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Study on the Nutritional Compositions of Boiled Jackfruit Seed and its effect on the Liver and Kidney Functions of Wistar Albino Rats

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ABSTRACT

Studies on the nutritional compositions of boiled *Artocarpus heterophyllus* (jackfruit) and their effects on some biochemical parameters were investigated in albino rats of wistar strain. Phytochemical and proximate, vitamins and mineral analysis of jackfruit seeds were carried out using standard biochemical method. Twenty-four (24) male wistar albino rats weighing from 120-150grams were used for the study and randomly assigned to three (3) groups of eight animals each. Each rat in group A (which is the control) received normal rat feed and water while group B received 30% jack fruit feed and 70% normal feed, while the third group received 60% jack fruit feed and 40% normal rat feed. The normal rat feed used was pelleted grower feed (top feed). Then at the end of twenty-eight days, the rats were bled and blood samples collected were used for the analysis of some biochemical parameters using standard biochemical methods, from the phytochemical analysis of jack fruit it was observed that it contained a very high phytate, high quantity of flavonoids and moderate quantity of alkaloids and tannins. The result of this study therefore indicates that boiled jackfruit seed possess good antioxidant phytochemical, antioxidant mineral elements and antioxidant vitamins. This suggest that boiled jackfruit seed diet could be useful in scavenging free radicals in the body, thereby preventing oxidative stress in the body. The result of this study also showed that boiled jackfruit seed diet has high iron content and appreciable protein which could assist in boosting blood parameters and hence in the treatment of anaemia. The result of liver and kidney function assay reveled that boiled jackfruit seed diet was not toxic to the liver and kidney of the albino rats used in the study therefore consumption of boiled jackfruit seed is encourage considering its nutritive potentials.

Keywords- Jackfruit, Phytochemical, Antioxidant, Anaemia

INTRODUCTION

The jackfruit (*Artocarpus heterophyllus*), otherwise called jackfruit [1,2,3,4,5,6] is a types of tree in the fig, mulberry, and breadfruit family (Moraceae). Its starting point is in the locale between the Western Ghats of southern India and the rainforests of Malaysia [7,8,9,10]. The jack tree is appropriate to tropical swamps, and is generally developed all through tropical locales of the world. It bears the biggest product, everything being equal, coming to as much as 55 kg (120 pounds) in weight, 90 cm (35 inches) long, and 50 cm (20 inches) in distance across [11,12,13, 14]. A develop jack tree delivers exactly 200 organic products each year, with more seasoned trees persevering to 500 natural products in a year. The jackfruit is a various natural product made out of hundreds to thousands of individual blossoms, and the beefy petals of the unripe natural product are eaten [15]. The ready natural product is sweet (contingent upon assortment) and is all the more regularly utilized for treats. Canned jackfruit has a gentle taste and meat-like surface that fits being known as a "vegetable meat" [16]. Present day cognates incorporate Javanese, Malay, Balinese,and Cebuano nangka; Tagalog, Pangasinan, Bikol and Ilocano langka; Chamorro lanka or nanka; Kelabit nakan; Wolio nangke; Ibaloi dangka; and Lun Dayeh laka. Note, notwithstanding, that the natural product was as of late acquainted with Guam by means of Filipino pilgrims when both were important for the Spanish Empire

[17,18]. Jackfruit is usually utilized in South and Southeast Asian foods [19,20]. Both ready and unripe natural products are burned-through. The jackfruit is the public product of Bangladesh and Sri Lanka, and the state product of the Indian territories of Kerala and Tamil Nadu. It is accessible globally canned or frozen and in chilled dinners as are different items gotten from the organic product like noodles and chips. While most research work on them seems to be with their extracts only. This work therefore is an attempt to elucidate the effects of the whole jackfruit seed diets on biochemical markers of albino rats.The result of this study will be particularly useful to nutritional biochemist, dieticians, food scientist, food technologists, medical chemists and health care practitioners for providing advisory information to the populace regarding the health benefits of jackfruit seeds.

