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EFFECT OF FEED TYPE ON PERFORMANCE OF PULLET CHICKS IN NSUKKA LOCAL GOVERNMENT AREA OF ENUGU STATE, NIGERIA

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ABSTRACT

A five-week study was conducted to determine the effect of feed type on performance of pullet chicks in Nsukka Local Government Area of Enugu State, Nigeria. One hundred and twenty 4-week old pullet chicks (ISA Brown strain) averaging 100.03g body weight were randomly divided into 4 groups of 30 birds each. Each group was randomly assigned to one of four experimental diets (self-compounded starter diet (C) and three commercial starter diets-A, B and D, respectively), using a completely randomized design (CRD). Each diet constituted a treatment. Each treatment was replicated 2 times with 15 birds per replicate. Feed and water were supplied ad libitum. There were significant (P<0.05) differences among treatments in average daily weight gain, average daily feed intake, feed conversion ratio, protein intake, protein efficiency ratio and final body weight. Birds on treatment C (self-compounded feed) had significantly (P<0.05) higher final body weight and average daily weight gain than those on treatments A, B and D (commercial feeds), while birds on treatment A had significantly (P<0.05) higher average daily feed intake than birds on other treatments. Birds on treatment C had the least FCR value and higher (P<0.05) protein efficiency ratio (PER) value. Birds on treatment C had the least (P<0.05) cost of daily feed intake and total feed intake and cost of feed per kg weight gain. It was concluded that diet C (self-compounded feed) was superior to the commercial feeds because it supported the highest growth rate of chicks and its use resulted in drastic reduction in feed cost per kg weight gain.

Keywords: Feed type, growth performance, pullet chicks, Nsukka Local Government Area, Enugu State, Nigeria

INTRODUCTION

Food and Agriculture Organisation of the United Nations (FAO, 2010) estimates that globally 925 million people were protein hungry in 2010. While this figure marked an improvement compared to 2009, it remains unacceptably high. Most of the world's protein hungry people live in developing countries where they account for 16% of the population The proportion of under-nourished people remains highest in sub-Saharan Africa at 30% in 2010 (FAO, 2010). Poultry has remained a major source of protein as its products contain the essential amino acids required by the human body to synthesize proteins. Hence, increased poultry production is necessary in patching up leaks in the level of protein consumption within sub-Saharan Africa. Poultry production can be grouped into two major categories, namely: egg production and meat production (Smith, 2001). Egg production is an enterprise which involves raising pullet chicks under good, healthy environment to ensure their maximum growth into laying hens, which can establish excellent and consistent egg laying (Oluyemi and Roberts, 2000). On the other hand, meat production as a category of poultry production deals with raising broilers/fryers, roosters, etc. for their meat. It is less expensive and time demanding when compared with egg production. Egg production however, has an edge over meat production as it gives a substantial turnover on revenue and profit. It also has other alternatives in its production, namely; table egg production, breeder egg production, old layer production, etc. In order to increase the productivity of laying birds to balance up protein consumption in sub-Saharan Africa, there is a need for increased growth. This is largely dependent on their nutrition. The kind of feed fed to the birds, directly reflects on their growth parameters. This is to show that aside the genetic makeup of the birds, the nutrition (environment) has an indelible effect on their

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phenotypic characteristics (Daghir, 2008).In poultry nutrition, poultry feed can be of two categories, namely: commercial feeds and self-made (locally compounded) feeds. Commercial feeds are feeds whose trademarks have been successfully established in the poultry feed market. They are mainly produced on a very large scale and almost monopolize the entire poultry feed market. They contain most of the times, feed additives such as antibiotics, arsenicals, coccidiostats and sometimes mold inhibitors. They are defined in the uniform feed bill as all materials distributed for use as feed or for mixing in feed for animals other than humans (Jurgens, 2002). According to Abeke *et al.* (2003), proliferation of small feed mills run sometimes by illiterate and semi-literate individuals has compounded the problem of poor feed quality in the market. This situation is thriving in many major cities across Nigeria because of lack of governmental control of feed quality standards. Farmers are, therefore, left at the mercy of quacks for supply of feeds and in many cases the feeds are very poor in quality. These feeds are however, patronized because they are cheaper than those made by well-established government approved feed mill companies (Abeke, 2005). With regards to the inconsistency in supply and also the high cost of commercial feeds, there is the need to substitute the commercial feeds with self-compounded feed. However, the use of self-compounded feed must ensure that it does meet the requirements of the particular poultry class and its stage of growth for maximum productivity. The present study was therefore conducted to investigate the growth response of pullet chicks to self-made and commercial feeds and it's cost implications in Nsukka Local Government Area of Enugu State, Nigeria.

