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Evaluation of Morphometric and Slaughter Parameters in Broiler Chickens Fed Graded Levels of Cocoyam-Based Diets

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Abstract

*This study evaluated the morphometric organ weights, carcass characteristics, and histopathological effects of feeding graded levels of cooked cocoyam (*Xanthosoma sagittifolium*) meal to broiler chickens. A total of 120 day-old Anak broiler chicks were randomly allocated into four dietary treatment groups, with 30 birds per group and three replicates of 10 birds each, in a Completely Randomised Design (CRD). The experimental diets contained 0% (T1 – control), 10% (T2), 20% (T3), and 30% (T4) levels of cooked cocoyam meal as a partial replacement for maize. The trial lasted for 8 weeks, covering both the starter and finisher phases. Results showed that final live weights of birds fed diets T1 (1843.51g), T3 (1807.66g), and T4 (1820.18g) were statistically similar ($p > 0.05$), but significantly higher ($p < 0.05$) than those fed T2 (1789.25g). Breast muscle yield was significansstly higher ($p < 0.05$) in birds on diet T4 (32.25%), while the lowest value was recorded in T2 (28.11%). Back cut percentage was highest ($p < 0.05$) in T1 (32.25%) and T4 (32.10%), and lowest in T2 (27.55%) and T3 (27.35%). Morphometric organ analysis revealed significant differences ($p < 0.05$) in crop, gizzard, and intestinal weights among treatments. Crop weight was highest in T1 (0.95%) and T2 (0.90%) and decreased in T3 (0.85%) and T4 (0.80%). Gizzard weight increased significantly in T3 (2.62%) and T4 (2.68%) compared to T1 (2.40%) and T2 (2.45%). Birds on T3 (4.90%) and T4 (4.94%) had significantly heavier intestines than those on T2 (4.65%) and T1 (4.20%). Histopathological evaluation of liver, kidney, heart, and intestinal tissues revealed changes ranging from normal architecture to mild sinusoidal congestion and mild necrosis in birds fed cocoyam-based diets. These changes were minimal and showed partial protective effects, particularly in birds fed 10% and 20% inclusion levels, suggesting some physiological adaptation. Overall, the inclusion of cooked cocoyam meal up to 30% in broiler diets did not negatively impact carcass traits or internal organ development. Instead, it supported acceptable growth performance, enhanced gizzard and intestinal morphometry, and induced only mild histological alterations without major functional impairments. The cooking process likely reduced the antinutrient load of cocoyam, thereby improving its safety and utilisation in poultry diets. The findings support the potential use of cooked cocoyam as an alternative energy source in broiler nutrition. Up to a 30% inclusion level is considered safe and effective for replacing maize in finisher diets without compromising carcass yield or organ integrity.*

Introduction

In most developing countries like Nigeria, there has always been short supply of grain for the populace (Apata and Babalola, 2012). This problem is further compounded by the accelerated increase in human population which created pressure on every form of food supply. However, most energy feed ingredients that will help in achieving improved performance, health, reduced production costs and improved product quality in poultry production are continuously becoming scarce and expensive for use in broiler production due to the stiff competition for available energy sources used by industries for biofuel and as food for humans (Apata and Babalola, 2012). Maize, a major energy source for poultry in Nigeria, contributes about 60 to 80% of the total poultry diets (Apata and Babalola, 2012). It was also observed that acute shortage and high prices of feed ingredients are responsible for the present rise in prices of poultry and livestock feed in

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Nigeria (Apata and Babalola, 2012), with the attendant rise in the cost of meat and eggs. The increasing cost of conventional feedstuff, coupled with high demand for grains for human consumption, has stimulated interest in the use of nonconventional and readily available cheaper ingredients (Apata and Babalola, 2012), such as cocoyam, etc.

