International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

Check for updates

Growth performance, carcass traits and internal organs of broiler chickens fed differently processed earth ball (*Icacina mannii*) meals

Ndak, U. U [1,*], Unah, U. L. [2], Assam, E. M .[1], Ekpo, K.O. [3], Onukak, C. E.[1] and Edo T. A.[1]

[1] *Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus, Nigeria.*

[2] *Department of Animal Science, Faculty of Agriculture University of Uyo, Uyo, Akwa Ibom State, Nigeria.*

[3] *Department of Animal Science, Faculty of Agriculture Akwa Ibom State College of Science and Technology, Nung Ukim, Ikono, Nigeria.*

International Journal of Science and Research Archive, 2026, 19(03), 687-696

Publication history: Received on 06 May 2026; revised on 13 June 2026; accepted on 16 June 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.19.3.1333

Abstract

This study was conducted using ninety – six (96) day-old Cobb 500 chicks to evaluate the effect of differently processed *Icacina mannii* meals on growth performance, carcass traits and internal organs of broiler chickens. The chicks were allotted to four dietary treatments, T_1 (0%IMM), T_2 (10%OIM), T_3 (10%TIM) and T_4 (10%FIM) each having twenty-four (24) birds and replicated three (3) times with eight (8) birds per replicate in a Completely Randomized Design (CRD). The different processing methods used were oiled *Icacina mannii* meal (OIM), toasted *Icacina mannii* meal (TIM) and fermented *Icacina mannii* meal (FIM). Feed and water were fed *ad libitum* and the experiment lasted for 56 days. Data collected on growth performance, carcass traits and cost benefits of finisher broilers were subjected to analysis of variance (ANOVA) using SPSS software. At the starter phase the results showed significant ($P<0.05$) differences existed among all the parameters measured for growth performance except the initial body weight. At the finisher phase, birds fed oiled *Icacina mannii* meal (OIM) showed progressive increase in most parameters evaluated, followed by toasted *Icacina mannii meal (TIM) and fermented Icacina mannii meal (FIM). The results of the carcass traits and internal organs of birds* fed differently processed *Icacina mannii* meals revealed that processing influenced significantly ($P<0.05$) the values for live weight, dressed weight, thigh, breast, and back cut while the gallbladder, lungs and the pancreas were also affected significantly ($P<0.05$). The differently processed *Icacina mannii* meals did not show any significant ($P>0.05$) effect on other parameters measured. In conclusion starter and finisher broiler chickens could be fed with the different processed *Icacina mannii* meals at 10% inclusion level without any deleterious effect on growth performance, carcass traits and internal organs. It is therefore recommended that oiled *Icacina mannii* meal (OIM) should be used in compounding feeds for broiler chickens at 10% inclusion level.

Keywords: Broiler; Growth Performance; Carcass Traits; Icacina Mannii; Internal Organs

1. Introduction

Poultry industry provides a reliable source of high quality meat which is popular among the majority of Nigeria's populace. Poultry production, especially the broiler chickens remains one of the dynamic ways of attaining sustainable production of high quality protein to meet the increasing demand of the Nigeria's teeming populace due to short generation interval of broiler chickens [1]. One of the major challenges confronting the poultry industry in Nigeria is the increase in the cost of conventional feed ingredients especially protein and energy sources.

The continued price increase and scarcity of conventional feed ingredients due to the competition between man and animal had resulted into search for non-conventional feed ingredients as replacement for the relatively scarce and costly

* Corresponding author: Ndak UU

conventional feed ingredients. The prospect of using a non-conventional feedstuff for livestock feed depends on its ability to provide adequate nutrients that will meet the nutritional requirement of the animal, thus enhancing growth and normal physiological process of the animal [2].

One of the non-conventional feed ingredients that is readily available, not competed for by man and is nutritionally safe is *Icacina mannii* tuber. *Icacina mannii* is a shrub with modified tuber which is mainly carbohydrate. It is widely available, not seasonal and not directly consumed by man [3]. It can be propagated by both seed and tuber sprout. Mature tuber weighs up to 20kg and their shape and colour varies based on soil type and stage of maturity. *Icacina mannii* tuber has crude protein content of 5.60-6.26% and gross energy of 3.21 – 3.58 Kcal/kg depending on usage [4].

It also contains various micro and macro minerals such as zinc, iron, manganese, copper, sodium, potassium, phosphorus and calcium at varying levels that aid in the animal growth and maintenance [4]. *Icacina mannii* though contained minimal protein, it also contains some anti-nutritional factors such as cyanogenic glycosides, phytic acid, and oxalate acid. Therefore, to enhance utilisation, processing methods such as oiled *Icacina mannii* meal (OIM), toasted *Icacina mannii* meal (TIM) and fermented *Icacina mannii* meal (FIM) become necessary to reduce the anti-nutritional factors that limit its use as animal feed ingredient [4]. This research was therefore aimed at investigating the growth performance, carcass traits, internal organs and cost benefit of starter and finisher broiler fed the differently processed methods of *Icacina mannii* meals.

