10.195±1.624%Brix), (7.137±0.544%Brix). Akoma et al. [25] reported that the pulp contained 70.4g/100g reducing sugars. The pulp had been previously reported to contain 20% reducing sugars. Based on the results obtained Maggi star and Knorr chicken cubes are within the normal limit.

Phytic acid, a hexaphosphate or inositol is an important storage form of phosphorus in plants. It is insoluble and cannot be absorbed in the human intestines. Phytic acid has 12 replaceable hydrogen atoms with which it can form insoluble salts with metals such as calcium, iron, zinc, and magnesium. The formation of these insoluble salts renders the metals unavailable for absorption into the body [27]. He also reported that, cooking does indeed destroy anti-nutritional factors which are toxic to health and make dietary minerals available for absorption. The phytate content is seen to reduce with fermentation and further reduction is expected with cooking. phytic acid (163 mg /100 g) was comparable with the observations of Esenwah and Ikenebomeh [28] (150 mg /100g) [26]. Phytic acid content in *P. biglobosa* seed was found to be (31.171±8.369mg/100g) and was not detected in other condiments. This result is consistent with the findings of Nkama and Gbenyi [29].

The average mean Saponin content in *P. biglobosa* seed was found to be (15.767±4.663 mg/ 100g) and it was not detected in bouillons cubes, which could be a contributory factor to the foaming characteristic of the fruit pulp. According to Gernmah et al. [22] the percentage of saponins to be 17.80mg/ 100g. In addition, although saponins have been shown to be highly toxic under experimental conditions, acute poisoning is relatively rare, both in man and animals (Tannenbaum, 1979).

The average mean Tannin content in *P. biglobosa* samples was found to be (55.772±6.655 mg/ 100g) and it was not detected in bouillon cubes. According to Gernah et al., 2007 the percentage tannins to be 81.00mg/100g Tannins are water soluble phenolic compounds and they occur as hydrolysable tannins and condensed tannins [30].

Total carotenoids in *P. biglobosa* amount to (41.561±2.632mg/100g) and was not detected in bouillon cubes on analysis. The value obtained in *P. biglobosa* (41.561±2.632mg/kg) indicate that *p. biglobosa* is at permissible limit for consumption. Gernmah et al. [22] also reported that the pulp contained total carotenoids 49.175 ug/100 g.

Phenols protect plants from oxidative damage and perform the same functions for humans [31]. The outstanding phytochemical feature of phenols is their ability to specifically blockenzymes that causes inflammations. They also modify the prostaglandin pathways, thereby protecting platelets from clumping [31]. The total phenols content of *P. biglobosa* seed was found to be (65.689±14.439mg/kg) and was not detected in bouilloncubes. Total phenols were also found to be 204.60mg/100g, which correspond to the one reported by (Gernmah et al. [22]) which is 204.60mg/ 100g. and therefore considered to be acceptable and safe.

Breathing small amounts of hydrogen cyanide may cause headache, dizziness, weakness, nausea, and vomiting. Large amount may cause gasping, irregular heartbeat, seizures, fainting, and even rapid death. Generally, the more serious the exposure, the more the severe the symptoms. The mean value of hydrocyanic in this study were lowest in *P. biglobosa* (7.618±1.922mg/kg) and was not detected in bouillon cubes. Hydrocyanic acid (HCN) content was found to be 17.30mg /100g, which is far below the lethal dose for man of 50-60mg/kg body weight/day as reported by (Gernmah et al., [22]). There have been reports of the presence of antinutritional factors in locust bean seeds. The value obtained in *P. biglobosa* were very low compared to the one reported based on the literature review.

Vitamin C (ascorbic acid) content in *P. biglobosa* and Knorr chicken cubes was found to be (101.025±11.670 mg/100g) and on analysis were not detected in bouillon cubes (0.000±0.000 mg/kg), Gernmah et al, [22] also reported that the pulp contained ascorbic acid of 191.20 mg/100 g. Based on the results Knorr chicken cubes were not detected on analysis. Vitamin C is very useful in collagen synthesis, facilitates iron absorption and participates in biosynthesis of glucocorticoids.