Cocoyam is a perennial herbaceous plant which is known as an edible aroid (Colocasia and *Xanthosoma* spp.) belonging to the family of Araceae. Tannia (*Xanthosoma sagittifolium*) CCYM, otherwise known as recent cocoyam, consist of central corms from which cormels, fibrous roots and the shoots arise, and leaves consist of long erect petioles with a large lamina that appears sagittate with dark green colour (Abdulrashid and Agwunobi, 2009). Cocoyam is an ancient crop grown throughout the humid areas for its edible corms and leaves as well as for its traditional and ceremonial uses. Cocoyam is nutritionally richer than most of the tuber crops, and requires little attention in terms of cultivation, yet it is not widely grown in the country owing to the low status and underutilization (Abdulrashid and Agwunobi, 2009). It was shown that cocoyam has comparatively higher protein content than other tuber crops like cassava, yam and potato (Okon *et al*., 2007). It was also observed that cocoyam has a higher score for total essential amino acids comparable to cassava, yam and sweet potatoes (Abdulrashid et al., 2006). The starch content of cocoyam is very readily digestible because of its small particle size (Okon *et al*., 2007 The substitution of grains with roots and tubers is an economical question and roots have a great potential in many areas of the world as a major supplier of energy for animals (Abdulrashid and Agwunobi, 2009). Cocoyam (*Xanthosoma sagittifolium*) is a high-yielding, disease-resistant crop. It is almost competition-free with man in most places, as it is eaten only as a last resort when a family can no longer afford garri or yam (FAO, 1990). It is therefore more likely to be available for use at a lower cost. Its energy content appears moderate when compared with maize. However, like most varieties of cocoyam, the problem with *Xanthosoma sagittifolium* is its content of some antinutritional factors, which could be a limitation to its use (Okon *et al.,* 2007). This limiting factor can be removed by boiling or sun-drying (Abdulrashid *et al.,* 2006). Uchegbu *et al*. (2010) reported that *Xanthosoma sagittifolium* corms can be cooked and used to some extent in the diets of growing pigs. Esonu (2000) reported that starter broilers could tolerate up to 20% inclusion levels of wild variegated cocoyam (*Canarium hortulanum* is cultivated in Edo, Benue and Eastern states, where they compete with yam (Apata and Babalola, 2012). Although cocoyam is cultivated extensively in Nigeria, information is scarce on its uses as animal feed. It was shown that cocoyam is a fairly good source of important nutrients, such as calcium and magnesium. Tannia has 39 mg per 110g of food (Ahaotu, 2018), and taro has 0.58 mg per 100g of food (Caicedo *et al*., 2018). Although the root and tuber meal is low in protein, its energy content is remarkably high, and its price, relative to maize, is low; hence, the cost of production will be low. Therefore, to compensate for the increase in the high price of maize and the competition with humans, there is a need to look at alternative sources of energy, like cocoyam, to produce poultry feeds at a comparatively cheaper rate. Thus, this study was carried out to determine the effect of graded levels of cocoyam meal on the morphometric organ weight of broiler chicken. A major source of concern is the fact that cost of feed takes the highest portion in terms of total cost of production in broiler chicken, but by the use of less competitive feedstuff or cheaper feedstuff materials with a reliable nutritional requirement for broiler chicken, this could be reduced. Therefore, it is most compelling to look for alternatives. Such a suitable alternative can be explored by incorporating cocoyam in the broiler diet. This study would also provide relevant information on the morphometric organ weight of broiler birds fed graded levels of cocoyam.

MATERIALS AND METHODS

This research was conducted at the Poultry Unit of the Teaching and Research Farm of the College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State. The area is in the South-Eastern part of Nigeria on latitude $5^0 27^!$ north, longitude 7^0 32' East, an altitude of 123m above sea level with an annual rainfall of 2177mm, temperature of 22^0C – 36^0C and relative humidity of 50 – 90%. It is situated within the humid rain forest zone of West Africa, characterized by long duration of rainy season (March-October) and short period of dry season (November - February). Climatic data were collected from the Meteorological Centre of National Root Crop Research Institute, Umudike, Abia State (NRCRI, 2010).

One hundred and twenty (120) day-old broiler chicks of the Anak strain were used for the study. They were procured from a recognised hatchery at Ibadan. They were brooded for two weeks before randomly allocating them to treatment pens. The birds were randomly divided into 4 treatment groups in a completely randomised design of 30 birds per group, and each group were further divided into 3 replicates of 10 birds per replicate in group. The groups were represented thus: T1, T2, T3 and T4, respectively. T1 served as the control. Adequate heat and light were provided with the aid of kerosene stoves and electric bulbs, respectively. They were managed in deep litter pens throughout the experimental period and were fed experimental diet and water *ad libitum.* Routine management practices were also carried out appropriately. The study lasted for 8 weeks.

