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EFFECT OF POLYZYME® ON THE CARCASS CHARATERISTICS OF BROILER CHICKEN FED SWEET ORANGE (*Citrus sinensis*) PEEL MEAL BASED DIETS

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Abstract: *The study evaluated the effect of Polyzyme® an exogenous enzyme on the carcass characteristics of Broiler Chicken fed Sweet Orange (Citrus sinensis) peel meal. 300 day-old broiler chicks were used. The birds were randomly grouped into five (5) dietary treatments D1, D2, D3, D4 and D5 of 60 chicks each. Each of the dietary treatments was further divided into two, one have enzyme and the other did not have. Each treatment was replicated 3 times with 10 birds per replicate. The experiment is a two by four factorial arrangement in a completely randomized design. Weight was taken for carcass, stomach contents and empty body weight. Weights of the breast, thigh, drum stick, wings, back, abdominal fat, liver, pancreas, gizzard, spleen, heart, kidney, gastro intestinal tract (GIT), oesophagus, crop, small intestine, large intestine and cecum were taken with a meter rule.. The result showed no significant difference (P<0.05) between the treatment mean for shank, drumstick, breast and the neck. But significant differences (P>0.05) existed between the treatment means of thigh, wing, back, head and the abdominal fat. This result suggested that the inclusion of SOP with enzyme (Polyzyme®) in broiler chicken diet did not have any noticeable negative difference on the carcass characteristics of broiler chicken. The use of polyzyme® appears to improve the performance. More research is recommended to establish the best level of inclusion.*

Key words: *Broiler chicken, Carcass, polyzyme, sweet orange peel,(SOP) and characteristics.*

1.0 Introduction

The need to bridge the gap between protein demand and supply in Nigeria and the Sub-Saharan Africa has remained a long standing challenge for nutritionists in particular and animal scientists in general. Livestock product play important role in Nigeria's agriculture. It contributes 9.88% of the agricultural gross domestic product (CBN, 2013). The 2001 population of livestock in Nigeria has been estimated to be 118.59 million poultry, 45.26 million goats, 28.69 million sheep, 15.60 million cattle, 5.25 million pigs, and 1 million horses, camels and donkeys (National Planning Commission, 2004). Despite this enormous animal resource, a wide gap exists between demand

and supply of animal resources. It has been reported that the daily animal protein intake per caput in Nigeria is about 45.4g, which is far below the required 53.8g protein intake requirement of animal origin out of 70g daily recommended total protein intake (Iyangbe and Orewa, 2009). One of the major reasons for the low level of animal protein intake in the tropics and in Nigeria in particular is because livestock production is not keeping pace with human population growth rate put at 2.6% (UNDESA, 2017).

Another critical reason is the scarcity of conventional feed stuffs (energy and protein sources) for monogastric animal feeding and consequently the cost of livestock feed. In Nigeria, feed cost is estimated to be about 70% of the total cost of intensive livestock production. The search for alternative feed resources which are less competitive, affordable, and readily available and can be efficiently converted by farm animals to meat and other consumable animal products for the enhancement of animal production has therefore become of great interest (Oluremi et al., 2008).

The poultry sector in Nigeria if properly harnessed has the potential of improving the nation's economy and the health status of the poor populace by providing affordable source of protein (Taiwo *et al*., 2005; Akinmutimi and Ugwu, 2007; Abubakar *et al*., 2009; Akinola, 2009). Nutrition and disease are the major limiting factors in poultry production (Jurgens, 2009). Availability of quality feed at a reasonable cost is therefore the key to successful poultry production. Poultry especially broiler, are excellent feed converters and do not suffer social infringements on consumer acceptability like other livestock species such as pig. The foregoing has triggered the rising demand for poultry products (eggs and meat) given their palatability and high nutritional value. These attributes amongst others, make the poultry industry stand tall amidst rival livestock practicing ventures. The development of the poultry industry has been described as the fastest way of ameliorating the animal protein deficiency in third world countries, due to the high turnover rate associated with poultry production and consequent economic efficiency (Dipeolu, 2004).

