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COCKEREL'S RESPONSE TO PINEAPPLE WASTE MEAL AS FEED: A TRIAL ON GROWTH, NUTRIENT UTILIZATION, AND CARCASS AND ORGAN CHARACTERISTICS

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Abstract: Pineapple waste meal (PWM) can be utilized as an alternative to wheat offal for poultry feed. This study aimed to examine the growth performance, nutrient digestibility, carcass, and organ characteristics of cockerels fed diets containing different levels of PWM. A total of 150 growing Harco cockerels were divided into five treatments, with different levels of PWM as a replacement for wheat offal. Results showed that birds fed 60% PWM had the highest feed intake, followed by those fed 45%, 30%, and 15%, while the control (0% replacement value) had the least feed intake. However, birds fed 15% PWM had the lowest feed: gain ratio, while those fed with 30%, 45%, and 60% had a higher feed: gain ratio. Pineapple waste was relatively fibrous, leading to a numerical depression in weight gain as fiber impaired digestion and absorption of nutrients. Nevertheless, at the replacement levels considered, pineapple waste did not negatively affect the final live weight and weight gain. The study recommends the use of pineapple waste to replace wheat offal up to 45% in the diets of cockerel chickens as it represents an indirect way to reduce feed production cost. These findings offer a valuable means to support sustainability in poultry production and serve as an alternative feed ingredient during dry seasons when wheat offal's price is high.

Keywords: Pineapple waste meal, cockerel, growth performance, nutrient digestibility, carcass and organ characteristics,

INTRODUCTION

Nutritional quality of agro-industrial wastes in animal nutrition especially for monogastric animals is of great importance in the recent time. In facts, many feeds that can be fed alternatively at cheaper cost to monogastric livestock are based on the use of agro- industrial waste that are of no food value to humans (Iyayi, *et al*., 2005). Onwuka, *et al*., (1997) stated

that a major strategy to develop the livestock industry in developing countries could be the use of agricultural by-products like pineapple waste, corn cobs and brewers dry grain as this will has impact on reduction of feed cost which represent approximately 65-75% of production cost and is considered the major cost of poultry production (Fasuyi, A.O, 2005). Many attempts have been made to decrease the cost of feeding to the minimum levels. These attempts include replacing the expensive feedstuffs by cheaper and more abundant byproducts to support the sustainability of poultry production.

Pineapple waste is agro-by products from pineapple fruit. Pineapple waste (PW) occurs as pineapple peels and core, making about 40-50% of the fresh fruit (Buckle 1989) and contains mainly sucrose, fructose, glucose and other nutrients (Krueger *et al*., 1992). Pineapple peel is rich in cellulose, hemicellulose and other carbohydrates. Raw pineapple waste on dry matter basis contains about 4% crude protein, 60-72% NDF, 40-75% soluble sugars as well as pectin (Pereira *et al*., 2009). Therefore, efforts at finding better use for the pineapple waste generated from such huge quantities may be important in terms of environmental pollutions and waste of potential animal feed resource. Such efforts towards preventing and remedying pollution from pineapple waste by previous investigators involved sun drying and incorporation in animal diets with satisfactory results. Makinde, and Sonaiya, (2010) found that chickens could tolerate up to 10% pineapple waste in their diets without any deleterious effects. Olosunde (2010) reported that West African Dwarf sheep could tolerate up to 45% PW but 30% PW was superior even against 0% PW when substituted for corn bran. Babatunde (1988) classified PW as an alternative feed ingredient to conventional wheat offal. These indicate potential for use as animal feed. The use of pineapple waste in poultry nutrition represents a valuable means of indirect production of feed which directly reduce the production cost, which is the major concern of this present studies.

Since the purpose of feeding cockerel is to convert the feedstuffs into cockerel meat, ration of major concern feed cost vary with the cost of ingredients but normally feed for cockerel are 60-70% of the cost of production of a live cockerel. Hence the experiment was carried out to determine the replacement value of pineapple waste for wheat offal in the diets of cockerel chickens.

MATERIALS AND METHODS

Experimental Site: The experiment was carried out at the Poultry unit of Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State.

Preparation of Test Ingredient: Fresh pineapple waste (skin, peeling and pulp peelings) were collected from Lafia Canning Factory of Funman Agricultural products Nigeria Ltd, Moor Plantation, Apata, Ibadan, Oyo state. Wheat offal and all other ingredients were purchased from reputable feed mill in Ogbomoso. The procured pineapple waste was sundried to a constant weight and moisture content of 10%. The dried PW was milled using hammer mill to obtain pineapple waste meal (PWM).