MATERIALS

Chemicals and instrument

All synthetic compounds utilized in the investigation were of logical evaluation and were results of legitimate organizations like BDH, UK; RDH, Germany; Merck Germany, Sigma Aldrich, Germany and May and Baker UK. The instruments utilized incorporate desiccators (Bücchi), refining unit (Markham contraption, England), gauging scale (Ohaus, Germany), stifle heater (Cole palmer, England), warming mantle (Cole palmer, England), vacuum siphon (Cole palmer, England), soxhlet device (Soxtec unit by Tecator), water shower (Cole palmer, England) spectrophotometer (Jenway, model number 6301), rotator (Gallenkamp, Germany) and broiler (Gallenkamp, Germany). Different instruments incorporate test-tubes, burettes, erlenmeyer carafe, cauldrons, porcelain dishes, ashing dishes, volumetric flagons, tapered jars, thimbles, bubbling jars, measuring glasses, buchner cups, Whatman channel paper no 42, channel papers and isolating pipes.

Plant Materials

The jackfruits were obtained from Awka market, in Awka South Local Government Area of Anambra State, Nigeria. They were washed and dried at room temperature. They were pummeled using electric blender and were put away in a fridge before use.

METHODS

Proximate Analysis

Standard methods of the Association of Official Analytical Chemists were used to determine the moisture, crude protein, crude fat, total ash and crude fibre contents of each sample [3]. Moisture content was determined by heating 2.0g of each fresh sample to a constant weight in a crucible placed in an oven maintained at 105 EC. The dry matter was used in the determination of the other parameters. Crude protein (% total nitrogen x 6.25) was determined by the Kjeldahl method, using 2.0g samples; crude fat was obtained by exhaustively extracting 5.0g of each sample in a Soxhlet apparatus using petroleum ether (boiling point range 40-60˚C) as the extractant. Ash was determined by the incineration of 10.0g samples placed in a muffle furnace maintained at 550˚C for 5h. Crude fibre was obtained by digesting 224.0g of sample with HSO and NaOH and incinerating the residue in a muffle furnace maintained at 550˚C for 5h. Moisture content was determined by heating 2 .0g of each sample to a constant weight in a crucible placed in an oven maintained at 105˚C. Each analysis was carried out in triplicate.

The carbohydrate content of the sample was obtained by difference

Carbohydrate = 100 – (% moisture +% ash +% crude fat +% crude protein +% crude fibre).

Phytochemical Determination

Determination of Alkaloids

This was finished by the soluble precipitation-gravimetric technique depicted by [8]. Five grams of the example were weighed into a 250 ml measuring utencil and 200 ml 10% acidic corrosive in ethanol was added. The measuring glass was covered and permitted to represent four hours. This was sifted and the concentrate was focused on a water shower to one fourth of the first volume. Concentrated ammonium hydroxide was added drop-wise to the concentrate until the precipitation was finished. The entire arrangement was permitted to settle and the accelerate was washed with weaken ammonium hydroxide after which it was sifted with a pre-gauged paper. The buildup after the filtration is the alkaloid which was dried and gauged. Rate alkaloid was determined from that point by% weight of alkaloids

Determination of Flavonoids

This was resolved utilizing the [8] method. Five grams of the example were extricated over and over with 100 ml of 80% fluid methanol at room temperature. The entire arrangement was separated through Whatman channel paper no 42. The filtrate was subsequently moved to a cauldron and dissipated to dryness over a water shower. It was then weighed to a steady weight to decide rate flavonoid.

Determination of Saponins

Saponin was resolved by the [7]. Ten grams of the example were weighed into a 250 ml funnel shaped cup and 100 ml 20% ethanol added to it. The example was warmed over a water shower for 4 hours at 55°C. The blend was separated and the buildup re-extricated with 200 ml 20% ethanol. The consolidated concentrates were decreased to 40ml over water shower set at 90°C. The pack was moved into a 250 ml isolating pipe and 20 ml diethyl ether was added and the arrangement shaken overwhelmingly. The fluid layer was recuperated while the ether layer was disposed of. The refinement interaction was rehashed. Sixty mililitre of n-butanol was added. The joined n-butanol separates were washed twice with 10 ml 5% NaCl arrangement. The leftover arrangement was warmed in a water shower and vanished to dryness after which it was dried to consistent mass and the saponin content determined.