2. Materials and methods

2.1. Experimental Site

The research was conducted at the Poultry Unit of the University of Uyo Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, University of Uyo, Uyo, Akwa Ibom State. Uyo is located on latitude $5^0 2^1$ N and longitude $7^0 55^1$ E, with an elevation of about 60.96m above sea level. Uyo has a bi-modal rainfall pattern with mean annual rainfall of 2190mm and mean relative humidity of 81% [5].

2.2. Source/ Preparation of Test Ingredient

Fresh *Icacina mannii* tubers were sourced from the fallow lands of Ikot Ebak in Mkpat Enin Local Government Area of Akwa Ibom State, Nigeria. The *Icacina mannii* tubers obtained were prepared into three different forms prior to feeding namely: Oiled *Icacina mannii* meal (OIM), toasted *Icacina mannii* meal (TIM) and fermented *Icacina mannii* meal (FIM).

2.2.1. Oiled Icacina mannii meal (OIM)

Preparation was carried out as reported by [6]. Fresh tubers of *Icacina mannii* tubers were harvested with no bruises. The tubers were peeled to remove the stalk, woody tips and any fibrous roots using a sharp knife. Peeled tubers were sliced and washed with clean water to remove any dirt and thereafter, grated with a mechanical grating machine to crush the tubers into a fine mash. Twenty (20) mills of palm oil was added per kg of *Icacina mannii* tuber mash and mixed thoroughly. The grated tuber mash with oil is then packed into a clean bag, such as a jute bag to allow for escape of extra water. The sac bag with the fine mash is then pressed with hydraulic jack to remove excess water until the grated mash crumble for 12 hours. The mash is then dried and hand mashed with home-made sieve to obtain oiled *Icacina manni* meal prior for use in feeding trials.

2.2.2. Toasted Icacina mannii meal (TIM)

Fresh tubers of *Icacina mannii* tubers were harvested, peeled and grated with mechanical grating machine to crush the tubers into a fine mash as reported by [7]; [8] and [6]. The dewatered lumps of grated *Icacina mannii* were crumbled with hand to remove the fibrous matter. The remaining mash is sieved with a traditional sieve made of splinters of cane. After being sieved, it was toasted traditionally in earthen pot over a fire made from splitted woods with an axe for 45minutes at 60^0C. After toasting, the toasted product was air dried to remove excess heat from the garri form of *Icacina mannii* meal accompanied with some moisture. These allow the toasted product to cool down and become crispy. Also, a simple home-made sieve was used to sieve the toasted product to remove any lumps. This was carried out to obtain high quality free flowing products ready for usage. This method of toasting was reported by [9] and [10].

2.2.3. Fermented Icacina mannii meal (FIM)

Anaerobic fermentation was adopted as reported by [11], [12] and [13]. In anaerobic fermentation, peeled and sliced *Icacina mannii* tubers were placed in a capped plastic bucket and allow to ferment for 3 days (72 hours) at an optimum temperature of 35⁰C. The *Icacina mannii* meal after fermentation were grated into mash and packed into porous jute bags and pressed with an hydraulic jack machine for 12 hours to drain out excess water. The *Icacina mannii* meal was then hand mash with home-made sieve to obtained fermented *Icacina mannii* meal prior for use in feeding trials.

Table 1 Composition of Experimental Starter Diets (%)

Treatments **Levels of inclusion (%)**	**T1** **0 (Control)**	**T2** **10 (OIM)**	**T3** **10 (TIM)**	**T4** **10 (FIM)**
Ingredients				
Maize	58.00	47.00	47.00	47.00
Soya bean meal	32.50	33.00	33.00	33.00
PIMM	0.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00
Limestone	2.00	2.00	2.00	2.00
Palm oil	0.50	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated Nutrients (%)				
Crude Protein	22.95	22.84	22.91	22.85
Metabolizable Energy (Kcal/kg)	3027.22	3078.76	3044.97	3049.09
Crude Fibre	3.93	4.50	4.59	4.55
Ether Extract	4.06	4.42	3.93	3.93
Calcium	0.48	0.55	0.55	0.55
Phosphorus	0.64	0.69	0.69	0.69

1kg of premix contains: vitamins A (5,000,000Iu), Vitamin D3 (1,000,000 1U), Vitamin E (16,000mg), vitamin K3 (800mg), vitamin B1 (1,200mg), Vitamin B2 (22,000mg), Niacin (22,000mg), Calcium panthothenate (4,600mg), Vitamin B6 (2000mg), Vitamin B12 (10mg), Folic acid (400mg), Biotin (32mg) ,Choline chloride (200,000mg), Manganese (48,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), iodine (600mg), Cobalt (120mg), Selenium (40mg), antioxidant (48,000mg). OIM = Oiled Icacina manni meal, TIM = Toasted Icacina manni meal, FIM = Fermented Icacina manni meal.; PIMM= Processed Icacina mannii meal