In spite of the aforementioned benefits derived from poultry, the ever-increasing cost of products such as meat and egg makes it imperative to explore the use of alternative feed ingredient that are cheaper, locally available and of low human preference in poultry feed formulation (Ani *et al*., 2015). One of such alternatives is the sweet orange (*Citrus sinensis*) peels. A number of residue materials like peels, pulp, rag and seed are produced when fresh citrus fruits are processed into juice, concentrates and canned fruits in developed countries (Chapman et al., 2000). In Nigeria, of all the varieties of citrus, the sweet orange is consumed on a wide scale, and the peels are usually considered as waste, which at times are seen littered on the streets and along roads due to the fact that the Nigerian Government and orange retailers have not developed strategic disposal programme. As such, orange peels have become an environmental problem (Ani *et al.,* 2015). It can be inferred that one of the present day *coci foci* of science is to come up with modalities on how to recycle waste materials that are hazardous to the environment into useful products that can be of benefit to humans. It is on this premise that Ipinjolu (2000) reported that rather than discarding these peels, they can be sundried and then milled in grading machine to

obtain fine-particles of orange peel meal. Orange fruit peel meal has been observed to be a source of calories and protein comparable with maize (Oluremi e*t al*., 2006).

Nutritional trials with monogastric animals have shown that the meal of sun-dried peels of *Citrus sinensis* can replace up to 2% to 20% of dietary maize in broiler diets (Nobakht, 2013; Orayaga *et al*., 2015; Alefzadeh *et al*., 2016; Ahaotu et al., 2017) without any adverse effect on their performance. The orange peel is reported to contain oil sacs and the oil is composed of 91 – 94% D-limonene and 2.0 – 2.1% B-myrcene as a minor constituent. Polymetholated-flavones are also a class of compound found in citrus peel and produce no negative effect in the animal fed on the polymetholated flavones-containing diets (Stevenson and Hurst, 2007).
However, citrus seed meal has been reported to contain limonene which is toxic to monogastric animals pig, and especially to poultry (Serres, 1992). While, orange peel has been included in the diet of ruminant especially in those areas where its production is in high quantity, the presence of limonene may be a limitation to its use in raising monogastric animals. Additional reports (Oluremi *et al*., 2007) shows that citrus fruit peel meal contains anti-nutritional factors such as limonene which prevent effective absorption and utilization of micro-macro nutrients in the body.

The various researchers on the use of sweet orange peel meal has various reports ranging from positive results to negative ones but all the researchers have agreed on the need for further research. Some of the researchers earlier mentioned have applied a variety of treatment methods to the sweet orange peel before feeding to animals. The preparations range from sun drying, air drying, and fermentation, soaking in water and subsequently grinding (Ojabo *et al.,* 2014). The use of exogenous enzyme has been considered by some researchers (Alefzadeh *et al.,* 2016; Abdel-Moneim *et al*., 2014), but literatures are scarce on the use of exogenous enzymes to treat sweet orange peel meal in animal feeding. This study is therefore designed to investigate the effect of exogenous enzyme (Polyzyme®) on the utilization of sweet orange peel meal by broiler chicken on the carcass characteristics. To determine the carcass yield of broiler chickens fed sweet orange peel meal base diets treated with Polyzyme®.

