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## INFLUENCE OF YEAST ADDITIVE (*Saccharomyces cerevisiae*) ON THE GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKEN FED DIETS CONTAINING *Calapogonium mucunoides* LEAF MEAL.

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### ABSTRACT

A study was conducted to determine the influence of yeast additive (*Saccharomyces cerevisiae*) on the growth performance and carcass characteristics of broiler chickens fed diets containing *Calapogonium mucunoides* leaf meal. One hundred and fifty day old agriated Anak broiler chicks were used for this experiment. *Calapogonium* leaf meal supplemented with yeast was used to replace soyabean meal at various levels to determine the best replacement that would give optimal performance in broiler chicken diets. The nutritional composition of sun dried *Calapogonium mucunoides* leaf meal showed that it contained %DM 93.06; %Moisture 6.94; % Crude protein 17.75; % Ether extract 1.02; %Crude fibre 15.36; %Ash 0.92; % Nitrogen free extract 58.07; Metabolizable energy (Kcal/kg) 2952.67. The anti-nutrients content of sundried mucunoides leaf meal were Tannins, 3.51 (mg/100g); oxalate, 0.42 mg/100g' Flavonoids, 3.3mg/100g' saponins, 0.30mg/100g; phytate, 0.17mg/100g; In the starter feeding trial, the *Calapogonium mucunoides* leaf meal supplemented with yeast was used to replace soya bean meal at levels of 0%, 10%, 15%, 20% and 25% in the control diet respectively. Each starter diets was fed to a group of 30 starter broiler chicks for four weeks using Completely Randomized Design (CRD). Each treatment was replicated into three of 10 broiler chicks. Parameters determined include initial body weight, final body weight, body weight gain, feed intake, feed conversion ratio and cost of production. In the finisher broiler feeding trial, the replacements were 0%, 10%, 15%, 20% and 25% of *Calapogonium mucunoides* leaf meal supplemented with yeast to partially replace soyabean meal in the control diet. Each finisher diet was fed to a group of 30 finisher broiler chicks for another four weeks using Complete Randomized Design (CRD). The parameters measured include initial body weight, final body weight, body weight gain, feed conversion ratio, carcass characteristics and cost of production. The starter broiler chicks on the control diet significantly ( $P < 0.05$ ) recorded the highest body weight gain than those on diets supplemented with yeast. The body weights gain of those on diet 4 (20% CLM) and diet 5 (25% CLM) supplemented with yeast were similar and significantly ( $P < 0.05$ ) better than those on diet 2(10% CLM) and 3 (15% CLM) supplemented with yeast. The broilers on 25% CLM supplemented with yeast recorded the best feed conversion ratio. At finisher phase, the finisher broiler chickens on 25% CLM supplemented with yeast recorded the highest body weight gain of (1937.58g/bird) followed by T<sub>1</sub>, T<sub>2</sub>, T<sub>4</sub> and T<sub>3</sub> respectively. The best feed conversion ratio was recorded for birds on diet 5 (2.80). The cost of production of the starter broiler chicks was lowest for those fed diet 5(25% CLM) (₦1184.00) supplemented with yeast, while the highest was for those on the control diet (₦1262.45). The cost of production of the finisher broiler chickens was lowest for those on diet 5 (₦1796.00), while the highest was for those on the control diet (₦2019.67). There was no significant difference ( $P < 0.05$ ) in the percent dressed weight across treatment. The percent internal organs and cut-parts were not affected by the treatments. The result of the study showed that *Calapogonium mucunoides* leaf meal supplemented with yeast (*Saccharomyces cerevisiae*) could be used up to 25% in the diets of both starter and finisher broiler chickens without of affecting body weight gain, feed intake and feed conversion ratio.

**Keywords:** Yeast additive, growth performance, carcass characteristics, diets, broiler chickens.

### Introduction

Feed cost account for 70 -75% of the total cost of production of pigs and poultry (Esonu et al, 2004). The search for the least cost feed component has brought about the replacement of some conventional feedstuffs with cheap and locally available

alternatives in the formulation of poultry feeds. The high cost of fishmeal for example, has led to exploring the alternatives such as termite, grasshopper and maggot meal sources of feed ingredients. Atteh and Ologbenla (1993) reported that any alternatives to be used should have comparative nutritive value, be

cheaper than the conventional protein sources and be available in large quantities.