MATERIALS AND METHOD

The study was conducted at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. Nsukka lies within longitude 6^o 45^{1}E and 7^{o}E and latitude 7^o 12.5^{1}N (Offomata, 1975) and on the altitude 447m above sea level. The climate of the study area is typically tropical, with relative humidity ranging from 65 – 80% and mean daily temperature of 26.8^{o}C (Agbagha, *et al* 2000). The rainy season is between April – October and dry season between November – March with annual rainfall range of 1680 – 1700mm (Breinholt *et al*., 1981).

Experimental Diets

Four experimental diets were used as follows: Diet C was self- compounded (homemade) starter diet, while diets A, B, and D were Top®, Gold medal® and Vital®, commercial starter feeds, respectively. The percentage composition of the self- compounded diet is presented in Table 1.

Management of Experimental Birds

The experiment was carried out in accordance with the provisions of the Ethical Committee on the use of animals and humans for biomedical research of the University of Nigeria, Nsukka (2006).One hundred and twenty 4-week old pullet chicks (ISA Brown strain) averaging (100.03g) body weight were randomly divided into 4 groups of 30 birds each. Each group was randomly assigned to one of four experimental diets (self-compounded starter diet (C) and three commercial starter diets-A, B and D, respectively), using a completely randomized design (CRD). Each diet constituted a treatment. Each treatment was replicated 2 times with 15 birds per replicate placed in 2m x 3m deep litter pens of fresh wood shavings. Kerosene stoves placed under metal hovers for 28 days provided heat. Feed and water were supplied *ad libitum* to the birds. The birds were properly vaccinated against Newcastle disease in the first, third and sixth weeks. They were also vaccinated against Gumboro disease in the second and fourth weeks and against fowl pox in the fifth week. Prophylactic treatment against coccidiosis was also given to the birds using Embazin forte®. The experiment lasted for a period of 5 weeks during which feed intake, weight gain, feed conversion ratios and protein efficiency ratios were determined. At the beginning of the experiment, chicks in each replicate were weighed together and subsequently live weights were recorded for each replicate on weekly basis. Feed intake was determined daily by the weigh-back technique. Feed conversion ratio was then calculated from the data generated as quantity (grams) of feed consumed per unit (grams) weight gained over the same period. All measurements were taken between 8.00am and 12.00 noon.

Proximate and Statistical Analyses

Samples of the five experimental diets were analyzed for their proximate compositions according to AOAC (2006) methods. Data collected were subjected to analysis of variance (ANOVA) for completely randomized design (CRD) as described by Akindele (2004) using a Statistical Analysis System (SAS, 2006). Significantly different means were separated using Duncan's new multiple range test (Duncan, 1955) as outlined by Obi (2002).

RESULTS

Proximate Compositions and Gross Energy Contents of the Experimental Diets Table 2 shows the proximate compositions and gross energy contents of the experimental diets. There were significant (P<0.05) differences among treatments in dry matter, crude protein, crude fibre, ether extract, ash, nitrogen free extract and gross energy contents of the diets. The dry matter (DM) percentage values of commercial diets A and D were comparable (P>0.05) and these were significantly (P<0.05) higher than the DM % value of commercial diet B. Diet C (self-compounded) had comparable DM with commercial diet B on one hand and with commercial diets A and D on the other hand. The crude protein (CP) values of diets C and D were comparable (P>0.05) and these were significantly (P<0.05) higher than the CP values of diets B and A. The crude fibre (CF) value of diet C was significantly (P<0.05) higher than the CF values of other diets. Diet B also had higher (P<0.05) CF value than diet A and D. Diet A had the least CF value. The ether extract (EE) value of diets B and D were significantly (P<0.05) higher than the EE values of diets A and C. Diet C had the least EE value. Diet A had the highest ash percen tage. This was followed by diet D which had similar value with diet B. The least ash percentage was recorded for diet C (self-compounded) and this was comparable with diet B ash%. Diet A had the highest (P<0.05) nitrogen free extract value which was comparable (P>0.05) with diet B. Diets C and D had the least NFE values (P<0.05) and these were comparable to the NFE value of diet B (P>0.05). The gross energy (GE) value of diet C was significantly (P<0.05) higher than the values recorded for other diets. Diet A had the least (P<0.05) GE value and this was similar with the GE value of diet D. The GE value of diet B was significantly (P<0.05) higher than those of diets A and D.