Hydrogen ion concentration (pH) of 5.22 suggests that the fruit pulp is a slightly acidic

food material this means that enzymic and microbiological activities would be inhibited to some extent, thus having a positive influence on protein stability. Based on analysis the average mean value of *P. biglobosa* (5.778±0.266) and the Knorr chicken cubes was found to be (6.080±0.032) . Based on this result obtained the two values are still within the W.H.O permissible limit (7.00).

Calcium content, An average mean value of (126.285±16.393) was obtained from *P. biglobosa* seed and (26.795±1.537) of mean value was obtained from Knorr chicken cubes followed by (23.565±3.203) mean value of Maggi star after analysis of the samples, while (22.378±6.679) was gotten from Tasty cubes. The recommended dietary allowance for calcium is 800mg/day, which means that about 68g dry weight of the pulp fruit would provide the recommended daily allowance for calcium [32]. The results of calcium gotten are still below permissible level.

The Magnesium content in the *P. biglobosa* samples has an average mean value of (3.737±0.776) and Knorr chicken cubes were found to be (2.185±0.193) and Maggi star and Tasty cubes values were found to be (2.450±0.523), (2.623±0.371) as indicated in the Table 2 [24]. Mean concentrations to be 278.23 mg/g. The findings from the study also showed that the *Parkia biglobosa* seed is rich in magnesium, a mineral that plays a major role in relaxing muscles along the airways to the lungs, thus allowing asthma patients to breathe easily. The study adds that deficiency of magnesium in man is responsible for severe diarrhoea, migraines, hypertension, cardiomyopathy, arteriosclerosis and stroke, Ekum (2003).

The Table 3 show the average means value of Sodium in both *P. biglobosa*, Knorr chicken cubes, Maggi star and Tasty cubes samples which were found to be (150.820±25.075 mg/kg), (24008.887± 119.294 mg/kg), (20439.800±13628.316 mg/kg) and (24111.078±358.573 mg/kg) respectively [24]. Mean concentrations to be 18.89mg/g. sodium was found to be the highest value obtained after the analysis of the samples. Sodium occurs naturally in many foods and is also added in the form of salt or other sodium-containing substances. The sodium content of food has important implications for health. But sodium is an essential nutrient, and we need a certain amount for normal body function. A safe intake is

considered to be between 0.9g and 2.3g of sodium per day, although in special circumstances, such as excessive sweating and diarrhea, higher levels may be needed.

Also for the Potassium content in the *P. biglobosa* samples has an average mean value of (1454.432±199.575mg/kg) and Knorr chicken cubes was found to be (7.910±0.926mg/kg) and the values of Maggi star and Tasty cubes was found to be (9.083±0.846mg/kg), (4.858±2.468 mg/kg) present as indicated in Table 2 [24]. Mean concentrations to be 18.89mg/g 19.43mg/g.

Iron is essential for the synthesis of chlorophyll and activates a number of respiratory enzymes in plants. An average mean of (6.373±1.093) from the table above indicate the Iron constituent in *P. biglobosa* seed samples and (59.478±1.499), (60.875±1.124) was obtained from the analysis of Knorr chicken cubes and Maggi star ,Tasty cubes value was found to be (34.468±30.112) which is indicated in the Table 2 [24]. Mean concentrations to be 21.55mg/g. Ekum (2003) again said that lru is equally rich in iron which is an important element in the diet of pregnant women, nursing mothers, infants, convulsing patients and the elderly and it prevent anemia and other related diseases.

Manganese supports the immune system, regulates blood sugar levels and is involved in the production of energy and cell reproduction. It works with Vitamin K to support blood clotting. Working with some vitamins, manganese helps to control the effects of stress. Birth defects can possibly result when an expecting mother does not get enough of this important element. An average mean percentage of (2.534±0.814mg/kg) was obtained from *P. biglobosa* and the mean value of (0.483±0.074mg/kg) was found in Knorr chicken cubes ,and the Maggi star and Tasty cubes values were (0.770±0.179), (0.520±0.149) as indicated in the Table 2 [24]. Mean concentrations to be 18.177 mg/g.