Tannia cocoyam corms *(Xanthosoma sagittifolium*) were obtained from the National Root Crop Research Institute, Umudike, Umuahia, Abia state. They were harvested, cleaned and chopped into bits. Chopped cocoyam was cooked for a few minutes to reduce the anti-nutrient content and then sun-dried. The dried cocoyam was milled. Other ingredients like maize, palm kernel cake, brewers dried grains, blood meal, fish meal, bone meal, vitamin premix, lysine, methionine, and salt were obtained from a reliable source in Umuahia, Abia state.

The cooked cocoyam was used to formulate diets at inclusion levels of 0.00%, 10.00%, 20.00% and 30.00% representing T1 (control) with no cocoyam inclusion, while

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T2, T3 and T4 contain 10.00%, 20.00% and 30.00% inclusion of cocoyam in partial replacement of maize, respectively. The ingredient compositions of the diets are shown in Table 1 below.

Table 1: Percentage composition of experimental diet

Ingredients	T1	T2	T3	T4
Maize	62	55.8	49.60	43.40
Cocoyam	0	6.2	12.4	18.6
Soy bean meal	20.8	20.8	20.8	20.8
Wheat offal	2.00	2.00	2.00	2.00
Groundnut cake	6.55	6.55	6.55	6.55
Fish meal	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Vit/mineral premix	0.25	0.25	0.25	0.25
Salt	0.20	0.20	0.20	0.20
Total	100	100	100	100
Metabolizable energy (Kcal/kg)	2921.32	2919.64	2917.97	2916.77
Crude protein	21	20.63	20.42	20.22
Crude fiber	3.15	4.05	4.14	4.24
Calcium	1.42	1.42	1.43	1.43
Phosphorus	0.91	0.90	0.89	0.88
Fat	4.3	4.12	3.97	3.81

Data were collected on the parameters below:

Carcass characteristic

Live weight (g/bird), Dressed weight (g), Percentage Dressed weight (%), Breast weight (%), Drum stick (%), Thigh (%), Back cut (%), Wing (%) Shank, Head (%), Neck (%) (%)

Morphometric organ weight

Intestine, Proventiculus, Kidney, Gizzard, Spleen, Heart, Liver, Lungs, Lung

The experimental design is a Completely Randomised Design (CRD) with 4 dietary treatments and replicated three times. Thirty (30) birds were randomly allocated to each treatment. Each treatment was replicated three (3) times with 10 birds per replicate. The experimental model is as follows:

Yij= U + Ti+ eij

Where **Yij** = individual observation on the broiler characteristics.

μ= overall mean

Ti = treatment effect

eij = random error assumed to be independently, identically and normally distributed with zero means and constant variances.

Data collected on the different parameters were subjected to one-way Analysis of Variance (ANOVA) according to Snedecor and Cochran (1989), where significant treatment effects were detected from the ANOVA. Means were separated using Duncan ˊs New Multiple Range Test Steel and Torrie (1980).

Results and Discussion

Carcass characteristics of broiler chicken fed graded levels of cocoyam.

The results of the carcass characteristics of broiler chicken fed graded levels of cocoyam-based diet are presented in Table 2.

Table 2: Carcass characteristics of broiler chicken fed graded levels of cocoyam.

Parameters	T1 (Control)	T2 (10%)	T3 (20%)	T4 (30%)	SEM
Live weight (g/bird)	1843.51^a	1789.25^b	1807.66^a	1820.18^a	13.71
Dressed weight (g)	1572.70^a	1440.53^b	1538.53^a	1508.86^a	10.85

Percentage Dressed weight (%)	85.31	80.51	85.11	82.89	1.43
Breast weight (%)	30.00[b]	28.11[c]	30.11[b]	32.25[a]	0.98
Drum stick (%)	20.20	22.10	20.85	20.70	0.36
Thigh (%)	19.30	18.25	20.36	21.45	0.51
Back cut (%)	32.25[a]	27.55[b]	27.35[b]	32.10[a]	2.90
Wing (%)	16.15	15.83	17.55	16.20	0.43
Shank (%)	5.60	5.00	5.11	5.02	1.09
Neck (%)	4.20	4.40	4.18	4.00	0.36
Head (%)	3.20	3.00	3.05	3.10	0.22

a,b,c Means across rows with different superscripts differ significantly at P<0.05; ±Standard error of means.