Table1: Percentage compositions of self -compounded and commercial diets

Ingredients	Diets			
	A	B	C	D
Maize	-	-	42.00	
heat offal	-	-	11.00	-
Palm kernel cake	-	-	16.00	-
Groundnut cake	-	-	14.00	-
Fish meal	-	-	2.00	-
Soy bean meal	-	-	10.0	-
Bone meal	-	-	4.00	-
Salt	-	-	0.25	-
Lysine	-	-	0.25	-
Methionine	-	-	0.25	-
Starter premix*	-	-	0.25	-
Total	-	-	100.00	-
Calculated composition:				
Crude protein (%)	20.00	21.00	20.01	20.00
Crude fibre (%)	5.00	4.40	6.81	9.00
Ether extract (%)	5.00	7.20	4.31	10.00
Lysine (%)	1.40	1.20	1.15	-
Methionine (%)	0.50	0.45	1.10	-
Calcium (%)	1.00	1.00	1.70	1.00
Energy (Mcal/kg ME)	3.10	2.75	2.80	2.80

Each 2.5kg of Starter premix contains: vit. A, 10000000 IU; vit.D3, 2000000 IU; vit.E, 23000 mg; vit.K3, 2000mg; vit.B1, 1800mg; vit. B2, 5500mg; Niacin, 27500mg; pantothenic acid, 7500mg; vit. B6, 3000mg; vit. B12, 15mg; folic acid, 750mg; biotin H2, 60mg; choline chloride, 300000mg; cobalt, 200mg; copper, 3000mg; iodine, 1000mg; iron, 20000mg; manganese, 40000mg; selenium,

Table 2: Proximate compositions and gross energy contents of the experimental diets.

Components	Diets/Treatments*				
	A	B	C	D	SEM
Dry matter (%)	90.01^a	85.98^b	87.06^{ab}	89.34^a	2.07
Crude protein (%)	18.40^b	18.15^b	20.01^a	20.25^a	0.36
Crude fibre (%)	6.20^d	10.20^b	11.25^a	9.10^c	0.71
Ether extract (%)	9.13^b	10.24^a	8.24^c	10.25^a	0.33
Ash (%)	4.55^a	3.10^{bc}	2.60^c	3.45^b	0.27
Nitrogen-free extract (%)	61.72^a	58.31^{ab}	57.90^{bc}	56.95^{bc}	1.64
Gross energy(Kcal/g)	4125^{cd}	4217^b	4371^a	4140^c	36.87

[abc]Means on the same row with different superscripts are significantly (P<0.05) different.
SEM= Standard error of mean
*Treatment / diet C represents self-compounded starter feed, while treatments / diets A, B and D represent commercial starter feeds A, B and D, respectively.
200mg; zinc, 30000mg; antioxidant, 1250mg.

Growth performance of pullet chicks fed self-compounded and commercial feeds

Table 3 shows the growth performance of pullet chicks fed the experimental diets. There were significant (P<0.05) differences among treatments in average daily weight gain, average daily feed intake, feed conversion ratio, protein intake, protein efficiency ratio and final body weight. Birds on treatment C (homemade feed) had significantly (P<0.05) higher final body weight and average daily weight gain than those on treatments A, B and D (commercial feeds), while birds on treatment A had significantly (P<0.05) lower final body weight and average daily weight gain than those on treatments B and D, which had comparable final body weight and average daily weight gain. Birds on treatment A had the least final body weight and average daily weight gain. Birds on treatment A had significantly (P<0.05) higher average daily feed intake than birds on other treatments. Birds on treatments B and D had similar average daily feed intake and this was significantly (P<0.05) higher than the average daily feed intake of birds on treatment C. Birds on treatment C had the least average daily feed intake.

The feed conversion ratio (FCR) value of birds on treatment A was significantly (P<0.05) higher than the FCR values of birds on other treatments. Birds on treatments B and D had comparable FCR values and these were significantly (P<0.05) higher than the FCR value of birds on treatment C which had the least FCR value. The daily protein intake value of birds on treatment D was significantly (P<0.05) higher than the daily protein intake values of birds on other treatments. Birds on treatments B and C had comparable daily protein intake values and these were significantly (P<0.05) lower than the daily protein intake value of birds on treatment A. Birds on treatment C had significantly (P<0.05) higher protein efficiency ratio (PER) value than those on other treatments. Birds on treatment B had significantly (P<0.05) higher protein efficiency (PER) value than those on treatments A and D Birds on treatments A and D had comparable PER values also birds on treatments B and D also had comparable PER values.