Determination of Terpenoids and Steroids

This was done utilizing the [19]. Ten grams of the example were macerated with chloroform for 12 hours. The macerate was sifted and the cycle rehashed. The filtrates were vanished to dryness. The dried mass gives the chloroform remove. The material was dried in the outdoors and afterward macerated once more, this time with methanol utilizing a similar method as portrayed above to get the methanol extricate. The chloroform extricate gave the steroid while the methanol remove gave the terpenoids. These were determined as rates on dry mass bases.

Determination of Tannins

The Folin Denis technique [16] was utilized in assurance of tannins. One gram of the example was removed with 300 ml diethyl ether for 20 hours at room temperature. The buildup was bubbled for two hours with 100 ml refined water, cooled and separated. The concentrate was changed in accordance with a volume of 100 in a volumetric cup. Then, at that point, the tannin substance of the example was removed colorimetrically utilizing Folin Denis reagent by estimating the arrangements absorbance at 760nm utilizing tannic corrosive as the norm.

Determination of phenols

The powdered plant leaf was extricated with 10 ml of CH3)2CO (70 v/v) and arrangement was exposed to ultrasonic treatment for 20 minutes at room temperature. The substance was centrifuged for 10 minutes at 3000 rpm. Furthermore, the supernatant was utilized for the assurance of complete phenol by the Folin Ciocalteau response as depicted by [11]. An alignment bend was gotten utilizing tannic corrosive as standard. Complete phenols were determined as tannic corrosive reciprocals and communicated as tannic corrosive same/100g.

Determination of hydrogen cyanide (HCN)

The technique for [16] was utilized. The cyanide extraction was done by gauging five grams of the example into a 250 ml conelike jar and 50 ml refined water was added after which the cup was plugged. The combination was permitted to stand for the time being. The concentrate was then separated for HCN assurance. The example filtrate (1 ml) was moved into a test-cylinder and 4 ml soluble filtrate was added (arranged by massing out 1g picric corrosive, 5 g sodium carbonate and making up the combination with 200 ml hot refined water). This was set in a water shower for five minutes. After shading advancement (rosy earthy colored), the absorbance was perused in a spectrophotometer at 490 nm subsequent to focusing with a clear arrangement (1 ml refined water and 4 ml basic picrate arrangement). The centralization of HCN was resolved utilizing a norm.

Determination of soluble carbohydrates

One gram of test was weighed into a 250 ml tapered cup. Ten mililitres of refined water were added. This was trailed by the expansion of 15 ml 52% perchloric corrosive. The blend was mixed for 30 minutes after which it was sifted. Then, at that point 1 ml filtrate was taken in a 50 ml test tube and blended in with 4 ml anthrone reagent on ice. The blend was perused at 620 nm in a spectrophotometer. D-Glucose was utilized as a norm and it was arranged a similar path as the example. Various groupings of the D-Glucose were utilized to create an alignment bend from where the dissolvable sugars of the example were extrapolated.

Determination of reducing sugars

Five grams of the example were refined into a 500 ml volumetric flagon and afterward it was weakened to check and blended. The arrangement was sifted utilizing Whatman No 42 channel paper disposing of the initial 25 ml filtrate. Subsequent to separating the whole arrangement, 50 ml of the filtrate was moved into a 100 ml volumetric carafe, weakened to the imprint and blended. The example arrangement was trailed by the primer titration of the example. A burette was loaded up with the example arrangement while 20 ml soxhlet reagent and 15 ml refined water were added to a 250 ml Erlenmeyer carafe. In this Erlenmeyer jar, 25 ml of the example arrangement from the burette was added. Utilizing hot plate and stirrer, the blend was brought to bubble inside 2 minutes. Then, at that point drops of methylene blue marker were added after which the titrant was added until the blue tone vanished. Utilizing the absolute volume of the despot utilized, the complete volume of water to be included the exact titration was determined to give the all out volume of 75 ml in the flagon. The rate convergence of decreasing sugars was calculated.