2.0 Materials and Methods

The experimental was carried out at the Poultry Unit in the Department of Animal Husbandry, School of Animal Technology, Akperan Orshi Polytechnic, Yandev, Gboko, Benue State, Nigeria. Yandev is located within the guinea savannah zone of Nigeria at latitude $7^0$23’ North and longitude 90^0 10’ East of the equator. The area is characterized by 6-7 months of rainfall and the annual rainfall intensity ranges from 1350-1400mm. The ambient temperature is higher around March and ranges from 34^0C-36^0C and the lowest mean monthly temperature ranges from 26^0C-28^0C around January. The relative humidity is highest (69%) between August and September and lowest (39%) in January and February (AOPOLY met. Station). Three hundred day-old broiler chicks was obtained from a reputable hatchery. The birds were randomly grouped into five (5) dietary treatments D1, D2, D3, D4 and D5 of 60 chicks each. Each of the dietary treatments was further divided into two, one have enzyme and the other did not have. Each treatment was replicated 3 times with 10 birds per replicate. The experiment is a two by four factorial arrangement in a completely randomized design. Sweet orange peel was collected from Yandev and Gboko from sweet orange fruit retailers who peel the fruit for immediate human

consumption. It was soaked in water for 24hrs, sun dried and ground. The macro and micro ingredients namely maize, soybean meal, common salt L-lysine, DL-methionine, premix, fish meal, bone ash and limestone was sourced locally in Gboko. While Polyzyme® was obtained from a commercial store dealing in feed additives.

An open sided house with one meter high brick wall, covered to the top with wire gauze and roofed with zinc sheets was used for the feeding trial. Before the feeding trial, the poultry rearing unit was thoroughly cleaned for any refuse. The building complex was fumigated, washed and disinfected with 1% formalin solution. Five pens of equal sizes (6m x 2m) was made by wire-net and wooden materials. Each of the five pens was further sub-divided into three (3) to make a total of 15 sub-pens. Feeders, waterers, buckets and all other necessary equipment were cleaned, washed and disinfected with a disinfectant solution, and dry rice husks was used as litter materials at a depth of 2.5cm. Immediately after the arrival of day-old-chicks, they were weighed and randomly distributed in each pen. Used sheet of paper was used to cover the litter to ensure easy feeding and brooding of day old chicks. The chicks were provided with vitality solution to overcome transportation stress. One 100-watt bulb hanging electric bulb placed in each pen were used to maintain brooding temperature. A metallic charcoal stove with a tripod stand and tray made of iron welded to the base of the tripod stand were used to provide heat in the night when the temperature is low to maintain the brooding temperature. The brooding temperature and humidity were measured four times in a day by an automatic digital thermo-hygrometer (KUSAM-MECO).

The litters was regularly checked for dampness and if necessary replaced by new one to minimize ammonia concentration in the house which will stress the birds. After fourth week of age, faecal droppings contains higher moisture thus, litter was checked frequently for its dampness. It was stirred once a week to prevent cake formation and minimize dampness. The feeding trial lasted for a maximum of 56 days. The broilers were given a starter diet for 28 days and a finisher diet 28 days. Both diets were in mash form. Fountain/self-feeders were used for supplying feed. Two fountain/self-feeders and one round drinker with a capacity of eighty litres were provided in each pen fresh and clean drinking water was supplied three times daily (morning, afternoon and evening). The birds had free access to both feed and water. Feeders were cleaned every day in the evening while drinkers were washed two times daily (morning and evening). Vitalyte was supplied to the births of all groups at manufacturer's prescription in fresh drinking water to overcome physiological stresses resulting from vaccination, weighing and the environment. Strict bio-security measures was maintained inside and outside the experimental sheds as an effective part of the disease prevention program. Entry to the experimental shed was highly restricted. A foot-bath was maintained at the gate of the shed where formaldehyde solution and Izal were used alternatively as disinfectants. All the birds were vaccinated against Newcastle Diseases (NCD), infections bronchitis disease (Gumboro), NCD vaccines was given at 4^{th} day of age, followed by booster dose of NCD at 21^{st} day of age, while the gumboro vaccine was given at 10^{th} and 17^{th} days of age. The vaccine before day 7 was intraocular and others orally via drinking water. The birds were placed on prophylactic coccidial medication.