Table 2 Composition of Experimental Finisher Diets (%)

Treatments **Levels of inclusion (%)**	**T1** **0 (Control)**	**T2** **10 (OIM)**	**T3** **10 (TIM)**	**T4** **10 (FIM)**
Ingredients				
Maize	60.00	49.00	49.00	49.00
Soya bean meal	30.00	30.00	30.00	30.00
PIMM	0.00	10.00	10.00	10.00
Fish meal	4.50	4.50	4.50	4.50

Bone meal	2.00	2.00	2.00	2.00
Limestone	2.00	2.00	2.00	2.00
Palm oil	0.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated Nutrients (%)				
Crude Protein	21.60	21.39	21.46	21.40
Metabolizable Energy (Kcal/kg)	3018.22	3036.42	3001.63	3005.75
Crude Fibre	4.32	4.85	4.85	4.81
Ether Extract	4.20	4.51	4.02	4.02
Calcium	0.48	0.55	0.55	0.55
Phosphorus	0.66	0.66	0.66	0.66

1kg of premix contains: vitamins A (5,000,000Iu), Vitamin D_3 (1,000,000 1U), Vitamin E (16,000mg), vitamin K_3; (800mg), vitamin B_1 (1,200mg), Vitamin B_2 (22,000mg), Niacin (22,000mg), Calcium panthothenate (4,600mg), ; Vitamin B6 (2000mg), Vitamin B_{12} (10mg), Folic acid (400mg), Biotin (32mg) ,Choline chloride (200,000mg),; Manganese (48,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), iodine (600mg), Cobalt (120mg),; Selenium (40mg), antioxidant (48,000mg). OIM = Oiled *Icacina manni* meal, TIM = Toasted *Icacina manni* meal,; TIM = Toasted *Icacina manni* meal, FIM = Fermented *Icacina manni* meal.; PIMM= Processed *Icacina mannii* meal

2.3. Experimental Animals, Management and Design

A total of ninety – six (96) day-old of Cobb 500 broiler chicks consisting of both sexes were sourced from Unfailing Veterinary and Pest Control Services, a major day old chicks' distribution agent located at 75 Aka Road, Uyo, Akwa Ibom State, Nigeria. At the commencement of the experiment, the chicks were weighed using a precision weighing balance (SF-400 model) to determine their initial weights. They were then allotted into four (4) dietary treatments, with twenty-four (24) birds each group and was replicated three (3) times, with eight (8) birds per replicate in a Completely Randomized Design (CRD). The broiler chicks were brooded for one (1) week. During the brooding stage, heat was provided to the chicks using kerosene lanterns, stove and 200 watt bulbs. The birds were given experimental diets throughout the study that lasted for 56 days. Four experimental diets were formulated to contain 0%, 10%, 10% and 10% of the differently processed *Icacina mannii* meals and were used with other feed ingredients (maize, soybean, palm kernel cake, fishmeal and bone meal) to formulate a concentrate diet as shown on Tables 1 and 2.

2.4. Data Collection

The birds' initial body mass (weight) was recorded at the commencement of the experiment. Thereafter, they were weighed weekly in the morning. The weight gain was calculated by taking the difference between the final weight and the initial weight. Weighing was done using 10,000g SF-400 sensitive scale. Feed intake data was measured by calculating the difference between the amount offered and the amount remaining each day. The resulting values were then used to calculate the feed intake, final body weight, daily body weight gain, feed conversion ratio (FCR), feed efficiency, protein intake and protein efficiency ratio. At the end of the experiment (56 days), evaluation of carcass traits was assessed. Six (6) birds were selected from each treatment, ensuring they were closest to the average weight within replicates. These birds were then fasted overnight and weighed to determine their live weight. They were subsequently bled by cutting the jugular vein and then immersed in hot water (85˚C) for three (3) minutes, defeathered, eviscerated and the carcasses were cut into parts. The neck, the head, the visceral organs and the shank were removed to obtain the dressed weight from which the percentage dressed weight was calculated as dressed weight divided by live weight, multiplied by 100. The organs were weighed and presented as a percentage of the live weight as well as the internal organs weights.

2.5. Data Analysis

Data obtained were subjected to Analysis of Variance (ANOVA) and their means were separated by Duncan Multiple Range Test using SPSS version 20.0.

Data (Statistical) Model:

$$Y_{ij}=\mu + Ʈ_i + e_{ij}$$

Where:

Y_{ij} = Single observation

μ= Overall mean

$Ʈ_i$ = Effect of treatment

e_{ij} = Error term.