Soyabean meal is widely used as a feed supplement with high energy content and amino acid profile close to ideal. World soyabean production (262 million ton in 2010) is dominated by United States (90.6), Brazil (68.5) and Argentina (52.7) (FAOSTAT, 2012). Soyabean meal is the residue after the oil is expressed and is dominantly used in highly industrialized production system of swine and poultry. Globally, however, there is little surplus soyabean meal for small holders. Therefore, to meet the nutritive requirements for small holder swine and poultry, there is a need to identify alternative low-cost feed resources (Lekule and Kyvsgaard, 2003).

Competition for feed/food used is still crucial criterion. The current need to substitute in animal feed especially, soyabeans and corn for food alternative is necessary not depending only on their high market price, but also the risk associated with Genetically Modified Organisms (GMOs) and the presence of possible contamination-mycotoxin. Any feedstuff is likely to be used in diets for animals if it supplies the required nutrients, if it is cost competitive with other available ingredients and if the user is confident it will produce the desired result.

The use of cereals in animal diets create a competitive conflict with human nutrition and the use of soyabean is expensive. An interesting challenge for scientists in the field of animal nutrition is the introduction of alternative feedstuffs that could overcome the problems of environmental harshness and production costs. At the same time, the preservation of animal health, production yield and product quality is essential (Martens et al, 2012). Based on these facts, *Calapogonium mucunoides* leaf meal can be an alternative *C. mucunoides* is widely cultivated as a forage and pasture legume, green manure and cover crop. It is commonly planted as a pioneer species, for fodder/animal feed, forage and as a nitrogen fixing species to reduce erosion and improve soil fertility in tropical and sub-tropical regions (Cook et al, 2005).

Despite generally low palatability, it is used as animal forage during the latter part of the dry season in tropical Asia and Africa (Cook et al, 2005; FAO, 2013). On the basis of its nutritive value. In vitro digestibility of leaf SM ranges from 58 to 66% depending on the age of regrowth and level of hairness. High densities of epidermal hairs (34 hairs/mm<sup>2</sup>) are associated with lower IVDMD. CP content of top growth ranges from 16 to 24%, with lower values for older growth. Reports for in-vivo DMD of the leaf and stem show 58%. The anti-nutrients present in *C. mucunoides* as reported by (Obua et al, 2012) are Tannin 1.24%, phytate 0.82%, oxalate 0.81% and saponin 0.44%. Adegboye et al

(2019) reported *C. mucunoides* leaf meal having tannin content of 2.96%, phytate 0.94%, oxalate 2.77% and saponin 0.85%. These anti-nutrients are detoxified by several processing methods such as soaking, germination, thermal or heat treatment, fermentation, genetic manipulation and other processing methods (Soetan, 2008).

Adenirola et al (2011) reported that incorporation of *Centrosema pubescens* up to 20% inclusion level gives results similar to the control while incorporation of *C. mucunoides* leaf meal up to 10% resulted in satisfactory result in growing rabbits. Ndelekwute et al (2021) reported that cassava peel meal could be improved with 40% *C. mucunoides* leaf meal in the diets of broiler chickens.

Yeast additive is a nutrient rich and complex micro – ecological fermentation product containing various metabolites. However, the major or specific effective components of yeast additive and their importance in poultry farming are unknown. Glycine, fructose, inositol, galactose, and sucrose were identified as potential effective metabolite in yeast. These findings suggest yeast additives as effective and harmless feed additive with improved nutritional properties for broiler chicks (Zhe et al, 2019). Yeast containing additives could be used as alternatives to the feed antibiotics due to their beneficial performance and health effects on monogastric animals (Dhama et al., 2015; Wang and Xu, 2008; Debsk et al, 2004) especially under leaf stress (Holder et al, 2011). In poultry, yeast probiotics have been found more effective than other probiotics to improve performance of birds (Reisinger et al., 2012; Yaser and Desen, 2014).

Considering the important attributes of *C. mucunoides* leaf meal and yeast probiotic, it would appear that supplements of diets containing *C. mucunoides* leaf meal and yeast additive would be efficient to partially replace soyabean meal as protein source in the diets of starter broilers chicks and finisher broiler chickens. Therefore, the research was designed to investigate the influence of yeast additive on the growth performance and carcass characteristics of broiler chickens fed diets containing *C. mucunoides* leaf meal.

## Materials and methods

### Experimental site

The study was carried out at the poultry unit of the Teaching and Research farm of Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State in Nigeria. The area is located on latitude 05° 21'N and longitude 07° 33'E with an elevation of about 112m above the sea level. The location has an annual rainfall of 177 – 2000 mm per annum from April to October and a short period of dry season from November to March with a relative humidity of about

50–90% and monthly temperature range of 17–36°C NRCRI (2019).