Experimental Treatment: Five experimental diets were formulated such that diets 1,2,3,4 and 5 contained 0, 15, 30, 45 and 60% pineapple waste as replacement for the wheat offal respectively. Other ingredients used were as shown in the gross composition (Table 1).

Experimental Animals and Managements: A total of 150 growing Harco cockerels were procured from reputable farm and were randomly divided into 5 treatments of 30 birds and each treatment replicated thrice with 10birds per replicate in a Completely Randomized Design Experiment. Feed was offered on daily basis while water was supplied *ad-libitum* throughout the experimental period. All routine and occasional management practices (vaccination and medication) were strictly adhered. The experiment lasted for 84days.

Data collection and analysis:

Performance characteristics and Nutrient digestibility Data were collected on the weight gain (weekly weight gain), final live weight, feed intake and feed conversion ratio. On nutrient digestibility, a three day acclimatization period was allowed prior to a four day faecal samples collection period. Feed were weighed and fed to the birds in the metabolic cage to monitor daily feed intake while feaces voided were collected on daily basis, packed in aluminum foil and oven dried for three days to a constant temperature. The droppings were weighed fresh before drying. The dried samples were ground and taken to laboratory for proximate analysis.

Carcass and Organ Evaluation

At 12 week, 3 birds from each replicate were randomly selected for sacrifice. The birds were starved for 12 hours before slaughtering. The selected birds were slaughtered, using knife. They were then de-feathered, eviscerated, after which heads and shanks were removed to obtain carcasses. The following cuts were made from the carcasses; neck, breast, back, wings and drumsticks while organs were blotted free of blood and adhering tissues removed. The following organs were considered; heart, gizzard, liver, spleen, kidney, lungs and proventiculus. Carcass weights were related to final live weight to obtain dressing percentage while other cuts and organs were expressed relative to the carcass weight and live weight respectively.

Proximate Analysis: Experimental diets and faecal samples were analyzed for proximate contents (moisture, crude fiber, crude protein, ash, ether extract and NFE) using AOAC (1995) methods

Data Analysis: Data were subjected to one-way analysis of variance (ANOVA) using SAS (2011) statistical package and where significant differences were observed, they were separated using Duncan Multiple Range Test of the same statistical package.

Table 2: Gross Composition of Experimental Diets With Varying inclusion levels of Pineapple Waste Meal

Ingredients	**1(0%)**	**2 (15%)**	**3 (30%)**	**4 (45%)**	**5 (60%)**
Maize	49.50	49.50	49.50	49.50	49.50
Wheat offal	34.00	28.90	23.80	18.70	13.60
Soyabean	11.75	11.75	11.75	11.75	11.75
Fish meal	1.50	1.50	1.50	1.50	1.50
Bone	2.50	2.50	2.50	2.50	2.50
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Premix*	0.25	0.25	0.25	0.25	0.25
Pineapple waste meal	0	5.10	10.20	15.30	20.40
	100	100	100	100	100
Proximate Analysis of experimental diets					
Crude protein (%)	17.35	17.01	16.56	16.05	15.76
Crude fibre (%)	4.48	4.91	5.11	5.95	6.63
Metabolizable energy (kcal/kg)	2915.1	2859.7	2831.3	2785.1	2744.5
Ether extract (%)	3.84	3.44	3.43	3.48	3.55
Ash (%)	3.5	4.37	5.25	6.1	6.77
Dry matter (%)	85.78	86.07	86.36	86.65	86.94
Nitrogen free extract (%)	56.61	56.34	56.01	55.07	54.03

**Vitamin and trace element declaration: 1kg of premix contain vitamin A 5, 000, 000UI, vitamin D_3 10,000,000 UI, vitamin E 16, ooomg, vitamin K_3 800mg, vitamin B1 1200mg, vitamin B_2 220mg, Niacin 2200mg, calcium pathronethate 4600mg, vitamin B6 2,008mg, vitamin B_{12} 90mg, chlorine chloride 20,000mg,* *folic acid 40,000mg, biotin 32mg, manganese 120,000mg, iron 40,000mg, zinc 32,00mg, copper 3400mg, iodine ```700mg, cobalt 120mg, selenium 48mg, antioxidant 48,00mg.*