3. Results

3.1. Growth Performance

The results of the growth performance of broiler chickens fed differently processed *Icacina mannii* meals for starter and finisher broiler chickens are presented in Tables 3 and 4. Significant (P<0.05) differences existed in all the parameters measured for growth performance at the starter phase except for initial body weight. The values obtained for initial weight were 35.54g, 35.54g, 35.46g and 35.54g for T1, T2, T3 and T4 respectively. For the final body weight, weight gain and daily weight gain, birds on T1 (0%IMM) were significantly (P<0.05) higher than T2 (10%OIM), T3 (10%TIM) and T4 (10%FIM) that were statistically (P>0.05) similar. The total feed intake of the birds also differed significantly (P<0.05). Birds fed diet T1 (0%IMM) was significantly (P<0.05) higher than T2 (10%OIM) and T4 (10%FIM) but similar to T3 (10%TIM)). The daily feed intake of the birds followed the same trend as the total feed intake. There were significant (P<0.05) differences in feed conversion ratio as birds on diet 1 (0%IMM) recorded the least feed conversion ratio of (2.40), followed by diet 4 (2.54). Daily protein intake (DPI) showed significant (P<0.05) differences across the dietary treatments. T1 (0%IMM) was statistically similar (P>0.05) to T2 (10%OIM) and T4 (10%FIM) but significantly (P<0.05) different from T3 (10%TIM)). The dietary inclusion of the differently processed *Icacina mannii* meals (Table 3) reduced the cost of feed production from (₦ 868.77) in the control to (₦ 746.19) in the processed treatments. Birds on T3 (10%TIM)) and T4 (10%FIM) had the least cost of feed per kg and the least cost of feed consumed was recorded for birds in T4 (10%FIM) with the value of (₦ 746.19) while the least cost/ kg weight gain was obtained from birds fed diet containing T2 (10%OIM) and T4 (10%FIM). The results from the finisher phase showed significant (P<0.05) differences in all the parameters measured. The initial body weights obtained were 532.38g, 476.83g, 478.17g and 472.75g for T1 (0%IMM), T2 (10%OIM), T3 (10%TIM) and T4 (10%FIM) respectively. For the final weight, birds fed T1 (0%IMM) were statistically similar (P>0.05) to birds fed T2 (10%OIM) but significantly (P<0.05) different from birds fed T3 (10%TIM) and T4 (10%FIM). Weight gain and daily weight gain followed the same pattern across the dietary treatments. On the total feed intake and daily feed intake, birds fed T4 (10%FIM) had the highest value which was significantly (P<0.05) different from T1 (0%IMM) and T3 (10%TIM) while T2 (10%OIM) had the lowest which was significantly (P<0.05) differently from other treatments. The feed conversion ratio of birds on T1 (0%IMM) and T2 (10%OIM) were statistically similar (P>0.05) but differed significantly (P<0.05) from T3 (10%TIM) and T4 (10%FIM). However, birds on T2 (10%OIM) had the least value (2.14). The protein efficiency and feed efficiency followed the same pattern, birds on T1 (0%IMM) and T2 (10%OIM) were statistically similar (P>0.05) but differed significantly (P<0.05) from T3 (10%TIM) and T4 (10%FIM). The cost per kg of feed reduced with the inclusion of dietary levels of the processed *Icacina mannii* meals. The cost of feed consumed was highest in the control diet which was significantly (P<0.05) different from the processed groups. Birds on T2 (10%OIM) had the least cost of feed consumed ₦ 2059.30 and the least cost/ kg weight gain (₦ 1388.84).

Table 3 Growth Performance and Cost Benefit of Starter Broiler Chickens Fed Diets Containing Differently Processed *Icacina mannii* Meals

Treatments **Levels of inclusion (%)**	**T1** **0 (Control)**	**T2** **10 (OIM)**	**T3** **10 (TIM)**	**T4** **10 (FIM)**	**SEM**
PARAMETERS					
Initial weight (g/bird)	35.54	35.54	35.46	35.54	0.10
Final weight(g/bird)	532.38^{a}	476.83^{b}	478.17^{b}	472.75^{b}	8.49
Weight gain (g/bird)	496.83^{a}	441.29^{b}	442.71^{b}	437.21^{b}	8.58
Daily weight gain (g/bird)	17.75^{a}	15.76^{b}	15.81^{b}	15.61^{b}	0.30
Total Feed intake(g/bird)	9308.67^{a}	9030.67^{b}	9140.00^{ab}	8931.33^{b}	6.33
Daily Feed intake(g/bird)	42.56^{a}	40.31^{b}	40.80^{a}	39.87^{b}	0.41
Feed conversion ratio	2.40^{b}	2.56^{a}	2.58^{a}	2.54^{ab}	0.03
Daily protein intake	9.18^{a}	8.60^{b}	8.70^{b}	8.51^{b}	0.10
Feed efficiency	0.42^{a}	0.39^{b}	0.39^{b}	0.39^{b}	0.00
Protein efficiency	1.94^{a}	1.84^{ab}	1.81^{b}	1.84^{ab}	0.02
Feed cost/kg of feed (₦)	746.63^{a}	683.38^{b}	638.38^{c}	638.38^{c}	11.92
Cost of feed intake/bird(₦)	868.77^{a}	772.31^{b}	760.57^{bc}	746.19^{c}	14.66
Cost of feed intake/kg body weight gain (₦)	791.91^{a}	749.45^{c}	763.12^{b}	747.17^{c}	5.37