The main indicator of the quality of poultry meat is the quality of the carcass, which is determined by its nutritional status, taking into account the degree of fat and muscle tissue (Maiorano and Bednarczyk, 2013). Showing that the quality of the carcass is very critical to the determination of the profit obtainable from broiler production. The result obtained in this study showed that there were significance differences (p<0.05) in the live weight, dressed weight, breast muscle and back cut while there were no significance differences (p>0.05) among the treatment groups in the dressing percentage, thigh, wings, drumstick, shank, neck and head.

The live weight of birds fed diet 1 (1843.51g), diet 3 (1807.66g) and diet 4 (1820.18g) were comparable (p>0.05) but significantly higher (p<0.05) than the relative live weight of birds fed diet 2 (1789.25g). However, the live weight obtained in this study ranged from 1789.25 to 1843.51g. Similar pattern were observed in the dressed weight in this study where birds fed diet 1 (1572.70g), diet 3 (1538.53g) and diet 4 (1508.86g) were comparable (p>0.05) but significantly higher (p<0.05) than the relative dressed weight of birds fed diet 2 (1440.53g). The dressed weight obtained ranged from 1440.53 to 1572.70g. The good performance depicted by the highest live weight of the birds fed diets 1, 3 and 4 was evidence of better utilisation of nutrients. Obun *et al*. (2011) linked improved performance of broilers fed cocoyam-based diets to improved palatability of feed, which makes more meat available. Also, the observed high mean live weight resulted in high dressed weights, which showed that a good portion of the live weight is edible (Oluyemi and Roberts, 2000). This is in agreement with the findings of Hayse and Marison (2003), who confirmed that heavier birds produced a greater eviscerated yield. The per cent carcass yield observed was also in agreement with Ojewola *et al*. (2000).

The breast weight recorded showed that birds fed diet 4 (32.25%) were significantly (p<0.05) higher while birds fed diet 2 (28.11%) recorded the least value. The broilers on diet 1 (32.25%) and diet 4 (32.10%) gave the highest (p<0.05) percent back cut while those on diet 2 (27.55%) and diet 3 (27.35%) gave the lowest back cut. The higher breast weight and back cut of birds fed diet 4 in this study may be an indication of better conversion of dietary nutrients into meat Okorie *et al*. (2010). The Increased in weight obtained as the level of cocoyam in the diets increased may be related to heavier live weights of broilers on cocoyam meal- based diets. Such an assumption is supported by Hossain *et al*. (2003), who found increasing dressing yield with the increase of live weight in broilers.

In addition, the carcass parameters studied by different authors showed different results. Onyimonyi and Okeke (2005) showed that the drumstick, wing, neck, shank, and breast among the birds in the different treatments showed no significant (p>0.05) difference although the weight of the breast, drumstick and thigh tended to decrease with increasing level of cassava. Similarly, Gomez and Noma (2006) reported that carcass primal parts, carcass yield were not significantly (p>0.05) affected by a diet of maize and cassava meal. Hossain *et al*. (2003) found that the meat yield characteristics of broiler fed dietary treatments were significant (p<0.05) in terms of statistical analysis. Thus, the differences in diet composition significantly (P<0.05) affect this carcass cut parts in broiler chickens. Upon digestion, a part of the nutrients absorbed are used for tissue synthesis (Hossain *et al*., 2003).

Meanwhile, the other parameters measured, such as dressing percentage, thigh, wings, drumstick, shank, neck and head, showed no significant differences (p>0.05) among treatment groups. The similarities in the carcass values between the dietary treatments indicate the uniformity of the diets. This seems to suggest that there was no foreign body in the cocoyam that negatively affected nutrient metabolism. The thighs and drumsticks are part of the most economically important portion of the carcass and also provide the greatest portions of edible meat in broilers (Smith and Teeter, 2007). The observation, here on the effect of cocoyam on carcass development, gives an indication that feeding broiler finishers within this level of replacement (30%) poses no serious consequences on the carcass development and function (Ahaotu, 2018). Thus, cocoyam meal can replace maize in the diets of broilers at 30% without any deleterious effect on the relative carcass cut parts of the birds, but promotes healthy growth of the organs.

Morphometric organ weight of broiler chicken fed graded levels of cocoyam.

The results of the organ proportion of broiler chicken fed graded levels of cocoyam-based diet are presented in Table 3.