RESULTS AND DISCUSSION Performance and Nutrient Digestibility

The Performance and nutrient digestibility of experimental birds was presented in Table 3. Final live weight and weight gain per day per bird were not significantly affected (P>0.05) by pineapple waste meal based diets although numerical reduction in the values were observed as level of pineapple waste increased. Increased level of pineapple waste in the diets significantly improved (P<0.05) feed intake although cockerels fed diets 2, 3, 4 and 5 had similar values (P>0.05). Cockerels fed the control diet had significantly low (P<0.05) feed intake which is similar to birds placed on diets 2 and 3. Similar trend was observed in feed - gain ratio. However, birds fed diets 4 and 5 had significantly high (P<0.05) feed intake and poor feed gain - ratio. High feed intake might have brought about by the high fibre content of the pineapple waste and in an attempt to satisfy the energy requirement, more feed intake is enhanced. Similar observation was made by Adeyemi *et al.,* (2011) when pineapple peel was fed to rabbits. It has been established that poultry generally are less efficient at digesting fibre than ruminant (Jayce *et al.,* 1971). At the replacement levels considered in this study, pineapple waste did not work against the final live weight and weight gain. Jaeger, *et al.,* (1998) had reported that pineapple contained tannins and pectins which have effect on growth. The anticipated anti-nutritional factors in the test ingredient did not affect the feed intake aside the fibre level that prompted increased feed intake. The increased feed intake without corresponding increase in weight gain could be ascribed to lower energy concentration per kilogram of feed. Also, the results agreed with the earlier work of Esonu *et al.,* (2003) which showed that inclusion of fibrous materials in a feed had an energy dilution effect on feed intake and consequently increased feed intake. Pineapple waste had been identified to be relatively fibrous, and thus could be responsible for the numerical depression in the weight gain as fiber impaired digestion and absorption of nutrient. On Nutrient digestibility, replacement of wheat offal with pineapple waste meal significantly affected (P<0.05) nutrient digestibility values. Nutrient digestibility of crude protein, crude fibre, ether extract, ash, nitrogen free extract and dry matter were highest (P<0.05) at the control diet. Crude fibre digestibility showed similarly up to cockerels fed diet 3 before depression set in. Generally, significant difference (P<0.05) was observed in birds fed diet 5. The significant decrease in the digestibility of the nutrients could be related to the bulkiness of the diets which was imposed by the high fibre content, thereby imposing a physical limitation upon the intake of digestible nutrients. Abioye *et al.,* (2006) reported similar observation in broiler chickens fed kolanut husk based diets. The deceased in crude protein digestibility could be due to the absorption of amino acid peptides by fibre which prevent their absorption from the gastro intestinal tract (GIT). Mitaru and Blair (1984) reported that the extent of the decrease depends on the degree of lignification of the fibre. At eight weeks of age, the decrease in crude fibre and dry matter digestibilities as replacement level increased could be related to increase in the crude fibre content of the diets and therefore, more fibre load for broiler on these diets to handle which may cause low digestibility. An inverse relationship between dietary fibre digestibility coefficients and/or bioavailability of nutrients (Mitaru and Blair, 1984; Akpodiete *et al.,* 1997 and Nworgu and Ologhobo, 2000) determines the ability of the birds to handle these diets to a reasonable extent which could relate to the age. The energy density favored similar digestibility of ether extract up to chicken fed diets 4.

Table 3: Performance Characteristics and Nutrient Digestibility of Cockerel Fed Pineapple Waste Meal Diets.

Parameters	T_1 0% PWM	T_2 15% PWM	T_3 30% PWM	T_4 45% PWM	T_5 60% PWM	sem ±
Initial weight (g)	961.23	960.55	961.10	961.10	961.20	0.07
Final live weight (g)	1849.00	1791.25	1695.50	1695.50	1684.75	16.45
Weight gain (g)	15.85	14.84	13.11	13.11	12.11	0.29
Feed intake (g)	89.63^{b}	100.75^{ab}	105.70^{ab}	132.11^{a}	132.25^{a}	4.97
Feed gain ratio	5.66^{a}	6.79^{ab}	7.64^{ab}	10.13^{a}	10.62^{a}	0.51
Nutrient digestibility						
Crude protein(%)	80.24^{a}	79.38^{b}	78.93^{b}	77.17^{b}	60.08^{c}	2.01
Crude fibre(%)	85.46^{a}	84.06^{a}	82.27^{a}	79.55^{b}	71.75^{b}	1.30
Esther extract(%)	82.96^{a}	82.42^{a}	81.28^{a}	81.09^{a}	64.91^{b}	1.80
Ash(%)	89.07^{a}	83.71^{b}	83.61^{b}	69.53^{c}	67.27^{c}	2.30
Nitrogen free extract(%)	83.78^{a}	71.14^{b}	59.95^{c}	57.74^{c}	18.12^{d}	6.15
Dry matter(%)	87.60^{a}	82.68^{ab}	81.61^{b}	80.30^{b}	65.05^{c}	2.03

^{abc}means with on the same row with different super scripts are significantly different (P<0.05) sem:- Standard error of means.