a-c: Means on the same row with different superscripts are significantly (P<0.05) different; SEM=Standard Error of Mean

Table 4 Growth Performance and Cost Benefit of Finisher Broiler Chickens Fed Diets Containing Differently Processed *Icacina mannii* Meals

Treatments **Levels of inclusion (%)**	**T1** **0 (Control)**	**T2** **10 (OIM)**	**T3** **10 (TIM)**	**T4** **10 (FIM)**	**SEM**
PARAMETERS					
Initial weight (g/bird)	532.38^{a}	476.83^{b}	478.17^{b}	472.75^{b}	8.49
Final weight(g/bird)	1886.67^{a}	1956.67^{a}	1533.33^{b}	1433.33^{b}	73.26
Weight gain (g/bird)	1354.29^{a}	1479.83^{a}	1055.17^{b}	960.58^{b}	70.24
Daily weight gain (g/bird)	48.37^{a}	52.85^{a}	37.68^{b}	34.31^{b}	2.51
Total Feed intake(g/bird)	3220.85^{b}	3177.53^{c}	3220.03^{b}	3312.93^{a}	15.01
Daily Feed intake(g/bird)	115.30^{b}	113.49^{c}	115.00^{b}	118.32^{a}	0.54
Feed conversion ratio	2.42^{b}	2.14^{b}	3.06^{a}	3.46^{a}	0.17
Daily protein intake	22.47^{b}	22.12^{c}	22.41^{b}	23.06^{a}	0.02
Feed efficiency	0.42^{a}	0.47^{a}	0.33^{b}	0.29^{b}	0.11
Protein efficiency	2.15^{a}	2.39^{a}	1.68^{b}	1.49^{b}	9.24
Feed cost/kg of feed (₦)	718.73^{a}	647.99^{b}	647.99^{b}	647.99^{b}	29.96
Cost of feed intake/bird(₦)	2314.92^{a}	2059.30^{d}	2086.52^{c}	2146.71^{b}	94.68

Cost of feed intake/kg body weight gain (₦)	1736.93^{c}	1388.84^{d}	1982.82^{b}	2239.85^{a}	0.17

a-c: Means on the same row with different superscripts are significantly ($P<0.05$) different; SEM=Standard Error of Mean

3.2. Carcass Traits

The results for the carcass traits of broiler chickens fed differently processed *Icacina mannii* is presented in Table 5. From the study, it was observed that the final live weight, drumstick, neck, shank and wing were not significantly ($P>0.05$) affected by the different processed *Icacina mannii* meal but dressed weight, dressing percentage, thigh, breast and back cut, were significantly ($P<0.05$) influenced by the different processed *Icacina mannii* meal. Birds fed T1 (0%IMM) recorded the highest values for live weight, dressed weight and dressing percentage followed by birds fed T2 (10%OIM). The least was recorded for birds on T4 (10%FIM).

The results for the internal organs of broiler chickens fed differently processed *Icacina mannii* are shown in Table 6. The results revealed that, lungs, pancreas and the gallbladder were significantly ($P<0.05$) different from the spleen, kidney, liver, gizzard, heart, oesophagus, proventriculus that were not affected by the different processed methods statistically ($P>0.05$).

Table 5 Effect of Differently Processed Icacina mannii (Earth Ball) Meals on Carcass (% body live weight) Yield of Broiler Chickens

Treatments **Levels of inclusion (%)**	**T1** **0(Control)**	**T2** **10 (OIM)**	**T3** **10(TIM)**	**T4** **10(FIM)**	**SEM**
Carcass Parameters (%)					
Final body Live weight (g)	1900.00	1766.67	1300.00	1600.00	90.72
Dressed Weight (g)	1700.00^{a}	1566.67^{ab}	1433.33^{bc}	1400.00^{c}	41.06
Dressing %	89.45^{a}	88.67^{ab}	87.72^{bc}	87.50^{c}	0.27
CUT PARTS (% Live weight)					
Thigh	12.61^{b}	14.35^{ab}	12.43^{b}	17.75^{a}	12.41
Drumstick	12.07	13.21	12.07	16.36	0.77
Breast	19.25^{b}	22.29^{b}	21.91^{b}	29.40^{a}	1.35
Neck	5.77	6.30	6.14	8.86	0.61
Backcut	20.42^{ab}	17.61^{b}	16.60^{b}	23.79^{a}	1.08
Shank	4.98	5.45	3.57	5.50	5.06
Wings	10.00	11.56	12.18	10.80	0.75