Table 3: Morphometric organ weight of broiler chickens fed graded levels of cocoyam.

Parameters	T1 (Control)	T2 (10%)	T3 (20%)	T4 (30%)	SEM
Intestine	4.02^{c}	4.65^{b}	5.90^{a}	5.94^{a}	1.27
Proventiculus	0.52	0.55	0.58	0.50	0.02
Kidney	0.88	0.78	0.78	0.88	0.02
Gizzard	2.10^{b}	2.05^{b}	2.62^{a}	2.68^{a}	0.52
Spleen	0.42	0.41	0.40	0.41	0.06
Heart	0.81	0.82	0.80	0.80	0.03
Liver	2.10	2.00	2.11	2.00	0.04
Lungs	0.88	0.83	0.87	0.80	0.06
Crop	0.95a	0.90a	0.85b	0.80b	0.05

[a,b,c] Means across rows with different superscripts differ significantly at P<0.05; S.E.M: Standard Error of the Mean.

The intestine, crop and gizzard showed significant (p<0.05) differences among the treatment groups, while the lungs, heart, liver, kidney, proventriculus and spleen were not significantly (p>0.05) different among the treatment groups. The weight of the crop was significantly (P<0.05) higher for birds fed diets 1(0.95%) and diet 2(0.90%) followed closely by birds fed diet 3(0.85%) and diet 4(0.80%). As reported by Ashika (2016), since the fullness of size of the crop is dependent on the rate of digestion in the lower segments of the gut, the lighter weight of the crop and its digesta in birds fed diet 3 and diet 4 is an indication of faster breakdown of feed in these segments of the gut and a better utilization of cocoyam-based diet. The better development of the crop on birds fed cocoyam-based diets could be due to the nature of the feed passing through the digestive tract, which has a profound effect on the development (Abonyi and Uchendu, 2005).

The weight of gizzard was highest (P<0.05) for birds fed diet 3(2.62%) and diet 4(2.68%), closely followed by birds on diet 1(2.10%) and diet 2(2.05%). An increase in the proportion of the gizzard could be an indication of a more intensive activity of the organ. A similar result was reported on broilers by Téguia *et al*. (2002). The significant increase in weight of the gizzard in birds fed diets 3 and 4 as compared to the control could be attributed to better growth and development as a result of effective utilisation of nutrients. A similar finding was reported on broilers by Agwunobi *et al*. (2002). Cooking of cocoyam could have reduced the level of anti-nutritional factors present, thereby enhancing the palatability, consumption and digestibility (Caicedo *et al*., 2018; Cagas, 2017). Thus, increases the bioavailability of the required nutrients and consequent positive development of organs. Similar changes were reported on broiler finisher birds by Ahaotu (2018).

The weight of intestine obtained showed that birds fed diet 3 (5.90%) and diet 4 (5.94%) were comparable but significantly (p<0.05) higher than that of birds fed diet 2 (4.65%) while birds on diet 1 (4.02%) had the least relative weight of intestine. The weight of the intestine, which increased with increasing level of cocoyam in the diet, showed that at 30% inclusion, it had no adverse effect on gut morphology (Eruvbetine *et al*., 2003). Onyimonyi and Okeke (2005) indicated that dietary fibre might be expected to influence the peristaltic activity and thereby increase the microbial growth in the gastrointestinal tract. This can lead to an increased excretion of nutrients in faeces. Dietary fibre beneficially influences well-being and health. Thus, high cocoyam in the diet increased the fibre content and had a considerable influence on the weight of most parts of the gastrointestinal tract. Phillips *et al.* (2004) showed that moderate amounts of fibre might improve the development of organs and nutrient digestibility in poultry. Similar results were obtained on broilers by Eruvbetine *et al*. (2003) using cassava meal diets.

In addition, the increase in weight of the intestine and gizzard with high fibre level could be explained by the fact that these organs directly handle the churning, maceration and digestion of feed. The higher the fibre, the longer these works are done. Unlike the less fibrous feed, it takes a longer time and more work before the digestion process of high fibre feed is completed, hence the increase in size of these organs. It had been reported that the presence of fibre in diets tends to lower the absorption of nutrients while the non-absorbed portions would add to the weight of the gastrointestinal tract (Alokan, 2002). Therefore, the increase in the weight of the intestine and gizzard at increased levels of replacement of cocoyam in this study is similar to results for broiler chickens fed graded levels of bread fruit and sun-dried wild cocoyam (Oladunjoye *et al*., 2004; Olayide, 2012). As reported by Onyimonyi and Okeke (2005), higher crude fibre in cassava may limit the level of inclusion of this ingredient in poultry ration, thus making the nutrients unavailable to the birds.