Analysis of Minerals

Determination of Zinc

[4], dithiozone technique was utilized in the assurance of zinc in the examples. Ten mililitres of debris arrangement of each example was pipette into a 30 ml

test tube. Five mililitre acetic acid derivation support was added trailed by 1 ml 2% sodium thiosulphate arrangement. Then, at that point, there was an expansion of 5 ml 0.05% dithiozone arrangement. The blend was left to respond for around 5 minutes after which 3 ml carbon tetrachloride arrangement was added. The combination isolated into two layers of which the upper layer was taken for spectrophotometric perusing at 540 nm:

Determination of Iron

The ortho-phenanthroline technique as depicted by [4] was utilized for the examination. 10 ml of the debris arrangement was put in a 30 ml test tube. One milliliter hydroxylamine hydrochloride was added. The blend was left for 5 minutes after which there were increments of 5 ml acetic acid derivation cushion and 1ml ortho-phenanthroline individually. The pink shaded blend was perused in a spectrophotometer set at 510 nm.

Determination of selenium

The method obtained from [4], was utilized in the assurance of selenium. Ten mililitre of the debris arrangement was pipetted into a 30ml test tube. One mililitre of 2% potassium iodide arrangement was added to the test tube. This was thus trailed by the expansion of 1 ml 1M HCl and the blend was delicately shaken until the presence of a yellow tone demonstrating the freedom of iodine. Then, at that point 0.5 ml of 0.02% Safranine O arrangement and 2 ml of acetic acid derivation support arrangement of pH 4 were both added. The absorbance of the resultant arrangement was estimated at 532 nm against a reagent clear.

Determination of Vitamins

Determination of vitamin A

The strategy of [4] was utilized in the assurance of nutrient A. One gram of the example was weighed into a launder 30 ml film holder. Total ethanol (30 ml) was added to the substance of the holder. This was left for 1 hour after which the blend was sifted in obscurity. Ten mililitres of insightful evaluation n-hexane was added to the filtrate which was gathered in a test tube preceding spectrophotometric perusing. The test tube was shaken enthusiastically for 5 minutes. The upper layer of the isolated blend was taken for spectrophotometric perusing at 450 nm utilizing n-hexane as the clear. Standard nutrient was likewise set up similarly and read at a similar wavelength.

Determination of vitamin C

This was resolved utilizing the [4], DCIP (2, 6 Dichlorophenol indophenol) strategy. Five grams of each example were weighed into a 250 ml tapered carafe and 60 ml TCA/acidic corrosive arrangement added. The blend was whirled for a few minutes and permitted to represent about 60 minutes. The combination was then sifted and the filtrate made up to 100 ml. An aliquot of 10 ml was taken up in a 50 ml recepticle and titrated against DCIP. Fifty miligrammes of standard nutrient C was ready and furthermore titrated against the DCIP arrangement.

Determination of vitamin E

Nutrient E was resolved utilizing the Pearson (1976) technique. The example (1 g) was extricated with 50 ml pet ether and concentrated to dryness. The buildup was saponified with 5 ml of 0.1M KOH under reflux. Pet ether (20 ml) was utilized to separate the unsaponified matter and the filtrate concentrated to dryness. Ethanol (20 ml) was added to break down the concentrate. Then, at that point, 1 ml was moved to a test tube after which 1 ml 0.2% ferric chloride in ethanol was added. 0.5% dipyridyl in ethanol (1 ml) was additionally added. The entire arrangement was made up to 5 ml with ethanol. The absorbance of the arrangement was then taken at 520 nm against a clear.

Assay and Determination of Liver Function Parameters

Assay of Serum Aspartate Aminotransferase Activity

Aspartate aminotransferase (AST) action was examined utilizing the technique depicted by [18] as contained in the Randox chemical Kit.

Assay of Serum Alanine Aminotransferase Activity

Alanine aminotransferase (ALT) activity in serum was assayed using the method described by [18] as contained in the Randox enzyme Kit.

Assay of Serum Alkaline Phosphatase (ALP) Activity

The activity of alkaline phosphatase (ALP) was assayed using the method described by [18] as contained in the Randox enzyme Kit.

Kidney Function Test

Concentration of creatinine was determined using the method of [20] while the method of [9] was employed to determine the serum urea concentration. Serum electrolytes concentrations were measured using the flame photometer as described by [5].

Statistical Analysis

The data obtained were analyzed using both one and two-way analysis of variance (ANOVA) in Statistical product and Service Solution (SPSS) version 16.0 and presented as Mean ±SD. Mean values with $p < 0.05$ were considered significant.