Table 6 Effect of Differently Processed *Icacina mannii* (Earth Ball) Meals on Internal Organs of Broiler Chickens Internal organs (%)

Treatments **Levels of inclusion (%)**	**T1** **0 (Control)**	**T2** **10(OIM)**	**T3** **10 (TIM)**	**T4** **10(FIM)**	**SEM**
Liver	2.08	2.21	2.21	2.25	0.05
Lungs	0.58^{ab}	0.61^{ab}	0.71^{a}	0.48^{b}	0.03
Gizzard	3.52	3.73	4.08	6.59	0.65
Heart	0.55	0.64	0.55	0.57	0.03

Pancreas	0.13^{b}	0.12^{b}	0.18^{b}	0.44^{a}	0.05
Oesophagus	0.16	0.16	0.13	0.13	0.02
Spleen	0.12	0.12	0.11	0.11	0.02
Proventriculus	0.58	0.61	0.58	0.61	0.05
Kidney	0.05	0.06	0.06	0.06	0.00
Intestine	4.57	5.24	4.68	5.27	0.17
Gall bladder	0.16^{b}	0.17^{b}	0.19^{a}	0.19^{a}	0.04

a-c: Means on the same row with different superscripts are significantly (P<0.05) different; SEM=Standard Error of Mea

4. Discussion

From the results at the starter phase, the initial body weight of birds fed differently processed *Icacina mannii* presented in Tables 3 showed no significant (P>0.05) difference. This is due to the fact that the chicks were unbiased (equally) distributed to the experimental diets by weight. The final body weight of birds fed T1 (0%IMM) were significantly (P<0.05) higher than T2 (10%OIM), T3 (10%TIM) and T4 (10%FIM) that were statistically (P>0.05) similar. Birds fed the control diets had a superior final body weight, weight gain and daily weight gain compared to those on oiled, toasted and fermented (532.38g, 496.83g and 17.75) respectively. The low weight gains may be attributed to the reduction in feed intake as reported by [15] and [16] who stated that the gut health is critical and that the relationship between the gut health and growth performance is crucial especially the young birds. This result is in with [16] who stated that birds fed control diets had superior average daily weight (21.93g) compared to those on diets with 30% each of toasted (10.30g) and fermented *I. mannii* (14.38g). Birds fed the control diet recorded the highest significant (P<0.05) average daily feed intake (42.56) compared to oiled (40.31), toasted (40.80) and fermented (39.87). This may be due the presence of anti-nutritional factors, dustiness [18]; and [19] and the bulky nature of the feed samples [20]. This is also in agreement with the report of [17]. Birds on the treatment diets recorded the highest feed conversion ratio (FCR) of 2.56, 2.58 and 2.54 for oiled, toasted and fermented *I. mannii* meals respectively. The FCR values recorded in this study is in line with the recommended value of 2.5 by [22] at starter phase. The FCR recorded in this study were also similar to the range 2.14- 2.59 reported by [17] observed at the starter phase. The cost per kg of feed, cost of feed consumed per bird and cost per kg body weight gain reduced with the inclusion of different processed *I. mannii* meals. The results of this study is in line with the report of [19] who reported that the cost of feed reduced with increase in dietary level of the rumen filtrate-fermented *I. manni* meal and birds on diet containing 60% processed *I. manni* meal had the least cost of feed consumed. At the finisher phase, the initial body weight of birds fed the control diets were significantly (P<0.05) higher than those fed treatment diets that were statistically (P>0.05) similar. Birds fed the control diets and oiled *I. mannii* had a superior final body weight, weight gain and daily weight gain compared to those on toasted and fermented *I. mannii* meals, T2 (10%OIM) recorded the highest values of 1956.67g, 1479.83g and 52.85g respectively. The average daily weight gain obtained in this study were higher than those reported by [22] and [23] who reported the average daily weight gain ranging from 33.65 to 35.86g and 36.95g for broiler chickens fed diets containing composite cassava supplemented with or without palm oil/methionine and cassava peel meal supplemented with palm oil, respectively at finisher phase. Birds fed the diet containing fermented *I. mannii* meal recorded the highest values for total feed intake and daily feed intake of 3312.93g and 118.32g respectively. Birds on the control diet were statistically (P>0.05) similar to those fed T2 (10%OIM) and T3 (10%TIM). The results obtained in this study agrees with the findings of [19] where feed intake of broilers in the control was statistically (P>0.05) similar with birds fed 30% TIMM (toasted *I. mannii)* The feed conversion ratio (FCR) for birds fed toasted and fermented *I. mannii* meals were significantly (P<0.05) higher than those fed oiled *I. mannii* meal and birds fed control diet while the oiled *I. manni* meal had the value (2.14). The FCR values recorded in this study were also similar to the FCR values of 2.14-3.61, 3.10- 3.78 and 2.52- 3.03 reported by [24], [25] and [23] for broiler chickens fed diets containing cassava peel meal supplemented with palm oil, rumen filtrate *Icacina mannii* meal and cassava root flour meal, respectively. The cost per kg of feed and cost of feed consumed per bird reduced with the inclusion of different processed *I. mannii* meals while and cost per kg body weight gain increased at T3 (10%TIM) and T4 (10%FIM). This may be as the result of the high feed intake recorded for the treatment groups that makes it most expensive to produce a kg meat on diets with toasted and fermented *Icacina mannii* meals. The results of the carcass traits and internal organs of broiler chickens fed differently processed *Icacina mannii* meals is presented in Table 6. From the results it was observed that 10% inclusion of differently processed *Icacina mannii* meals significantly (P<0.05) affected the dressed weights, dressing percentage, thigh, breast and back cut while the other cuts parts were not affected significantly (P>0.05) by the 10% inclusion of differently processed *Icacina mannii* meals. This results disagrees with the findings of [16] who reported non-significant (P>0.05) relationship in the carcass characteristics between birds fed treatments diets and those on the control diets. This could be as the results of the weight gain of these birds fed the processed differently processed *Icacina mannii* meals as their live weights were significantly (P<0.05) influenced. The lungs, pancreas and the gall bladder were significantly (P<0.05) influenced by the dietary inclusion of differently processed *Icacina mannii* meals while the other organs were not significantly (P>0.05) influenced. The liver and the kidney were not statistically (P>0.05) affected by the inclusion of differently processed *Icacina mannii* meals as they are involved in the elimination of toxins and metabolic wastes from animals' body. The results tends to agree with the report of [27] who reported that broilers fed moist heat treated and toasted *Icacina mannii* meals did not differ significantly (P>0.05).