Furthermore, the other parameters measured, such as lungs, heart, liver, kidney, proventriculus and spleen, were not significantly (P>0.05) affected by the treatment diets. The result aligns with the report of Gomez and Noma (2006), who observed that carcass primal parts, internal organs were not

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significantly (p>0.05) affected by a diet of maize and cassava. An indication that the cocoyam-based diets can be used as a substitute for maize in broiler nutrition without deleterious effects, and no signs of toxicity were observed. Boiling of cocoyam reduced the anti-nutritional factor to safe levels (Agwunobi *et al*., 2002). Furthermore, the non-significant effect of the cocoyam on the relative weight of these internal organs, as observed in this study, tends to indicate that these organs were able to perform their physiological activities. Besides, the diets containing varying levels of cocoyam were able to support normal organ and development. Green *et al*. (2006) showed that the growth of organs can be inhibited when insufficient protein and carbohydrate are available, which is not the case in this study. Although there could be physiological differences in the utilisation of the various nutrients by these organs due to structural form, other factors can be due to the stage at which this cocoyam was harvested, the processing method used, the species type, the climate and environmental factors (Etuk *et al*., 2013).

From the study, the comparable weights of the internal organs showed better utilisation of the feed at those parts of the gastrointestinal tract when cocoyam meal-based diets were fed to the finisher birds. The values were higher for birds fed diet 3 and diet 4. Thus, these comparable weights of the internal organs on the diet support the assertion that at various levels of inclusion of cocoyam as a replacement for maize, the birds can perform well without any deleterious effect on carcass yield.

Conclusion

The comparable weights of the carcass and organs showed better utilization of the feed at those parts of the gastrointestinal tract when cocoyam-based diets were fed to the finisher birds.

Recommendation

The observation on the effect of cocoyam indicates that feeding broiler finishers up to 30% level poses no serious consequences on the carcass development and function

References

1. Abdulrashid, M., & Agwunobi, L. N. (2009). Taro cocoyam (*Colocasia esculenta*) meal as feed ingredient in poultry. *Pakistan Journal of Nutrition, 8*(5), 666–673.
2. Abdulrashid, M., Agwunobi, L. N., Akpa, G. N., & Adeyinka, E. D. (2006). The performance of finisher broilers on varying levels of Taro cocoyam meal. In *Proceedings of the 31st Annual Conference of Nigerian Society of Animal Production (NSAP)*, Kano, Nigeria.
3. Abonyi, F. O., & Uchendu, C. N. (2005). Carcass quality of broilers fed graded levels of palm kernel cake finisher diet. In *Proceedings of the 30th Annual Conference of the Nigerian Society for Animal Production*, Nsukka, Nigeria (pp. 210–212).
4. Agwunobi, L. N., Angwukam, P. O., Cora, O. O., & Isika, M. A. (2002). Studies on the use of Taro cocoyam in the diets of weaned pigs. *Tropical Animal Health and Production, 34*(3), 241–247.
5. Ahaotu, E. O. (2018). Performance and carcass characteristics of starter broiler birds fed processed cocoyam (*Xanthosoma sagittifolium*) corm meal. *Journal of Poultry Science and Technology, 6*(1), 5–9.
6. Alokan, J. A. (2002). Evaluation of water parri (*Azolla pinnata*) in the diet of group rabbits. In *Proceedings of the 25th Annual Conference of Nigerian Society of Animal Production*, Umudike, Nigeria.
7. Apata, D. F., & Babalola, T. O. (2012). The use of cassava, sweet potato and cocoyam, and their by-products by non-ruminants. *International Journal of Food Science and Nutrition Engineering, 2*(4), 54–62.
8. Caicedo, W., Vargas, J. C., Uvidia, H., Samaniego, E., Valle, S., & Flores, L. (2018). Effect of taro (*Colocasia esculenta* (L.) Schott) silage on the productive performance of commercial pigs: Technical note. *Cuban Journal of Agricultural Science, 52*(2), 1–5.
9. Esonu, B. O. (2000). *Animal nutrition and feeding: A functional approach*. Owerri, Nigeria: Memory Press.
10. Etuk, E. B., Anopueme, B., Etuk, I. F., Ekpo, J. S., Emenalom, O. O., & Esonu, B. O. (2013). Effect of different combination levels of palm kernel cake, yam peel and plantain peel meals as partial replacement for maize in broiler starter diets. *Nigerian Journal of Animal Production, 40*(1), 73–78.
11. Eruvbetine, D., Tajudeen, I. D., Adeosun, A. T., & Olojede, A. A. (2003). Cassava (*Manihot esculenta*) leaf and tuber concentrate in diets for broiler chickens. *Bioresource Technology, 86*, 277–281.
12. FAO. (2010). *The state of food and agriculture 2010–2011: Women in agriculture – Closing the gender gap for development*. Rome: Food and Agriculture Organization of the United Nations.
13. FAO. (2011). *Small-scale poultry production*. FAO Corporate Document Repository. http://www.fao.org/docrep/008/y5169e/y5169e01.htm
14. Gomez, G. M., & Noma, E. (2006). Evaluation of cassava root meal prepared from low and high-cyanide-containing cultivars in pig and broiler diets. *Nutrition Reports International, 28*, 693–704.
15. Green, D. K., Lindsey, J., McGill, N. I., Lindsey, L. A., & Cooke, H. J. (2000). In vivo loss of telomeric repeats with age in humans. *Mutation Research, 256*, 45–48.
16. Hossain, M. H., Ahammad, M. U., & Howlider, M. A. R. (2003). Replacement of fish meal by broiler offal in broiler diet. *International Journal of Poultry Science, 2*(2), 159–163.