Carcass and Organ Characteristics

Carcass and organ characteristics of cockerels fed pineapple waste based diets are presented in Table 4. Bled weight and defeathered weight showed similarity (P>0.05) across the dietary treatments. Eviscerated weight and dressing percentage showed significant differences (P<0.05) across the dietary treatments. Cockerels fed diets 1, 2, 3 and 4 were not significantly (P>0.05) affected. Pineapple waste meal diets at various replacement levels did not impose significant (P>0.05) changes on the proportion of drumstick values. Wings proportion was significantly bigger (P<0.05) in the control compared to other replacement level (15, 30, 45 and 60%). Thigh, breast and neck parts were significantly favored (P<0.05) up to 30% PWM replacement level before slight decrease. Cockerels fed diet 5 had significantly less (P<0.05) values for thigh and neck. Similarity in the relative value of back extended to cockerels fed diet 3 which was significantly higher (P<0.05) than those on diets 4 and 5. Carcass yield is an indication of the quality and utilization of the ration (Bamigbose and Niba, 1998). From the data on carcass parameters revealed that the dietary treatments had a significant effect on all the parameters recorded. This is in accordance with the report of Augusting *et al.,* (2011) who reported significant effect of enzymes supplemented cassava peel on the carcass parameters of broiler birds.

Birds on the control diets had the highest bled weight, defeathered weight and dressing percentage. This result is in agreement with Iyayi *et al*., (2005) who reported that the enzymes supplementation produced significantly effect on carcass weight but had no effect on some other weight of birds fed on control diet was higher compared to other treatments while T5 had the lowest value. Birds on diet 5 had the lowest value because it contained high level of fibre (PWM 60%). The observed results were in agreement with the reports of Hetland and Suihus (2001) who worked on the effect of different levels of fibre in animal feed. The dressing percentage for birds on T_1 had the highest value (64.82%) compared to those fed T_2, T_3, T_4 and T_5. The percentage weights of cuts parts namely: wings, shark, drumstick, thigh, back, breast and neck were superior among birds fed the control diet. The results of relative organ weights showed a progressive decrease in most of the organs evaluated as the level of PWM increased (Table 4). Proportion of spleen, liver, heart, gizzard and proventiculus were significantly affected ($P<0.05$) by PWM inclusion with cockerels fed the control and 15% PWM showing similarity. Significantly lowest, ($P<0.05$) values for lung and gizzard were obtained in birds fed 60%PWM replacement level while birds on 30 and

45%PWM had gradual decreased value of proventiculus. Testes values showed similarity

($P>0.05$) across the treatments although progressive decease in the valve was observed as level of test ingredient increased. The higher weights of internal organs observed in birds fed control diets may be as a result of decrease digestibility of nutrient due to the low level of fibre diet and their gastrol intestinal tracts (GIT) modified to be able to accommodate more bulky rations. This result is supported by reports of Hetland and Svilhus (2001); Hetland *et al*., (2002) and Hetland *et al*.., (2003) who obtained increased weight and length of the GIT in broilers and Japanese quail when high fibre diets were fed.

Table 4: Carcass and organs characteristics of cockerel fed varying levels of pineapple waste meal based diets.