RESULTS AND ANALYSIS

Phytochemical Composition of Jack Fruit Seed

Quantitative Analysis

The result of phytochemical quantitative analysis of jackfruit seeds used in this study (table 1) indicates that jack fruit seed has high quantity of flavones followed by tannins and epicatechin.

Table 1: Phytochemical Quantitative composition of jack fruit seed used in the study

PARAMETERS(ppm)	CONCENTRATION(ug/g)
PROANTHOCYANIN	18.54±0.06
FLAVAN 3 OL	17.83±0.05
RIBALENIDINE(ug/ml)	11.67±0.03
EPICATECHIN	22.91±0.08
SAPOGENIN	3.356±0.02
STEROIDS(ppm)	5.76±0.04
LUNAMARIN	6.56±0.03
FLAVONONES(ug/ml)	49.83±0.50
KEAMPFEROL(ug/ml)	4.33±0.01
PHYTATE	5.28±0.03
NARINGIN(ug/ml)	3.56±0.06
SPARTEIN	17.74±0.08
FLAVONE	8.98±0.04
TANINNS (ug/ml)	37.45±0.10

The result of the mineral test in table 2 revealed that there was a significant difference in copper and molybdenum concentrations of rats supplemented with jack fruit seed were significantly lighter when compared with those of control group i.e. those fed only on top feed. While manganese and zinc were significantly higher in top feeds than in jackfruit.

Table 2: Concentration of Some Minerals Present In Jack Fruit Seed And Top Feed Used in the Study

MINERAL ELEMENT (Ppm)	JACK FRUIT	TOP FEED
IRON	3.49±0.01	3.68±0.01
MANGANESE	0.36±0.01	2.23±0.01
COPPER	0.32±0.01	0.00±0.00
ZINC	0.82±0.01	4.69±0.02
MOLYBDONUM	0.06±0.01	0.00±0.01
SELENIUM	0.19±0.01	0.32±0.00

The result in table 3 indicated that jackfruit seed has significantly lower ($p<0.05$) concentration of vitamin C and E.

Table 3: Water Soluble Vitamins and Fat Soluble Vitamins

VITAMINE (mg/kg)	VALUES	JACK FRUIT
Vitamin C	84.48±0.60	154.0±0.04
Vitamin E	3.32±0.01	149.99±007

The result of the proximate composition of jackfruit seed and top feed used in this study reveals that jackfruit seed has significantly higher ($p<0.05$) concentration of fat than top feed. The result in table 4 further reveals that top feed has significant higher concentration ($p<0.05$) of ash than jackfruit seed, also that both jackfruit seed and top feed used in this study have high carbohydrate.

COMPOSITION (%)	JACK FRUIT	TOP FEED
MOISTURE	14.44±0.02	11.88±0.02
FAT	26.06±0.03*	10.84±0.04
ASH	2.85±0.01	13.44±0.05*
FIBRE	1.48±0.01	2.17±0.01
PROTEIN	13.3±0.50	17.85±0.40
CARBOHYDRATE	41.84±0.56	41.18±0.38

Table 4: The Proximate Composition of Jack Fruit Seed Feed

Liver and Kidney Function Test

Table 5: Concentration of Some Liver Markers Present In Different Groups of Rats Used In the Study

N.B

A =Rats feed with normal rat feed

B=Rats fed 40% jackfruit seed and 60%rat feed

C=Rats fed with 60% jackfruit seed and with 40% rat feed.

The result of some liver function markers evaluated in this study (Table 5) indicated that there was no significant difference ($P > 0.05$) observed in Total Protein(TP), Albumine (ALB) and globulin (GLOB) concentrations of rats supplement with Jackfruit feed (group B and C) when compared with those feed with animal seed only (group A). the result in (table 5) also indicates that there was significant increase ($p<0.05$) in Alkaline Phosphatase (ALP), Alkaline amino transferase (ALT) and aspartate Amino transferase (AST) concentration of rat supplemented with Jackfruit feed (B and C) when compared to rat feed with animal feed (control A).Aspartate amino transferase (AST)concentration of rats supplement with jackfruit seed (B and C) when compared to rat feed with animal feed only (control A.) the result in table 5 also revealed significant increase ($p<0.05$) in ALT of rats fed with 49% jackfruit seed diet (group B) when compared to that of the control (group A).