The control diet is D1 with no sweet orange peel (SOP) meal and Polyzym® in their feed. D2 – D5 contained Polyzyme® at 40g per 100kg and sweet orange peel meal replaced maize in the control diet at 10%, 20%, 30% and 40% to give diets D2, D3, D4 and D5 respectively in both starter and finisher diets. The feed ingredients used for compounding the diets are presented in Table 1 (Broiler starter) and table 2 (Broiler finisher).

Table 1: Gross Composition of the Starter Broiler Diet

	Experimental Diets				
Ingredients	**D1**	**D2**	**D3**	**D4**	**D5**
SOP*	-	5.50	11.00	16.50	22.00
Soybean meal	34.00	34.00	34.00	34.00	34.00
Bone ash	2.30	2.30	2.30	2.30	2.30
Limestone	1.00	1.00	1.00	1.00	1.00
Fish meal	3.50	3.50	3.50	3.50	3.50
Rice offal	3.30	3.50	3.50	3.50	3.50
Common salt	0.20	0.20	0.20	0.20	0.20
L-lysine	0.20	0.20	0.20	0.20	0.20
DL-methionine	0.25	0.25	0.25	0.25	0.25
Premix**	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition					
Crude protein (%)	22.73	22.75	21.77	22.78	22.80
ME (Kcal/Kg)	2903.98	2891.22	2878.46	2865.70	2852.94
Crude Fibre (%)	4.14	4.63	5.12	5.61	6.11
Methionine (%)	0.76	0.75	0.74	0.72	0.71
Lysine (%)	1.47	1.46	1.45	1.43	1.42
Calcium (%)	1.51	1.51	1.51	1.51	1.51
Phosphorus (%)	0.86	0.84	0.83	0.81	0.80

D1 – Control, D2 – 10% SOP, D3 – 20% SOP, D4 – 30% SOP, D5 – 40% SOP ,SOP - Sweet Orange Peel

** Premix Bio-Mix® supplied per tonne; Vit A 5,000000 I.U., Vit D3 1,000000 I.U., Vit E 20,000mg, Vit K3 100mg; Vit B1 1200mg, Vit B12 10mg; Folic acid 400mg; Chlorine Chloride 120,000mg; Manganese 40,000mg; Iron 20,000mg; Zinc 18,000; Copper 800mg; Cobalt 100mg, Iodine 620mg, Selenium 40mg.

Table 2: Gross Composition of the Finisher Broiler Diet

	Experimental Diets				
Ingredients	**D1**	**D2**	**D3**	**D4**	**D5**
Maize	57.00	51.30	45.60	39.90	34.20
SOP*	-	5.23	11.40	17.10	22.80
Soybean meal	32.00	32.00	32.00	32.00	32.00
Bone ash	2.50	2.50	2.50	2.50	2.50
Limestone	1.00	1.00	1.00	1.00	1.00
Fish meal	2.50	2.50	2.50	2.50	2.50
Rice offal	4.05	4.05	4.05	4.05	4.05
Common salt	0.25	0.25	0.25	0.25	0.25
L-lysine	0.20	0.20	0.20	0.20	0.20
DL-methionine	0.25	0.25	0.25	0.25	0.25
Premix**	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition					
Crude protein (%)	21.43	21.45	21.46	21.48	21.50
ME (Kcal/Kg)	2908.61	2891.22	2878.46	2865.70	2852.94
Crude Fibre (%)	4.14	4.63	5.12	5.61	6.11
Methionine (%)	0.76	0.75	0.74	0.72	0.71
Lysine (%)	1.47	1.46	1.45	1.43	1.42
Calcium (%)	1.51	1.51	1.51	1.51	1.51
Phosphorus (%)	0.86	0.84	0.83	0.81	0.80

D1 – Control, D2 – 10% SOP, D3 – 20% SOP, D4 – 30% SOP, D5 – 40% SOPSOP - Sweet Orange Peel

** Premix Bio-Mix® supplied per tonne; Vit A 5,000000 I.U., Vit D3 1,000000 I.U., Vit E 20,000mg, Vit K3 1000mg; Vit B1 1200mg, Vit B2 2400mg; Vit B6 2400mg, Niacin 16,000mg; Calcium Pantothenate 4,000mg, Biotin 32mg; Vit B12 10mg; Folic acid 400mg; Chlorine Chloride 120,000mg; Manganese 40,000mg; Iron 20,000mg; Zinc 18,000; Copper 800mg; Cobalt 100mg, Iodine 620mg, Selenium 40mg.