### Procurement and processing of feed ingredients

*C. mucunoides* leaves were harvested from Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The leaves were air-dried and sun-dried to about 10% moisture content and then grind to powdery form. This was done to reduce the anti-nutritional factors (ANF) present in the forage legume, other feed ingredients included in the diets are maize, wheat offal, fish meal, soyabean meal, bone meal, vitamin/mineral premix, lysine, methionine and salt. The yeast used as additive (*Saccharomyces cerevisiae*) was bought from a reputable supermarket at Umudike, Umuahia, Abia State.

### Proximate analysis of raw and sun dried *C. mucunoides* leaf meal

Proximate composition of the fresh (raw) and sundried *C. mucunoides* leaves were determined according to the method of AOAC (2003). Gross energy of the leaves was determined using bomb calorimeter. All analysis was based on 100% dry matter. The anti-nutrients such as tannins, oxalate, phytate, saponins, cyanide and alkaloids were also determined according to AOAC (2003).

### Experimental Starter Broiler Diets

Five (5) experimental broiler chicks diets were formulated such that diet 1 (Control) contained soyabean meal as the main protein source while diets 2–5 contained *C. mucunoides* leaf meal (CLM) at 0%, 10%, 15%, 20% and 25% supplemented with yeast additives diet to partially replace soyabean meal in the control diet. Other ingredients were varied in order to provide the required protein and energy for the starter broiler chicks (Table 1).

### Experimental finisher broiler chicken diets

Five experimental finisher broiler chickens diets were formulated. Diet 1 (Control) contained 75% basal diet and 25% soyabean meal while diets 2, 3, 4 and 5 contained 10%, 15%, 20% and 25% of sun dried *C. mucunoides* leaf meal supplemented with yeast probiotic as replacement for soyabean meal (Table 2). Basal diet contained maize, palm kernel cake, fish meal, wheat offal, bone meal, vit/mineral premix, lysine, methionine and common salt.

### Experimental design

The design of the study was Completely Randomized Design (CRD). The statistical model was:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

- $Y_{ij}$  = Individual observation
- $\mu$  = Population mean
- $T_i$  = Treatment effect
- $e_{ij}$  = Error effect

### Experimental birds and management

A total of 150 day old Anak broiler chicks were procured from Agrited hatchery at Ibadan for this study. The chicks were brooded together for one week with top commercial starter feed to stabilize them before distributing them into five experimental treatment groups. Each treatment group contained thirty (30) broiler chicks. Then each treatment group was divided into three replicates of 10 birds each. Each replicate was kept in a pen and covered with polythene sheet to conserve heat. Heat was supplied with electricity and kerosene lanterns during the brooding period. The floor of the pens was covered with wood shavings.

Each group was randomly assigned to an experimental starter broiler chickens diet using completely randomized design (CRD) and was fed for four weeks. Feed was supplied in feeding troughs built in such a way as to minimize feed wastage. Water was supplied ad-libitum. Feeding was done once daily around 8am. The birds were weighed at the beginning of the feeding trial and weekly thereafter. Feed intake was recorded daily by weighing the quantity of feed given and the leftover the following morning. The starter phase of the trial lasted for four weeks. The feed was changed from starter broiler chick diets to finisher broiler chicken diets and was fed for another four weeks using Completely Randomized Design (CRD).

Health management practices were carried out on the broiler chicks. The chicks were given anti-stress on arrival to boost energy level. They were given Newcastle disease vaccine strain NDV (Hitner strain) by intraocular vaccination (1/0) at day old. The Gumboro vaccine was administered at the second week through drinking water and Lasota vaccine was administered against Newcastle disease at the third week and the second Gumboro vaccine was administered by drinking water at the end of fourth week against infections dorsal disease (Gumboro). Coccidostat and antibiotics were also administered by drinking water when there were signs of infection.

### Carcass Evaluation

At the end of the feeding trial, three (3) finisher broiler chickens from each treatment were randomly selected, starved of feed but not water for 24 hours and then weighed, slaughtered and processed for determination of the following internal organ weights (hearts, kidney, spleen, lungs, abdominal fats), cut parts (thigh, muscle, wings, back cuts, drumsticks, breast muscle) and dressed weight. The internal organ weights were expressed as percentage of the live weight.