5. Conclusion

Inclusion of 10% level of oiled *Icacina mannii* meal (OIM) in broiler starter and finisher diets is recommended as it enhanced poultry productivity, growth performance in terms of weight gain, feed intake and feed conversion ratio and could serve as alternative feed ingredient when maize is scarce and it is therefore recommended.

Compliance with ethical standards

Acknowledgements

We acknowledge Akwa Ibom State University, Obio Akpa Campus, Oruk Anam Local Government Area, Akwa Ibom State for the permission to use her facilities on the Teaching and Research Farm and Animal Science Laboratory for the study.

Disclosure of conflict of interest

Authors declare that there is no conflict of interest with any financial, personal, or other relationship with other people or organization related to the material discussed in this Article.

Statement of ethical approval

The study was conducted after ethical approval and research committee of the Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus, Oruk Anam Local Government Area, Akwa Ibom State, Nigeria.

Statement of informed Consent

Authors have given an approval and consent for this article to be submitted for publication

References

[1] Akinmutimi, A. H. (2004). Effects of cooking periods on the nutrients composition of Mucuna utilis seeds. *Nigerian Poultry Science Journal* 28: 45-50

[2] Onigemo, M.A., Dairo, F.A.S., Oso ,Y.A. A and Onigeno, H. A. (2020). Growth, haematology and serum biochemistry of albino rat fed diet containing raw and thermally processed Loofah Gourd (Luffa Cylindrica Roem) seed meals. *Nigerian Journals of Animals Production, 47:200 -209.*

[3] Umoh, E. O. (2013). Anti-nutritional Factors of False Yam (*Icacina tricachantha*) flour.*Internet Journal of Food Safty*, 15: 78-82.

[4] Unah, U. L., Ndak, U. U., Afolabi, K. D., Ekpo, K. O., Mbaba, E. N. and Ayanniyi, N. N. (2026). The Nutritional Composition of Differently Processed *Icacina mannii* (Earth Ball) meals. *Journal of Agriculture and Veterinary Science*. 3048-9075.

[5] Meteorological Station Report, (2022) University of Uyo.

[6] Ndife, J., Nwaubani, O. and Aniekpeno, I. E. (2019). Effect of palm oil inclusion on the quality of garri produced from white and yellow cassava (*Manihot esculenta* cranz) roots. *International Journal of Food Science and nutrition*, 4 (3): 180-185.

[7] Okolie, N.P., Brai, M. N. and Atoyebi, O. M. (2012). Comparative study on some selected garri samples sold in Lagos metropolis. *Journal of Food Studies* 1(1): 52-63.