At the end of the feeding trial, three (3) birds per replicate totaling nine birds per treatment were selected. Care was taken to choose the most representative birds with respect to body weight compared to the group mean body weight. The head and the legs were separated. Weight was taken for carcass, stomach contents and empty body weight. Weights of the breast, thigh, drum stick, wings, back, abdominal fat, liver, pancreas, gizzard, spleen, heart, kidney, gastro intestinal tract (GIT), oesophagus, crop, small intestine, large intestine and cecum were taken with a meter rule. All data were analyzed using analysis of variance (ANOVA) procedures in the SPSS version 16.0 (March 8, 2008). Where significant difference exists, means were separated according to the procedure of the Duncan's Multiple Range Test.

3.0 Results and Discussion

Result of the interaction effect of dietary sweet orange peel (SOP) by enzyme (Polyzyme ®) supplementation on carcass characteristics of broiler chickens are presented in table 7. The result showed no significant difference ($P<0.05$) between the treatment mean for shank, drumstick, breast and the neck. But significant differences ($P<0.05$) existed between the treatment means of thigh, wing, back, head and the abdominal fat.

Table 3: Interaction Effect of Dietary Sweet Orange Peel (SOP) by Enzyme (Polyzyme®) Supplementation on Carcass Characteristics as Percentage of Dress Weight of Broiler Chickens

SOP X Enzyme	Shank (SHK)	Drumstic (DRST)	Thigh (THG)	Wing (WG)	Breast (BRT)	Back (BCK)	Neck (NCK)
0% SOP 0g (Polyzyme) T_1	6.93^{a}	16.7^{a}	17.57^{ab}	12.53^{ab}	30.09^{a}	13.99^{abc}	2.27^{a}
40g (Polyzyme) T_2	5,84^{a}	15,43^{a}	17.77^{ab}	12.84^{ab}	31.63^{a}	12.16^{c}	6.94^{a}
10% SOP 0g(Polyzyme) T_3	7.21^{a}	16.72^{a}	17.71^{ab}	13.15^{ab}	30.52^{a}	12.27^{bc}	7.84^{a}
40g(Polyzyme) T_4	6.12^{a}	16.35^{a}	17.59^{ab}	11.76^{b}	30.61	15.01^{a}	6.88^{a}
20% SOP 0g(Polyzyme) T_5	6.51^{a}	14.92^{a}	17.74^{ab}	12.80^{ab}	31.35^{a}	12.05^{c}	8.23^{a}
40g(Polyzyme) T_6	7.23^{a}	16.71^{a}	13.16^{b}	13.29^{a}	32.90^{a}	14.30^{abc}	7.37^{a}
30% SOP (Polyzyme) T_7	6.26^{a}	15.54^{a}	13.21^{ab}	13.04^{ab}	29.44^{a}	14.44^{abc}	9.25^{a}
40g (Polyzyme) T_8	7.74a	16.59^{a}	17.81^{ab}	13.21^{ab}	29.19^{a}	14.49^{abc}	7.12^{a}
40% Sop (Polyzyme) T_9	6.80^{a}	15.81^{a}	17.96^{a}	12.42^{ab}	31.08^{a}	13.31^{abc}	7.23^{a}
40G (Polyzyme) T_{10}	7.03^{a}	16.42^{a}	18.02^{a}	1.90^{ab}	30.44^{a}	14.84^{ab}	6.25^{a}
SEM	1.068	-	5.559	0.534	6.978	1.694	2.532
P	0.073	0.178	0.242	0.057	0.161	0.101	0.065
LS	NS	NS	S	S	NS	S	NS