### Data collection

The following parameters were determined: daily feed intake, initial body weight, final body weight, body weight gain, feed conversion ratio, cost of production,

dressed weight, internal organ weight, and cut parts weight.

**Data analysis**

Data collected was analysed using one way analysis of variance (ANOVA) according to Snedecor and Cochran (1989), where significant difference was dictated, means were analysed using Duncan's New Multiple Range Test (Duncan, 1955).

**Table 1: Ingredients and nutrient composition of experimental starter broiler diets**

Ingredients (%)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
	0% CLM	10% CLM	15% CLM	20% CLM	25% CLM
Maize	50.00	50.00	50.00	50.00	50.00
Soyabean meal	30.00	27.00	25.50	24.00	22.50
CLM	0.00	3.00	4.50	6.00	7.50
Palm kernel meal	6.15	6.00	6.00	6.00	6.00
Wheat offal	7.00	7.00	7.00	7.00	7.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Vit/Mineral Premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.25	0.25	0.25	0.25	0.25
Yeast	-	0.15	0.15	0.15	0.15
Common salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated nutrients composition of experimental starter broiler chicken diets					
Crude protein (%)	23.90	23.10	23.05	23.06	22.42
ME Kcal/Kg	2851.30	2879.02	2892.88	2906.74	2920.60

\*To provide per kg of diet: Vit. A, 2,000,000iu; Vit D3, 4000iu; Vit. E, Kg; Vit. J, 0.49g; Choline, 48.00g; BHT, 3200g; Manganase, 16.00g; Iron, 8.00mg; zine, 72gm; copper, 0.32g; Iodine, 0.25g; Cobalt, 36.00g; Selenium, 16.00g.

CLM = *Calapogonium mucunoides* leaf meal

**Table 2: Composition of the experimental finisher broiler chickens diets**

Ingredients (%)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
	0% CLM	10% CLM	15% CLM	20% CLM	25% CLM
Maize	60.00	60.00	60.00	60.00	60.00
Soyabean meal	25.00	22.50	21.25	20.00	18.75
CLM	0.00	2.50	3.75	5.00	6.25
Palm kernel meal	4.15	4.15	4.15	4.15	4.15
Wheat offal	4.00	4.00	4.00	4.00	4.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Vit/Mineral Premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.25	0.25	0.25	0.25	0.25
Yeast	-	0.15	0.15	0.15	0.15
Common salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated nutrients composition of experimental finisher broiler chickens diets					
Crude protein (%)	21.05	20.47	20.18	19.90	19.61
ME Kcal/Kg	3148.40	3171.50	3183.05	3194.60	3206.15

CLM = *Calapogonium mucunoides* leaf meal

\*To provide per kg of diet: Vit. A, 2,000,000iu; Vit D3, 4000iu; Vit. E, Kg; Vit. J, 0.49g; Choline, 48.00g; BHT, 3200g; Manganase, 16.00g; Iron, 8.00mg; zine, 72gm; copper, 0.32g; Iodine, 0.25g; Cobalt, 36.00g; Selenium, 16.00g.

## RESULTS AND DISCUSSION

**Table 3: Proximate composition of fresh (raw) and sun dried *Calapogonium mucunoides* leaf meal**

Parameters	Fresh (Raw) <i>C. mucunoides</i> leaf meal	Sun dried <i>C. mucunoides</i> leaf meal
Dry matter (%)	84.26	93.06
Moisture (%)	15.74	6.94
Ether extract (%)	0.35	1.02
Crude protein (%)	23.08	17.75
Crude fibre (%)	25.60	15.30
Ash (%)	3.39	0.92
Nitrogen Free Extract (%)	31.84	55.07
Metabolizable energy (Kcal/kg)	3181.88	3528.55

The proximate composition of *C. mucunoides* leaf meal is shown in (Table 3). The values obtained for crude protein, crude fat, crude fibre, moisture content, ash and metabolizable energy fall within the ranges

obtained by Aduku (1993), Obua et al (2012), Osakwe and Ekwe (2007), Adebayo et al (2019), Bamigboye and Oluwarinde (2017), Mecha and Adegbola (1980), Ikhimiyoa and Olaguiju (1996).