[8] Zhu, C., Caia, Y., Gertza,E., La Franoa, M., Burnetta, D., and Buri, B.(2015). Red palm oil supplemented and biofortified cassava garri increase the carotenoid and retinylpalmitate concentrations of triacylglycerol –rich plasma in women. *Nutrition Resource*, 35 (11): 965-974.

[9] Ekpo, K. O. and Udedibie, A. B.I (2012). Moist-treatment as a method of improving the nutrients value of *Icacinia manni* (Earth Ball) for broilers. *International Journal of Agriculture and Rural development*, 15 (3): 1154-1161.

[10] Ekeno, A.M. (2014). The performance of broiler birds fed raw or processed (Earth-ball) *Icacinia manni* meal.M.Sc Thesis. Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

[11] Hahn, S.K., Mahungu, N. M., Otoo, J.A., Msabaha, M. A. M., Lutaladio, N.B. and Dahniya, M. T. (1987). Cassava and African food crises in Tropical root crops and the African food crisis. Proceedings of Third Triennial Symposium of the International Society for Tropical Root Crops, African Branch, edited by Terry, E,R., Akoroda, M and Arene, O.B , 17-23 August 1986, Owerri, Nigeria. pp 24-29.

[12] Duncan, D. B. (1955). Multiple ranges and multiple F. test. *Biometrics* 11 (1) :1-42

[13] Umoren, U. E., Isika, M. A., Asanga, , E.P. and Eziegwe, O. N.. (2007). Effect of replacement of maize with earth ball (*Icacinia manni*) meal on performance of broiler chickens. *Pakistan Journal of Biological Science*., 10(14): 2368-2373.

[14] Makanjuola, O. M., Ogunmodede, A. S., Makanjuola, J. O. and Awonorin, S.O. (2012). Comparative Study on Quality Attributes of Garri Obtained From Some Processing Centres in South West, Nigeria. *Advance Journal of Food Science and Technology*; 4(3):135-140.

[15] Clack, J. A. (2009). Effect of feeding cracked corn and concentrate protein pellets on broiler growth performance. *The Journal of applied poultry research* 18(2), 259-268.

[16] Choct, M. (2009). Managing gut health through nutrition. *British Poultry Science*, 50(1), 19-15.

[17] Effiong, O. O. and Jimmy, N. P. (2019). Chemical composition of toasted and fermented earth ball (*Icacina manni*) meal. Determination of their feeding value using broiler chickens. *Global Journal of Agricultural Sciences*. 18(1): 1-7.

[18] Umoren, I., Esonu, B. O. and Udedibie, A. B. (2001). Growth Performance and nutrient utilization of broiler chicks fed graded levels of *Icacina manni* (earth ball) meal. *Journal of Sustainable Agriculture and the Environment*

[19] Effiong, O. O., Harry, B. J. and Udora, D. D.(2024). Growth Performance of broiler chicks fed varying levels of Rumen Filtrate-fermented earth ball (*Icacinia manni)* meal diets. *Nigerian Journal of Animal Production*,344-347

[20] Effiong, O. O., Umoren, U. E. and Sylvester, G. D. (2014). Chemical composition of *Icacina manni* (earth ball) meal: Nutritional potentials as energy source in broiler rations. *Nigerian Journal of Animal Production*, 40(2), 84-90.

[21] Jafamejad, M F. and Bahonar, A, R. (2010). Growth response and carcass quality of broiler chickens fed on diets supplemented with dietary copper sources. *Global Veterinaria,* 5(2)89-93.

[22] Oluyemi, J. A. and Robert, F. A. (2000). Poultry production in warm wet climates. Spectrum Book Ltd, (Ibadan, Nigeria) and Macmillan Publishers (London) 1-165.

[23] Ukachukwu, S. N. (2008). Effect of composite cassava meal with or without palm oil and/or Methionine supplementation on broiler performance. *Livestock Research for Rural Development*, 20(4).

[24] Zanu, H. K., Azametin, M. K. and Agare, D.. (2017). Effects of dietary inclusion of cassava root flour in broiler diets on growth performance, carcass characteristics and haematological parameters. *International Journal of Livestock Production*. 8(3), 28-32.

[25] Ojewola, G. S., Opara, O... E. and Ndukpu, O... (2006). The substitutional value of cassava meal supplemented and unsupplemented with palm oil for maize in broiler diets. *Journal of Animal and Veterinary Advances.* 5(4), 306-364.

[26] Effiong, O. O. and Akpan, I. P. (2017). The chemical composition of toasted and fermented earth ball (*Icacina manni)* meals: Determination of their feeding value using broiler chickens. *Global Journal of Agricultural Sciences,* 16(1), 1-8.

[27] Asuquo, L. E. and Udedibie, A. B. I. (2012). Effects of Dietary Toasted *Icacinia manni* meal on the Performance of Laying Hens. *International Journal Agriculture and Rural Dev*elopment, 15(3):1162 – 1168.