SEM = Standard Error of Mean, P = Probability Value, LS = Level of Significance, S – Significant (P>0.05), NS = Not Significant (P<0.05), S = Significant (P>0.05)
ab = means of the same column with different superscripts are significantly (P>0.05) different
T1 – T10 = Treatments 1 – 10, 0% - 40% = Percentage inclusion of SOP, 0g = no enzyme of SOP
40g = 40g enzyme inclusion

Table 4: Main Effect of SOP or Enzyme (Polyzyme®) Supplementation of Carcass cuts as Percentage of Dressed Weight of Broiler Chickens

Parameters	SOP							Enzyme (Polyzyme®)	
	T1	T2	T3	T4	T5	SEM	P	T1(0g)	T2 (40g)
Shank	6.587	6.668	6.872	6.998	6.918	0.422	0.876	6.744	6.793
Drumstick	16.096	16.538	15.815	16.062	16.118	0.554	0.925	15.951	16.301
Thighs	17.669	17.638	15.448	17.007	17.992	0.963	0.385	17.436	16.865
Wings	12.687	12.455	13.048	13.125	12.160	0.298	0.164	12.789	12.601
Breast	30.859	30.562	32.125	39.316	30.077	1.078	0.507	30.496	30.954
Back	13.077	13.638	13.173	14.463	14.070	0.531	0.359	13.212	14.157
Neck	7.101	7.358	7.800	8.185	6.737	0.649	0.566	7.963	6.909
Head	3.483	3.647	3.687	4.480	3.573	0.358	0.333	3.950	3.597
Abdominal fat	2.512	1.812	2.610	1.808	1.842	0.279	0.132	2.169	2.065

These results are similar to results of many researchers in literature. Sunmola *et al* (2019) reported that there was no significant (P>0.05) difference between the dietary treatments on the dressed weight, thigh and breast. Abdel-Moneim et al (2014), reported that there was no significant (P<0.05) difference in live body weight, gizzard and heart weights for all the experimental groups. The groups fed different levels of orange waste with or without enzyme supplementation recorded a significant decrease in the edible parts. Weights as compared to the control groups, for the dressed weight they reported no significant (P>0.05) differences between

the groups fed orange waste with and without enzyme which showed lower dressed weight compared to the positive control group.

Alefzadeh *et al* (2016) reported that the effect of different treatments supplemented with dried *C. Sinensis* peel on final body weight and carcass yield percentage of broilers was not significantly different from the control groups, but those of different treatments supplemented with dried *C. Sinensis* peel on carcass characteristics and the jejunum and ileum were significantly different from the control groups. This result is in partial agreement with the result of Ebrahimi *et al* (2013a). Also Abbasi et al (2015) reported that there was no significant difference in all the carcass parameters except for the relative weight of the liver and the abdominal fat. Amaga *et al* (2019) reported that there were no significant difference in carcass cut and internal organs.The interaction effect of dietary sweet orange peel (SOP) by enzyme (Polyzyme®) supplementation on carcass characteristics (as percentage dress weight) of broiler chickens as presented in table 3 shows that there was no significant differences among the treatments of the shank, drumstick, breast and neck. But record significant differences in thigh, wing, back, head and abdominal fat. This result agrees with the result of Alfzadeh *et al* (2016) who reported that there was a significant enhancement of broiler drumstick weight ($P<0.05$). That adding 300ppm of dried orange peel powder improved drumstick weight by 27g on average, while at 700ppm dose improved drumstick weight by 36g compared to natuzyme P50® treatment.