Table 3: Growth performance of pullet chicks fed homemade and some commercial feeds

Parameters	Treatments / feed brands				
	A	**B**	**C**	**D**	**SEM**
Initial Body Weight (g)	100.01	100.00	100.03	100.02	2.63
Final Body weight (g)	365.00^{c}	425.00^{b}	505.00^{a}	455.00^{b}	20.51
Average Daily Weight Gain(g)	31.50^{c}	40.00^{b}	46.00^{a}	39.50^{b}	2.02
Average Daily Feed Intake (g)	38.50^{a}	36.00^{b}	31.50^{c}	36.50^{b}	0.98
Feed Conversion Ratio	1.23^{a}	0.90^{b}	0.69^{c}	0.93^{b}	0.74
Protein Intake Per Bird (g)	0.72^{b}	0.65^{c}	0.64^{c}	0.74^{a}	0.02
Protein Efficiency Ratio	0.04^{c}	0.06^{b}	0.07^{a}	0.05^{bc}	0.00407

^{abc}Means on the same row with different superscripts are significantly (P<0.05) different.
SEM= Standard Error of Mean

Table 4: Cost Implication of feeding homemade and commercial feeds to pullet chicks

Parameters	Treatments				
	A	**B**	**C**	**D**	**SEM**
Total feed intake (g)	2900^{a}	2700^{c}	2400^{d}	2750^{b}	68.63
Cost of 1kg(₦)	86.00	76.00	70.00	80.00	3.07
Cost of daily feed intake (₦)	3.33^{a}	2.74^{c}	2.222^{d}	2.94^{b}	0.15
Cost of total feed intake (₦)	249.40^{a}	205.20^{c}	168.00^{d}	220.00^{b}	11.08
Cost of feed / kg weight gain / bird (₦)	105.35^{a}	68.78^{b}	47.95^{c}	74.00^{b}	7.85
Total body weight gain (g)	264.99^{b}	325^{b}	404.7^{a}	354.8^{a}	29.20

^{abc}Means on the same row with different superscripts are significantly (P<0.05) different.
SEM = Standard error of mean

Cost Implication of Feeding the Experimental Diets to Pullet Chicks

Table 4 shows the cost implication of feeding the experimental diets. There were significant ($P<0.05$) differences among treatments in total feed intake, total body weight gain, cost of daily feed intake, cost of total feed intake and cost of feed per Kg weight gain.The total feed intake value of birds on treatment A was significantly ($P<0.05$) higher than those of birds on other treatments. Birds on treatment D had significantly ($P<0.05$) higher total feed intake value than those of birds on treatments B and C. Birds on treatment C had the least total feed intake value. Birds on treatments C and D had comparable total body weight gain values ($P>0.05$) and these were significantly ($P<0.05$) higher than the total body weight gain values of birds on treatments A and B which were similar ($P>0.05$).The cost of daily feed intake value of birds on treatment A was significantly ($P<0.05$) higher than those of birds on other treatments. Birds on treatment D had significantly ($P<0.05$) higher cost of daily feed intake value than those of birds on treatments B and C. Birds on treatment C had the least cost of daily feed intake value.The cost of total feed intake value of birds on treatment A was significantly ($P<0.05$) higher than those of birds on other treatments. Birds on treatment D had significantly ($P<0.05$) higher cost of total feed intake value than those of birds on treatments B and C. Birds on treatment C had the least cost of total feed intake value.The cost of feed per kg weight gain of birds on treatment A was significantly ($P<0.05$) higher than the costs of feed per kg weight gain of birds on other treatments. Birds on treatments B and D had comparable feed costs per kg weight gain ($P>0.05$) and these were significantly ($P<0.05$) higher than that of birds on treatment C. Birds on treatment C had the least cost of feed per kg weight gain.