Parameters (%)	T1 (0%) PWM	T2 (15%) PWM	T3 (30%) PWM	T4 (45%) PWM	T5 (60%) PWM	SEM ±
Bled weight (g)	1787.00	1703.75	1667.50	1512.00	1478.25	47.31
Defeathered (g)	1638.25	15.83.00	1566.50	1405.00	1365.50	43.15
Eviscerated (g)	1354.25^{a}	1314.75^{a}	1257.75^{ab}	1187.50^{ab}	1073.25^{b}	33.59
Carcass weight (g)	1186.75^{a}	1160.25^{a}	1046.75^{ab}	1044.50^{ab}	944.50^{b}	32.06
Dressing %	64.82^{a}	64.78^{a}	60.29^{ab}	61.76^{ab}	55.24^{b}	1.19
CUT-UP PARTS (%) Wings	14.94^{a}	14.03^{b}	13.66^{b}	13.32^{b}	12.65^{c}	0.19
Drumstick	17.72	17.27	16.97	16.65	16.58	0.21
Thigh	19.73^{a}	18.98^{ab}	18.07^{ab}	17.41^{b}	16.59^{c}	0.32
Back	19.44^{a}	18.68^{ab}	17.83^{ab}	17.66^{ab}	17.16^{b}	0.29
Breast	26.36^{a}	24.52^{ab}	24.70^{ab}	22.99^{b}	22.72^{b}	0.47
Neck	10.14^{a}	10.04^{a}	9.69^{ab}	9.02^{b}	8.15^{c}	0.20
Spleen	0.33^{a}	0.33^{a}	0.28^{ab}	0.27^{ab}	0.21^{b}	0.02
Lung	0.95^{a}	0.82^{b}	1.03^{a}	0.77^{b}	0.66^{c}	0.03
Liver	2.60^{ab}	2.79^{a}	2.61^{ab}	2.24^{b}	2.02^{b}	0.09
Kidney	0.66^{b}	0.65^{b}	0.96^{a}	1.04^{a}	0.79^{b}	0.47
Heart	0.67^{ab}	0.61^{ab}	0.43^{c}	0.56^{bc}	0.74^{a}	0.03

Testes	0.86	1.76	0.99	0.91	0.94	0.16
Gizzard	6.06^{a}	6.16^{a}	5.19^{b}	5.69^{ab}	4.94^{c}	0.14
Proventiculus	0.62^{a}	0.56^{ab}	0.50^{b}	0.43^{c}	0.36^{d}	0.02

^{abcd}means within the same row with different superscripts differed significantly (P<0.05)

CONCLUSION AND RECOMMENDATION

It can be concluded that, pineapple waste meal can be used to replace wheat offal up to 45% in cockerel diets with a promising good category of cockerel performance, nutrient utilization, carcass and organ characteristics. In view of these, there is need to popularize the use of pineapple waste meal among farmers as this would serve as an alternative feed ingredient during the dry season when the price of wheat offal is always expensive.

REFERENCES

A.O.A.C (1995). Official methods of Analysis, 16th edition. Association of Official Analytical Chemists. Arlington, VA, Pp.225Washington, DC.

Abioye, J.A., Fanimo, A.O., Bamigbose, A.M., Dipeolu, M.A., and Olubamiwa, O (2006). Nutrient utilization, growth and carcass performance of broiler chickens fed graded levelsof kolanut husk. *Journal of Poultry Science* 43:365-370.

Adeyemi, O.A., Ajado, A.O., Okunbanjo, A.O.,and Eniolorunda, O.O (2011). Response of growing Rabbits to gradual level of internal unfermented pineapple peels. *Nigerian Journal Animal Production* 38(1):86-98

Akpodiete, O.J., Ologbobo, A.D., and Ayoade, O.G. (1997). Replacementvalue of maggot meal for fishmeal in broiler chickens diets. In. *Livestock products. Of 2nd Annual Conference Animal Science Association of Nigeria.* September 16th-19th, 1997- Ikeja- Lagos 64-76. [5] Augustine, C., Midau, A.,Yakubu, B., Kibon, A. and Udoyond, A.O. (2011). Effect of enzyme supplemented Cassava Peel Meal (CPM) on carcass characteristic of broiler chicken. *International Journal of Sustainable Agricultural.* 3(1): 21 – 24.

Awesu, J.R., A.M Bamigbose., O.O, Oduguwa., A.O Fanimo, and E.B Oguntona (2002). Performance and nutrient utilization of cockerel finisher fed graded level of rice milling waste. *Nigerian Journal Animal Production* 29(2) 181-188.

Babatunde, G.M. (1988) Research highlights and their application to alternative sourcing of feedstuff: Non-ruminants. Communiqué. In: Babatunde, G.M.(ed) Proc. National workshop on alternative feeds in Nigeria organized by Economic Affairs office of the Presidency,Agricultural and Rural Management Training Institute, ARMTI, Ilorin, Nigeria. *The Presidency*. Pp.389 – 315.