Zinc In this study have the average mean of *P. biglobosa* to be (13.280±3.484mg/kg) and is higher than Knorr chicken cubes (0.500±0.090mg/kg) and it was also found to be low in both Maggi star and Tasty cubes with the mean values of (0.643±0.082mg/kg), (0.353±0.124mg/kg). Zinc is known to play a crucial role in antioxidant defense in type 2 diabetic patients where it enhances reduction and neutralization of free radicals and acts as a cofactor of SOD, by modulating glutathione

metabolism and metallothionein expression. Its deficiency has been implicated in a number of metabolic abnormalities such as impaired glucose tolerance, decreased pancreatic insulin content as well as insulin degradation [33,34]. The content of Zinc in the *P. biglobosa* is higher than W.H.O permissible limit of (0.60mg/kg) and the value of bouillon cubes are safe for consumption. Based on the result, *P. biglobosa* found to be higher than permissible limit by W.H.O which is very dangerous for consumption.

The mean value of Phosphorus in both *P. biglobosa* and Knorr chicken cubes samples was also found to be (9.312±3.778) and (1.310±0.229).The mean value of Maggi star and Tasty cubes were(1.987±0.263), (1.275±0.678) as shown in the Table 3 [24]. Mean concentrations to be 12.19mg/g. The mean values obtained from both *P. biglobosa* and bouillon cubes are below the normal range recommended by WHO which was (70mg/kg) and are safe for the body.

Copper is an important micronutrient that acts as a biocatalyst, required for body pigmentation in addition to iron, maintaining a healthy central nervous system, prevents anemia and interrelated with the function of Zn and Fe in the body. An average mean of (2.478±2.077mg/kg) was found in the *P. biglobosa* samples and (0.032±0.045mg/kg),(0.006±0.001mg/kg) was detected in Knorr chicken cubes and Maggi star. While (0.008±0.003 mg/kg) was detected in Tasty cubes and was found to be insignificant after the Copper determination, as indicated in the Table 3 [24]. Mean concentrations to be 6.11mg/g. The measured copper levels in the plant are below the permissible limit (10mg/kg). The values of copper in *Parkia biglobosa* seed and the bouillon cubes are not up to the permissible limit.

Chromium is important in the body. It is able to stabilize blood sugar levels, which could prevent diabetes, by using insulin efficiency. It also aids the breakdown of fats in the body and is said to increase the good cholesterol in the body while lowering the bad cholesterol. The chromium contents of *P. biglobosa*, Knorr chicken cubes, Maggi star, and Tasty cubes samples was found to be (0.201±0.065), (0.001±0.001), (0.001±0.001), (0.001±0.001) respectively. According to the result gotten Knorr chicken cubes mean value was found to be insignificant. The WHO permissible limit for chromium in

vegetables is 1.3 mg/kg. Thus, this indicates that both seasonings are safe for consumption.

The Cobalt content of *P. biglobosa* after analysis was (0.506±0.265/kg) and was found to insignificant in Knorr chicken cubes, Maggi star, and Tasty cubes with average mean values of (0.001±0.001 mg/kg), (0.001±0.001 mg/kg), (0.002±0.001 mg/kg) respectively. (Ojewumi 2016c; Alabi et al., 2005) report the values of Cobalt to be 4.41 mg.

Lead has been reported to be a serious cumulative body poison, which penetrate into the body system via food, air and water respectively and cannot be detached by washing the vegetables. The lead content of *P. biglobosa* and bouillon cubes obtained after analysis (0.001±0.001) and (0.001±0.001) were found to be insignificant. And they all are below the W.H.O permissible limit of 2mg/kg. Thus, the levels of Lead in these condiments are within acceptable levels for human consumption. [35,8] report the values of Lead to be 2.65 mg.

5. CONCLUSION

From the result of the analysis, African Locust Beans (*P. biglobosa*) and bouillon cubes contain enough essential nutrients like carbohydrate, calorific value, lipid, protein and mineral such as (Ca, Mg, Na, K, and Fe) that can serve as potential sources of food. The level of ant nutrients (phytic, phenols, HCN, tannins) which interfere with digestion and absorption are all below the toxic level or daily intake. It can therefore, be concluded that "*P. biglobosa*" seed can contribute to the human nutrient requirement and could be used as a source of nutrients supplement. The results obtained of this research study confirmed and upgraded other previous research works that have been carried out on the comparative Analysis of *P. biglobosa* "seed" should be packaged in appealing ways so as to make it more presentable and as marketable as imported food flavourings. Finally, it is recommended that '*P. biglobosa*' seed should be made into cubes and packaged well to attract prospective buyers and there should be vigorous campaign on the danger of heavy metal content in our daily seasonings intake to safe many life's from the adverse effect on the body.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our

area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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