This result partly agree with that of Ebrahimi *et al* (2013a) who stated that the effect of different treatments supplementation with dried citrus sinensis peel on final body weight and carcass yield percentage of broilers was not significantly ($P>0.05$) different from the control groups, but those of different treatments supplemented with dried citrus sinensis peel on carcass characteristics and the jejunum and ileum were significantly different from the control group. The result of Orayaga *et al* (2016) was also in line with this result. They reported that the carcass yield, final weight, bled and plucked percentages were not significantly affected ($P>0.05$) by the dietary treatments. The non-significant difference that existed between the treatment means suggested that with the inclusion of SOP and Polyzyme the plane of nutrition of the treatment diets and that of the control was the same. Disproportionate growth could be caused by diet (Habbard, 2006) and a situation of no significant difference means that the diets were similar in value with respect to supporting carcass yield.

4.0 Conclusions and Recommendation

The non-significant difference that existed between the treatment means suggested that with the inclusion of SOP and Polyzyme the plane of nutrition of the treatment diets and that of the control was the same. More research is recommended to establish the optimum replacement value of sweet orange peel treated with exogenous enzyme with maize.

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References

Abbasi, H., Seidavi, A., Lin, W. and Asadpour, I. (2015). Investigation on the effect of different levels of fried Sweet Orange (*Citrus sinensis*) Pulp on Performance, Carcass characteristics and Physiological and Biochemical Parameters in broiler Chicken. *Saudi Journal of Biological Sciences* 22(2):139-146

Abdel-Moneim, M.A., Hamady, G.AA. and Motawe, H.F.A. (2014). The Use of Orange Waste with and without Enzymes in Broiler's Diets and its Effect on their Performance, Carcas Traits and Some Blood parameters. *Research Journal of Veterinary and Fishery Science* 2(12):14 – 19

Abubakar, M., Doma, U.D., Kalia, D.J.H., Ngile, M.B. and Augustine, C.L.D. (2009). Effect of Dietary Replacement of Maize with Malted or Unmalted Sorghum on the Performance of Weaner Rabbits. *Livestock Research for Rural Development* 18(5):1 – 8.

Ahaotu, E.O., Ekenyem, B.U. and Aggry, E. (2017). Sustainability of Sweet Orange (*Citrus sinensis*) Peel Meal on the Performance of Finisher Broilers. *Journal of Agricultural Science and Practice* 2:27 – 32.

Akinmutimi, E.O., & Ugwu, S.O.C. (2007). Performance of Laying Hen fed varying Dietary levels of Bambara (*Voandzeia Subterrenea Thouars)* Offals. *International Journal of Poultry Science,* 6(3), 223-226. http://dx.doi.org/10.3923/ijps.2007.223.226

Akinola, A. (2009). Economics of Rabbit Production in Gokina Local Government Area of Rivers State, Nigeria Proc. 34th Annual Conference of Nigerian Society of Animal Production, March 15 – 18, 2009. University of Uyo, Akwa Ibom State, Nigeria. Pp 70 – 72.

Alefzadeh, T., Bouyeh, M., Hoven, R.V.D., Seidavi, A.I., Laudadio, V. and Tufarelli, V. (2016). Effect of Dietary Dried Orange (*Citrus sinensis)* Peel Powder and Exogenous Multi Enzymes on Growth and Carcass Traits and Ileal Microflora of Broiler Chickens. Pakistan Journal Zoology 48(6): 19=891 – 1897.

Ani, A.O., Iloh, E.A. and Akinsola, O.O. (2015). Dietary Effect of Processed Orange Peels on Growth Performance of Broiler Finisher Birds. *Britain Journal of Applied Science and Technology* 9(6): 576 – 583.

Central Bank of Nigeria (2003). Annual Report and Statement of Accounts. Central Bank of Nigeria, December, 2013.

Chapman, H.I. Jr., Ammenman, C.B., Baler, F.S. Jr., Henleges, J.F., Hages, B.W. and Cunha, J.J. (2000). Citrus Feed for Beef Cattle. Reviewed Bulletin 151 Dept. of Animal Science Florida Coop. Extension Service, Institute of Florida and agricultural Science, University of Florida, USA.

Dipeolu, B.A. (2004). Studies of Enzymes Supplementation and Herbal Preparation at Different Levels of Energy on the Performance of Broilers. *Journal of International Academic* 3: 53 – 58.