*Corresponding Author: **Urom, S.M.O.C**

17. National Root Crops Research Institute (NRCRI). (2010). *Annual Report*. Umudike, Abia State, Nigeria.
18. Ojewola, G. S., Oguike, M. A., Akomas, S. C., Likita, T., Onyiro, O. M., & Wokocha, C. (2000). Comparison of the supplemental effects of Roxaenzyme-Genzyme in palm kernel meal and brewer's dried grain-based diets fed to turkey poults. *Nigerian Agricultural Journal, 34,* 116–124.
19. Okon, B. I., Obi, M. B., & Ayuk, A. A. (2007). Performance of quail (*Coturnix coturnix japonica*) fed graded levels of boiled sun-dried taro cocoyam (*Colocasia esculenta*) as a replacement for maize. *Agriculture Journal, 2*, 654–657.
20. Oladunjoye, I. O., Ologhobo, A. D., Emiola, I. A., & Amao, O. A. (2004). Growth performance, carcass analysis and organ weights of broilers fed varying levels of breadfruit (*Artocarpus utilis*) meal-based diets. *Tropical Journal of Animal Science, 7*(1), 133–140.
21. Olayide, R. (2012). Performance, carcass and blood indices of broiler chickens fed graded levels of sun-dried raw wild cocoyam (*Colocasia esculenta* Schott) corms as partial substitutes for maize. *Nigerian Journal of Animal Production, 39*, 71–82.
22. Oluyemi, J. A., & Roberts, F. A. (2000). *Poultry production in warm wet climate* (4th ed.). London: MacMillan Press Ltd.
23. Onyimonyi, A. E., & Okeke, G. C. (2005). Carcass, organ and pathological characteristics of grower pigs fed cassava peel meal. *Journal of Agriculture, Food and Environment Extension, 1*(1), 1–4.
24. Smith, M. O., & Teeter, R. G. (2007). Influence of feed intake and ambient temperature stress on the relative yield of broiler parts. *Nutrition Reports International, 35*, 299–306.
25. Teguia, A., Mpoame, M., & Okourou Mba, J. A. (2002). The production performance of broiler birds as affected by the replacement of fish meal by maggot meal in the starter and finisher diets. *Tropicultura, 4,* 187–192.
26. Uchegbu, M. C., Etuk, E. B., Omede, A. A., Okpala, C. P., Okoli, I. C., & Opara, M. N. (2010). Effect of replacing maize with cassava root meal and maize/sorghum brewer's dried grains on the performance of starter broilers. *Tropical Subtropical Agroecosystems, 14*, 363–367

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