**Table 4: Anti-nutrients composition of fresh (raw) and sun dried *C. mucunoides* leaf meal**

Parameters	Fresh (Raw) <i>C. mucunoides</i> leaf meal	Sun dried <i>C. mucunoides</i> leaf meal
Tannis (mg/100g)	3.90	3.51
Oxalate (mg/100g)	0.74	0.42
Flavonoids (mg/100g)	3.67	3.39
Saponins (mg/100g)	0.30	0.30
Phytate (mg/100g)	0.20	0.17

The result of the anti-nutrients composition of fresh (raw) and sun dried *C. mucunoides* leaf meal are shown in (Table 4). The values of Tannins (3.90

mg/100g), oxalate, flavonoids, saponins, phytate falls below the values reported by Obua et al (2012) and Adeboye et al (2019).

**Table 5: Proximate composition of experimental starter broiler chicken diets**

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
Dry matter (%)	91.68	91.50	91.50	91.46	91.43
Crude protein (%)	17.75	17.75	21.30	23.08	23.08
Ether extract (%)	4.55	4.55	4.58	4.60	4.60
Crude fibre (%)	7.15	7.15	7.80	7.95	8.45
Ash (%)	8.85	8.30	8.60	8.79	9.39
Nitrogen Free Extract (%)	53.38	53.75	49.22	47.04	45.91
Metabolizable energy (Kcal/kg)	2792.30	2803.26	2826.28	2835.21	2817.87

The proximate composition of the experimental starter broiler chicken diets is shown in (Table 5). The crude protein content ranged from 17.75% to 23.08% with T<sub>1</sub> and T<sub>2</sub> having the highest values while T<sub>1</sub> to T<sub>2</sub> have lowest values. Similar trend was found with the crude fibre, ether extract and ash content of the experimental diets. Increasing levels of *Calapogonium* leaf meal in the diet produced

increased crude protein, crude fibre, ether extract, and ash contents across dietary treatments. However, NFE (%) decreased across dietary treatments with increased inclusion of *C. mucunoides* leaf meal. T<sub>1</sub> and T<sub>2</sub> had the least values of ether extract (4.55%) and NFE of (53.38%) while T<sub>4</sub> and T<sub>5</sub> had high extract values of (4.60%) each and low NFE of 47.04% and 45.91% respectively.

**Table 6: Proximate composition of experimental broiler finisher chickens diets**

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
Dry matter (%)	91.50	91.43	91.40	91.40	91.32
Crude protein (%)	20.13	20.13	21.00	21.00	23.08
Ether extract (%)	4.69	4.60	4.62	4.62	4.62
Crude fibre (%)	5.00	5.35	6.00	6.35	6.70
Ash (%)	7.45	8.90	8.90	9.75	10.24
Nitrogen Free Extract (%)	54.32	52.45	50.88	49.68	46.68
Metabolizable energy (Kcal/kg)	2837.72	2800.34	2808.99	2784.69	2755.74

The proximate composition of the experimental finisher broiler chicken diets is shown in (Table 6). The crude protein content ranged from 20.13% to 23.08% with T<sub>5</sub> having the highest value and T<sub>1</sub> and T<sub>2</sub> having the lowest value. Similar trend were found with the crude fibre, ether extract and ash content across dietary treatments. The NFE (%) however, decreased across dietary treatments as inclusion level of *Calapogonium mucunoides* leaf meal increased.

T<sub>1</sub> and T<sub>2</sub> had the least values of ether extract and crude fibre (4.60%, 5.00% and 5.35%) respectively and T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> had high NFE of (54.32%, 52.45% and 50.88%) respectively while T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub> had higher Ether extract of (4.62%) T<sub>4</sub> and T<sub>5</sub> had lower NFE of 49.68% and 46.68% respectively.

**Table 7: Growth performance of starter broiler chicks fed diets containing sun dried *Calapogonium mucunoides* leaf meal supplemented with yeast.**

Parameters	T <sub>1</sub> (Control)	T <sub>2</sub> (10% CLM)	T <sub>3</sub> (15% CLM)	T <sub>4</sub> (20% CLM)	T <sub>5</sub> (25% CLM)	SEM
Initial body weight (g/bird)	141.13	145.43	158.46	155.53	130.27	4.09
Final body weight (g/bird)	922.43	834.25	829.84	871.81	841.12	15.11
Body weight gain (g/bird)	781.28 <sup>a</sup>	688.82 <sup>ab</sup>	671.37 <sup>b</sup>	716.28 <sup>ab</sup>	710.85 <sup>ab</sup>	15.57
Daily body weight (g/bird)	27.90 <sup>a</sup>	24.60 <sup>ab</sup>	23.98 <sup>b</sup>	25.58 <sup>ab</sup>	25.39 <sup>ab</sup>	0.56
Daily feed intake (g/bird)	76.08 <sup>ab</sup>	74.51 <sup>b</sup>	75.57 <sup>b</sup>	78.54 <sup>a</sup>	73.44 <sup>c</sup>	0.55
Feed conversion ratio	2.73 <sup>a</sup>	3.03 <sup>ab</sup>	3.15 <sup>c</sup>	3.07 <sup>ab</sup>	2.89 <sup>a</sup>	0.06