Ipinloju, J.K. (2000). Performance of Juvenile Orange Koi Crop (*Cyprinus carpio*) Fed Diets Supplemented with Sweet Orange Peel Meal; Body Composition, Nutrition, utilization and Skin Pigmentation. *Sokoto Journal of Veterinary Science* 2000: 228 – 229.

Iyangbe, C.O. and Orewa, S.I. (2009). Determinants of Daily Protein intake among Rural and Low-Income Urban Households in Nigeria. *American-Eurasian Journal of Scientific Research* 4(40: 290 – 301.

Jurgens, M.H. (2009). In: lee, I. Chiba (c). Poultry Nutrition and feeding Animal Nutrition handbook.

Nobakht, A. (2013). Evaluation of the Effects of Different Levels of Dried Lemon (*Citrus aurantifula*) Pulp on Performance of Broiler and Laying hens. *International Research Journal of Applied and basic Science* 4(3): 992 – 998.

Ojabo, l.D., Oluremi, O.I.A. and Uza, D.V. (2014). Effect of Feeding Sun-dried Sweet Orange (*Citrus sinensis*) Fruit peel on Pullet Chick Performance. Res. Opin. Anim. Vet. Sci., 4(9): 484 – 488.

Oluremi, O.I.A., Igyu, A.D. and Abu, F.T. (2005). Response of Growing rabbits to Dietary replacement of maize with Sweet Orange (*Citrus sinensis*) Rind. *Journal of Production, Agriculture an Technology* (PAT) 1: 130 – 136.

Oluremi, O.I.A., Mou, P.M., and Adekola, A.Y. (2008). Effect of Fermentation of Sweet Orange (*Citrus sinensis*) Fruit Peel on its Maize Replacement value in Broiler Diet. *Livestock Research for Rural Development* 20(2): 1 – 3.

Oluremi, O.I.A., Ojighen, V.O. and Ejembi, E.H. (2006). The Nutritive Potentials of Sweet Orange (*Citrus sinensis)* Rind in Broiler Production. *International Journal of Poultry Science* 5(7): 613 – 617.

Oluremi, O.I.A., Okafor, F.N., Adekola, A.Y. and Orayaga, K.T. (2010). Effect of Fermentation of Sweet Orange (*Citrus sinensis*) Fruit Peel on its Phytonutrients and the Performance of Broiler Starter. *International Journal of Poultry Science* 9(6): 546 – 549.

Oluremi, O.I.A., Wuanor, G.J. and Orayaga, K.T. (2009). Effect of Fermentation on Some Chemical Constituents in Sweet Orange (*Citrus sinensis*) Peel Meal and Nutrient Digestibility in Broiler Chickens. Proc. Of 14th Annual Conference of Animal Science Association of Nigeria (ASN), September 14th – 17th, 2009. LAUTECh, Ogbomoso, Nigeria.

Orayaga, K.T., Oluremi, O.I.A., and Adekola, A.Y. (2015). Effect of Water Soaking of Sweet Orange (*Citrus sinensis*) Fruit Peels on Haematology, Carcass Yield and Internal Organs of Finisher Broilers Chickens. *Journal of Animal Health and Production* 4(3): 65 – 71.

Serres, H. (1992). Manual of Pig production in the tropics. Cab International, Wellington. Pp 14 – 50.

SPSS (2010). Version 16.0

Stevenson, D.E. and Hurst, R.D. (2007). Polyphenolic Photochemical: Just Antioxidants or Much More? Cellular and Molecular life Sciences 64(22): 2900 – 2916.

Taiwo, A.A., Adejuyigbe, A.D., Adebowale, J.S., Oshotan, O.O. and David, O.O. (2005). Performance and Nutrient Digestibility of Weaner Rabbits Fed Forages Supplemented with Concentrate. *Nigerian Journal of Animal Production.* 32; 74 – 78.