Results in the table 5 further reveals significant decrease in the ALP of rats fed with 60% jackfruit seed diet when compared to the control (group A). Results in table 5 further revealed significant decrease in the ALP of rats fed with 60% jackfruit seed diet when compared to the control (group A). However the result of all the liver markers assayed for in this study revealed that they are all within normal range.

GROUPS	AST	ALT	ALP	TP	ALB	GLOB
A	46.5±0.10	103.0±0.30	171±0.10	6.5±0.01	3.7±0.01	2.9±0.01
B.	73.5±0.08	128±.50.40	174±0.10	6.6±0.01	3.9±0.01	2.3±0.01
C	107.0±0.50	104.0±0.02	125±0.8	6.0±0.01	3.5±0.01	2.45±0.01

Table 6: Concentration of Some Kidney Markers Present Different Groups of Rats Used In The Study

GROUPS	UREA	CREATININE
A	41.5±0.20	1.45±0.01
B	54.5±0.8	0.85±0.01
C	36.5±0.10	0.75±0.01

N.B
A = Rats feed with normal rat feed
B = Rats fed 40% jack fruit seed feed and 60%rat feed
C = Rats fed with 60% jack fruit seed feed and rats fed with 40% rat feed.

The result of some kidney function markers assayed in the study table revealed that there was a significant difference ($P > 0.05$) observed in the urea levels of rats fed with jackfruit seed (group B and C) when compared to the control (group A). The result table 6 also revealed that the creatinine levels of rats fed on jackfruit seeds (group B and C) were lower than those of the control group (group A), but they were still within normal range.

Table 7: Concentration of Some Electrolyte Markers Present In Jack Fruit Seed And Top Feed Used In the Study

GROUPS	K^+	NA^+	CL^-	$HC0_3^-$
A	11.905±0.08	197.53±0.50	197.53±0.50	22.5±0.03
B	7.68±0.02	135.3±0.10	135.3±0.10	35±0.01
C	6.505±0.08	135.125±0.30	135.125±0.30	22.5±0.08

N.B
A = Rats feed with normal rat feed
B = Rats fed 40% jack fruit seed feed and 60%rat feed
C = Rats fed with 60% jack fruit seed feed and rats fed with 40% rat feed.

The result of some electrolyte markers assayed in the study (Table 7) Revealed that the electrolyte concentrations of K^+, NA^+, CL^-, $HC0_3^-$ were all within the normal range.

Hematology Profile Result of Hematology Profile of Different Groups of Rats Used In the Study

Table 7 hematology profile of different groups of rats used in the study

Group	PCV (%)	HB (G/DL)	RBC ($x10^3$/11L)	Total WBC ($x10^3$/11L)
A	39.30±2.04	13.10±1.80	8.10±0.49	7.20±0.27
B	47.91±3.40	15.97±0.40	10.90±0.26	7.65±0.45
C	50.91±2.10	16.97±0.40	12.10±0.11	7.80±0.36

Result in Table 7 revealed that PCV, Hb and RBC concentrations of rats fed on 40% of jack fruit seed (group B) AND 60% jackfruit seed diet (group C) Were significantly higher than those of the control (group A). Result in Table 7 further revealed that there was no significant difference ($p>0.05$) observed in WBC counts of rats fed on 40% jackfruit seed diet (group B), rats fed on 60% jackfruit seed (group C) when compared to those fed on normal fed only (control).

DISCUSSION

In this study, the nutritional compositions of boiled jack fruit seeds and their effects on some biochemical parameters of wistar rats were evaluated. The result of quantitative phytochemical composition of the boiled jack fruit seeds used in the study revealed that it contains high concentration of Flavonones, Tannins and Epicatechin (Table 1) Flavonones and Epicatechins are flavonoids assisting in preventing oxidative stress. Furthermore, the results of antioxidant minerals compositions of boiled jack fruit seed used in the study revealed that jack fruit seed contains high concentration of iron and little quantities of manganese, copper, zinc molybdenum and selenium (Table 2). Iron is the major component of red blood