<sup>abc</sup> Mean in the same row with different superscripts differ significantly of P < 0.05; SEM: Standard Error of the Mean

**Table 8: Growth performance of finisher broiler chickens fed diets containing sun dried *Calapogonium mucunoides* leaf meal supplemented with yeast**

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	SEM
Initial body weight (g/bird)	922.42	834.25	829.84	871.81	841.12	15.10
Final body weight (g/bird)	2215.29 <sup>a</sup>	2123.93 <sup>ab</sup>	1944.69 <sup>b</sup>	2020.34 <sup>a</sup>	2778.70 <sup>a</sup>	32.25
Body weight gain (g/bird)	1292.87 <sup>ab</sup>	1289.68 <sup>ab</sup>	114.35 <sup>bc</sup>	1143.53 <sup>bc</sup>	1937.58 <sup>a</sup>	27.09
Daily body weight (g/bird)	46.17 <sup>b</sup>	46.06 <sup>b</sup>	39.82 <sup>c</sup>	41.02 <sup>b</sup>	69.20 <sup>a</sup>	0.97
Daily feed intake (g/bird)	217.04 <sup>a</sup>	208.85 <sup>ab</sup>	187.40 <sup>c</sup>	194.80 <sup>bc</sup>	193.73 <sup>bc</sup>	2.33
Feed conversion ratio	4.71 <sup>ab</sup>	4.53 <sup>b</sup>	4.71 <sup>ab</sup>	4.75	2.80 <sup>c</sup>	0.15

<sup>abc</sup> Means in a row with different superscripts differ significantly of P < 0.05; SEM: Standard Error of the Mean

The influence of yeast additive on the growth performance of the broiler chickens at the starter and finisher phases are presented in (Table 7 and 8).

#### Feed intake

In the starter broiler phase significant differences (P < 0.05) existed in feed intake among the various treatment groups. The feed intake of the starter broiler chicks on treatment 2 and (10% CLM) and treatments (15% CLM) supplemented with yeast were similar and significantly (P < 0.05) and lower than those on the control diet. The starter broiler chicks on treatment 4 (20% CLM) supplemented with yeast significantly (P < 0.05) recorded higher feed intake than those on treatment 1 (Control), while the least feed intake was those in treatment 5 (25% CLM) supplemented with yeast. Generally, the inclusion of yeast improved the feed intake of the broiler starter chicks by improving palatability (Gao et al, 2008; Ignacio, 1995).

In the broiler chicken finisher phase, significant differences (P < 0.05) existed among the various treatment groups. The feed intake of the broiler chickens on treatment 4 and 5 were similar and significantly (P < 0.05) higher than those in treatment

3. The feed intake of the broiler finisher chickens on treatment 2 (10% CLM) was significantly (P < 0.05) better than those on treatment 3, 4 and 5 but lower than those on the control diet. Generally, the feed intake of the various treatment groups was improved by the inclusion of yeast in their diets (Gao et al., 2008; Ignacio, 1995).

#### Body weight gain:

In the broiler starter phase, significant difference (P < 0.05) existed among the various treatment groups. The body weight gain of those on treatment 4 (20% CLM) and treatment 5 (25% CLM) supplemented with yeast were similar and significantly (P < 0.05) better than those on treatment 2 (10% CLM) and treatment 3 (15% CLM) supplemented with yeast. The starter broiler chicks on the control diet (treatment 1) significantly (P < 0.05) recorded the highest body weight gain.

Significantly differences (P < 0.05) existed among the various groups in their body weight gain. The finisher broiler chickens on treatment 5 (25% CLM) supplemented with yeast recorded the highest body weight gain which was significantly (P < 0.05) better

than those on the control diet. The body weight gain of the finisher broiler chickens on the control diet and treatment 2 were similar and significantly ( $P < 0.05$ ) better than those on treatment 2 and 3. Earlier researchers have attributed part of the growth promoting properties of yeast to its ability to stimulate feed intake by improving palatability (Gao et al, 2008; Ignacio, 1995).