Bamgbose, A. M. and Niba, A. T. (1998). Performance of broiler chicken fed cotton seed cake in starter and finisher rations. *The Nigeriann livestock in the 21st century, proceeding of third annual conference of Animal Science Association of Nigeria (ASAN),* Pp 84-47.

Buckle, K. A. (1989). "Biotechnology Opportunities in Waste Treatment and Utilization for the Food Industry" In: Rogers Pl (ed.) Biotechnology and the food Industry; *Breach Science Publishes*, New York. Pp 261 – 277.

Esonu, B.O., Ihankwumere F.C., Iwaji, T.C., Akanmu, N., and Nwugo, O.H (2003). Evaluation of microdenus puberula heat meal as feed ingredient in broiler starter diet. *Nigerian Journal of Animal Production* 30(1):3-8.

Hetland, H., and Svihus, B. (2001). Effect of oat hulls on performance, gut capacity and feed passage time in broiler chickens. *British Poultry Sci*ence, 42: 354 - 361.

Hetland, H., Svihus, B., and Kroghahl, A. (2003). Effect of oat and wood shavings in broiler and layers fed diets based on whole or ground wheat. *British Poultry Science*. 44: 275 282.

Hetland, H., Svihus, B., and Olaisen, V. (2002). Effect of feeding whole cereals on performance, starch digestibility, and duodenal particle size distribution in broiler chickens. *British Poultry Science*, 43: 416 – 423.

Igene, F.U. and Ekundayo, A.A. (2010). Effect of feeding graded levels of boiled pigeon. Pea (Cajanus cajan) as replacement for soyabean meal on carcass quality on broiler chickens. *Proceedings of the 35th Annual conference Nigerian Society. For Animal Production, University of Ibadan, Nigeria.*

Iyayi, E. A. and Davies, B.I. (2005). Effect of enzyme supplementation of palm kernel meal and brewer`s dried grain in the Performance of broilers. *International Journal of Poultry Science,* 4(2).76- 78.

Janger De Carvallo, L.M. Silva., C. Alberto, B. D Piene, A. Paola and R. Tarindada, (1998). Claripocation of pineapple juice by altrafiltration and microfiltration. Physicchemical evaluation of chemical juice, soft drink formulation and subsorial evaluation *Journal of Agricultural and Food Chemistry*. 46 (6): 2185-2189.

Joyce, P.J., Battray, P.V and Parker, J.(1971). Utilization of pasture and barley by rabbits food intake and live weight of cockerel finisher fed graded levels of rice milling waste. *Nigerian Journal of Animal Production* (2): 181-188.

Krueger, D.A., Krueger, R.G. and Maciel, J. (1992). Composition of Pineapple juice. *Journal of AOAC International* 75:280 – 282.

Makinde, O.A.A. and Sonaiya, E.B. (2010). A simple technology for production of vegetable carried blood or rumen fluid meals from abattoir wastes. *Animal Feed Science and Technology* 162: 25 – 29.

Mitaru, B.N and Blair, R.(1984). The influence of dietary fibre source on growth, fed efficiency and digestibility of dry matter and protein in rats *Journal of Science Agric* 35:625631.

Nworgu, F.C and Ologbobo, A.D. (2000). Effects of Agro-industrial wastes on the performance on exotic cockerels. *Tropical Journal of Animal Science* 3 (1):17-24

Oduduguwa, O.O., Jegede, A.V., Kolajo, S.O., and Efontoye, A.S (2000). Effect of enzyme supplementation on the utilization of shrimp waste by broiler chickens. Procedure of *7th Annual conference Animal Science Association of Nigeria*. Held at Abeokuta on September. 16-17-2002.

Olosunde, A.O. (2010). Utilization of Pineapple waste as feed for West African Dwarf (WAD) Sheep. M.Phil, Thesis. Obafemi Awolowo University, Ile – Ife, Nigeria.

Onwuka C.F.I., Adetiloye, P.O and Afolami, C.A. (1997). Use of household wastes and crop residues in small ruminant feeding in Nigeria. *Small Ruminant* 24(3) 233-337

Pereria, E.S., Regadas Filho J.G.L., Freitas, E.R., Neiva J.N.M and Candid, M.J.D (2009). Energetic value from by-product of the Brazil agro-industria Archivos de Zootecnia 455-558. International symposium on Food and Agro-biodiversity (ISFA)2017.

SAS (2011). Statistical Analysis System. Institute Incorporated Version 4.3