cells known as erythrocytes. Iron is found while Tannins are polyphenols. Flavonoids and phenols are known to possess good antioxidant potentials [3,9]. The result of quantitative phytochemical analysis of boiled jack fruit seed used in the study revealed that it possesses good antioxidant activity and therefore suggests that its diets could be useful in scavenging free radicals in the body. The iron in the haemoglobin assists in the transportation of oxygen from the lungs to other tissues in the body [9]. The result of this study is in agreement with the work of [15] which reported that due to high iron content of jack fruit seed that the diet could be used in treatment of anaemia. The results of the antioxidant mineral elements assayed in this study (Table 2) therefore suggests that boiled jack fruit seeds diet could assist in boosting the haemoglobin concentration and hence in the transportation of oxygen in the body. The results in Table 2 also suggest that boiled jack fruit seed possess some antioxidant activity. The results of antioxidant vitamins C and E for boiled jack fruit seed used in the study (Table 3) revealed that it contains significant concentration of vitamins C and E, although lower than the concentrations present in the top seed used in the study. Vitamins C and E are known to be good antioxidant vitamins [5]. The results of this study therefore reveal that boiled jack fruit seeds possess good antioxidant phytochemicals, antioxidant mineral elements and antioxidant vitamins. This suggests that boiled jack fruit seeds diet could be useful in scavenging free radicals in the body thereby preventing oxidative stress in the body. The result proximate analysis of boiled jack fruit seeds used in the study indicated that it contains high carbohydrate and fats with moderate percentage of protein. The result of proximate composition of jack fruit seeds used in the study is in agreement with the report of [5] which also indicated that jack fruit seeds contain about 42% of carbohydrate and appreciable quantity of fats and protein. The results in Table 4 suggests that jack fruit seeds when metabolized could be useful source of energy generation because of its high carbohydrate and fats composition. It high iron content and appreciable protein composition could assist in boosting blood parameters of anaemia [16]. The results of some liver function markers evaluated in this study showed that there was no significant different ($P>0.05$) observed in the total protein, albumin and globulin concentrations of rats fed with jack fruit seed diets (Group B and C) when compared to those of the control (Group A) fed with only normal rat geed. This suggests that jack fruit seed was not toxic to the rats. The results in Table 5 also revealed that there was increase in AST concentration of rats supplemented with jack fruit seed (Groups B and C) when compared to those of rats fed with animal feed only (Group A), however they were still within the normal range. The results in Table 5 also revealed significant increase ($p<0.05$) in ALT of rats fed with 40% Jack fruit seed diet (Group B) when compared to that of the control (Group A). Table 5 further revealed significant decrease in the ALP of rats fed with 60% Jack fruit seed diet when compared to the control (Group A). However the results of all the liver markers evaluated in this study revealed that they are all within the normal range. The results of the liver function parameter evaluated therefore suggest that Jack fruit seed diet is not toxic to the liver. This result is in agreement with the findings of [18] who reported the hepatoprotective effect of aqueous extract of seed of jack fruit against CCl_4 induced hepatotoxicity of Swiss albino mice. The results of some kindey function markers assayed in the study (Table 6) revealed that there was no significant difference ($p<0.05$) observed in the urea level of rats fed with jack fruit seed (Group B and C) when compared to the control (Group A). Results in the Table 6 also revealed that the creatinine level of rats fed on jack fruit seeds (Groups B and C) were lower than those of the control (Group A), but were still within the normal range. The results of kidney function

markers suggests that the boiled jack fruit seed seeds used in the study were not toxic to the kidney, furthermore, the results of the electrolytes (K^+, Na^+, Cl^- and HCO^-_3) were all within the normal range. Results of electrolyte assays give credence to non-toxicity of boiled jack fruit seed to the kidney of wistar rats used in the study

CONCLUSION

The result of this study therefore indicates that boiled jackfruit seed possess good antioxidant phytochemical, antioxidant mineral elements and antioxidant vitamins. This suggest that boiled jackfruit seed diet could be useful in scavenging free radicals in the body, thereby preventing oxidative stress in the body. The result of this study also showed that boiled jackfruit seed diet has high iron content and appreciable protein which could assist in boosting blood parameters and hence in the treatment of anaemia. The result of liver and kidney function assay reveled that boiled jackfruit seed diet was not toxic to the liver and kidney of the albino rats used in the study therefore consumption of boiled jackfruit seed is encourage considering its nutritive potentials.

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