**Feed conversion ratio**

In the broiler starter feeding trial, significant differences ( $P < 0.05$ ) existed among the various groups in their feed conversion ratios. The starter broiler chicks on the control diet compared favourably with those on treatment 5 (25% CLM) supplemented with yeast in their feed conversion ratios. Generally, the feed conversion ratios improved with increase in

the level of *C. mucunoides* leaf meal supplemented with yeast in their diets. According to Adejumo et al (2005), yeast supplemented at the starter phase improves feed conversion ratio. In the broiler finisher chickens, significant differences ( $P < 0.05$ ) existed among the various groups in their feed conversion ratios. The finisher broiler chickens on treatment 5 (25% CLM) supplemented with yeast recorded the best feed conversion ratio of 2.80. Generally, the feed conversion ratios of the finisher broiler chickens on diets containing *C. mucunoides* leaf meal supplement with yeast were improved. The inclusion of yeast in the diets of the finisher broiler chickens containing *C. mucunoides* leaf meal improved their feed conversion ratios Adejumo et al (2005).

**Table 9: Carcass yield of finisher broiler chickens fed diet containing sun dried *Calapogonium mucunoides* leaf meal supplemented with yeast.**

Parameters	T <sub>1</sub> (Control)	T <sub>2</sub> (10% CLM)	T <sub>3</sub> (15% CLM)	T <sub>4</sub> (20% CLM)	T <sub>5</sub> (25% CLM)	SEM
Live weight (g)	2175.33 <sup>a</sup>	2133.00 <sup>ab</sup>	2032.33 <sup>abc</sup>	2017.33 <sup>bc</sup>	1977.00 <sup>b</sup>	26.21
Dressed weight (g)	1891.67	1750.00	1650.00	1733.33	1666.67	57.05
Defeathered weight (g)	1321.67	1400.00	1316.67	1300.00	1316.67	18.87
Dressing (%)	60.75 <sup>b</sup>	65.69 <sup>ab</sup>	64.72 <sup>ab</sup>	64.47 <sup>ab</sup>	66.56 <sup>a</sup>	0.79
Breast (%)	33.24	33.34	31.33	32.58	32.95	0.63
Wing (%)	12.45	12.16	12.28	12.81	11.82	0.21
Drumstick (%)	16.62	15.32	15.86	16.51	15.05	0.27
Thigh (%)	17.32	16.54	16.70	17.02	16.03	0.23
Back cut (%)	19.95	18.76	19.16	18.71	18.99	0.40

<sup>abc</sup> Means in the row with different superscripts differ significantly at  $P < 0.05$ : SEM = Standard Error of the Mean

The results of the live weight and dressed weight had the same trend of significance where there were significant differences ( $P > 0.05$ ) across the treatment groups where broiler chickens fed control diet, was significantly higher ( $P < 0.05$ ) than the remaining treatment groups, while the dressing percentage, breasts, thighs, drumsticks, wings and back cuts showed that there were no significant difference ( $P > 0.05$ ) across the treatment groups. The results of the dressing percentage showed that the inclusion of CLM up to 25% with the addition of yeast, did not have any

negative effect on the carcass yield as the dressing percentage of the control diet, diet 2, 3, 4 and 5 at inclusion level of 0%, 10%, 15%, 20% and 25% of CLM had good dressing percentage of 60.75, 65.69, 64.72, 64.47 and 66.56 respectively. These agrees with the reports of Aksu et al (2015); Zhang et al (2005); Kabir (2009); Afsharmanesh et al (2010); Javadi et al (2012) that supplementation of yeast brings about improved sensory and quality characteristics of the animal derived meat.

**Table 10: Organ proportion of finisher broiler chicken fed diets containing sundried *Calapogonium mucunoides* leaf meal supplemented with yeast**

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	SEM
Head	3.90 <sup>a</sup>	3.20 <sup>ab</sup>	3.72 <sup>ab</sup>	3.58 <sup>ab</sup>	3.01 <sup>b</sup>	0.12
Neck	7.20	7.08	6.86	7.04	6.68	0.13
Shank	6.75	5.69	6.06	6.69	5.89	0.21
Heart (%)	0.59 <sup>a</sup>	0.44 <sup>b</sup>	0.66 <sup>a</sup>	0.51 <sup>ab</sup>	0.53 <sup>ab</sup>	0.03
Liver (%)	3.38	3.10	2.77	2.99	3.23	0.13
Gizzard (%)	1.94	1.93	2.26	2.22	1.94	0.06
Small intestine	6.89	6.16	6.57	6.71	5.32	0.38
Large intestine	1.20	1.28	1.18	1.14	1.05	0.05
Kidney (%)	0.73	0.69	0.60	0.64	0.63	0.03
Spleen (%)	0.15 <sup>b</sup>	0.16 <sup>b</sup>	0.26 <sup>a</sup>	0.15 <sup>b</sup>	0.16 <sup>b</sup>	0.01
Lungs (%)	0.79 <sup>ab</sup>	0.42 <sup>b</sup>	0.57 <sup>bc</sup>	0.64 <sup>abc</sup>	0.89 <sup>a</sup>	0.05
Abdominal fat (%)	0.22	0.37	0.23	0.37	0.27	0.03



Crop (%)	1.32	1.34	1.72	1.78	2.35	0.23
Gall Bladder	0.15 <sup>ab</sup>	0.14 <sup>b</sup>	0.18 <sup>a</sup>	0.15 <sup>ab</sup>	0.15 <sup>ab</sup>	0.01
Proventriculus	0.44	0.45	0.56	0.44	0.44	0.02
Pancreas	0.37	0.37	0.38	0.30	0.37	0.02

<sup>abc</sup> Means in a row with difference superscripts differ significantly at  $P < 0.05$ ; SEM = Standard Error of the Mean.  
Cons: Consumed; Invest: Investment

Significant difference ( $P < 0.05$ ) exists in some of the organ proportion like the head, heart, spleen, lungs and gall bladder. While among other organ proportion, there exist no significant difference ( $P > 0.05$ ) this could be as a result of the positive influence of yeast supplementation in the formulated diets (Vohra et al, 2016), while in the result of the abdominal fat where

no significant difference existed, it corresponds with the result of Afsharmanesh et al (2010) and Gao et al (2008) that supplementation of yeast additive (*S. cerevisiae*) increases body weight gain and feed efficiency while decreasing the percentage of abdominal fat in broiler chickens.

**Table 11: Economics of experimental starter broiler chicks fed experimental diets**

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	SEM
Cost/Kg feed (₦)	315.14	303.7	299.3	294.9	290.5	2.26
Cost of feed cons. (₦)	609.5 <sup>a</sup>	568.9 <sup>ab</sup>	557.9 <sup>bc</sup>	563.5 <sup>b</sup>	530.8 <sup>c</sup>	7.61
Cost/Kg weight gain (₦)	780.89 <sup>ab</sup>	835.7 <sup>a</sup>	834.9 <sup>a</sup>	787.57 <sup>bc</sup>	747 <sup>bc</sup>	16.37
Cost of production (₦)	1262.45	1222	1211	1216.7	1184	7.58
Revenue (₦)	1660.5 <sup>a</sup>	1502 <sup>abc</sup>	1494 <sup>bc</sup>	1569 <sup>ab</sup>	1514 <sup>ab</sup>	27.2
Gross margin (₦)	397.8	279.7	282.7	352.8	330.2	23.8
Return on Invest. (₦)	31.5	22.8	23.4	28.9	27.8	1.91

<sup>abc</sup> Means in a row with difference superscripts differ significantly at  $P < 0.05$ ; SEM = Standard Error of the Mean.  
Cons: Consumed; Invest: Investment

Cost of feeding was significantly reduced for these groups of broilers during the starter phase. Significant difference ( $P < 0.05$ ) exists in the cost of feed consumed, cost per kg weight gain and revenue. Those fed diet 1 were significantly higher ( $P < 0.05$ ) in cost of feed consumed and in the revenue generated than the remaining groups. The high cost of feed was as a result of the non-inclusion of *Calapogonium mucunoides* leaf meal (CLM) in the control diet as soyabean meal is expensive and CLM is recognized as a cheaper alternative protein source of poultry (Olomu, 2011). In cost of production, diet 5 (25% CLM) happens to be the most economical to use in starter broiler production. The cost of production of starter broilers on diet 3 and 4 were practically the same.

### Conclusion

The result of the study showed that yeast supplementation of the diets of broiler chickens is recommended for improved growth performance in terms of total body weight gain, feed intake, and feed conversion ratio. It offers a number of potential advantages as a feed additive for broiler chickens at both the starter and finisher stages. It was concluded that *Calapogonium mucunoides* leaf meal supplemented with yeast (*Saccharomyces cerevisiae*) could be used up to 25% in the diets of both starter and finisher broiler chickens without affecting, feed intake, body weight gain and feed conversion ratio.

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