DISCUSSION

As shown in Table 3, although birds on treatment C (Self–compounded diet) had the least feed intake, their performance was superior to that of birds on other treatments with respect to final body weight and average daily weight gain. This may be attributed to the fact that diet C which was consumed by the birds had the highest energy content (Table 2). Energy is an indispensable factor affecting feed intake in animals. According to Jurgens (2002), if a diet containing a low concentration of energy is fed to an animal, feed intake is high, whereas with a high energy containing diet, feed intake is reduced. Similarly, Leeson and Summers (1997), suggest that energy intake of pullets is the limiting factor to growth rate and that birds will simply eat less as energy level of the diet increases under warm conditions. This could be the reason why birds on treatment A had the highest average daily feed intake considering the fact that diet A which was fed to the birds had the least energy content. According to Obioha (1992), the rate of feed intake affects the level of protein intake. As observed in Table 3, although birds on treatment C had the least value of protein intake, they had the highest protein efficiency ratio. This tends to suggest that those birds efficiently converted the protein consumed into meat more readily than birds on other treatments as evidenced by their having the highest value of final body weight. In other words birds on diet C efficiently utilized their feed more than birds on other treatments as shown by their least value of feed conversion ratio; which is a measure of the efficiency of feed consumed by the animal (Kellems and Church, 2010). Besides energy, feed preparation also affects feed intake (MacDonald *et al*., 2002). According to Kellems and Church (2010), the nature of feed presented to birds also affects their feed intake. Although feeding animals with pelletized feeds increase the level of their feed intake (Najime, 2003), the effect of the energy content of feeds on the level of feed intake of birds masked the known effect of nature of feed on the feed intake of birds in the present study. This was shown by the fact that in spite of the pelletized nature of diet D, its consumption was less than the consumption of diet A. As shown in Table 2, diet C also had the highest crude protein content in addition to having the highest energy value. Thus it supports higher growth rate than other experimental diets, since high levels of protein and energy content of feed fed to animals, enhance their productivity/performance (Jurgens, 2002). It has been shown that as the protein level of the diet is increased in relation to the energy, there is an increase in food consumed leading to better feed conversion efficiency and growth including egg production (Elliot, 2002).As shown in Table 4, the cost of daily feed intake, feed cost per kg weight gain and the cost of total feed intake of birds on treatment A were higher than those of other treatments. The observed increase could be attributed to the high average daily feed intake (ADFI) value, poor feed conversion efficiency and utilization, and poor growth rate of the chicks that consumed the diet. The fact that birds on treatment A had the least feed cost per kg weight gain was due to the low ADFI, average daily weight gain and better feed efficiency of birds that consumed diet C. This tends to suggest that diet C (Self-compounded feed) was more economical and profitable for the production of pullet chicks.

CONCLUSION

It is evident from the results obtained in the present study that diet C (self-compounded feed) was superior to the commercial feeds used because it supported the highest growth rate of chicks. Its use was also the most economical as it resulted in drastic reduction in feed cost per kg weight gain. Diet C, therefore, can be used in pullet chicks' production to enhance the growth performance of pullets.

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REFERENCES

Abeke, F. O. (2005) Evaluation of the nutritive value of *lablab purpureus* beans in replacing groundnut cake in poultry diets. Ph.D Desertation, Ahmadu Bello University, Zaria, Nigeria. pp. 1-128.

Abeke, F. O; Ogundipe, S. O; Sekoni, A.A; Dafwang I.I; and Oladele, S. B. (2003).Effects of *duration of cooking* of lablab (lablab purpureus) beans on organ weights and blood parameters of pullet chicks. Proc. of the 28th Annual NSAP conference Ibadan, vol. 28: pp. 240-242.

Agbagha, F. M., Ezema, F.U. and Omeke, B.C.O. (2000) Studies of Management Effects on Fertility Purbred and Crossbred Exotic Guts in Two Breeding Farms at Nsukka *Nigeria Journal Animal Production*. Vol. 28(l) pp 20-21.

Akindele, S.O. (2004). *Basic Experimental Designs in Agricultural Research*. 1st Ed. Royal Bird Ventures; Mushin-Lagos (Nigeria).

American Association of Feed Control Officials (AAFCO). 2007. *Official Publication 2007*. Washington, DC: AAFCO.

Association of Official Analytical Chemists (A.O.A.C.) (1990). *Official Methods of Analysis*. (13th Edition) Washington, D. C. USA.

Association of Official Analytical Chemists (AOAC). 2006. *Official Methods of Analysis*. 18th ed. Washington, DC: AOAC.

Austic, R. E., and M. C. Nesheim. 1990. *Poultry Production*. 13th ed. Philadelphia: Lea and Febiger.

Baker, D. H. 1997. Ideal amino acids profile for swine and poultry and their applications in feed formulation. *BioKyowa Technical Review-9*.

Breinholt, K.A, Gowen, F.A and Nwosu C.C (198 l).Influence of Environmental and Animal Factors Day and Night Grazing Activity of Imported Holstein Freisian Cows in the Humid Lowland Tropics of Nigeria. Trop. Animal Produc.6:4.

Daghir, N.J. (2008). Poultry Production in Hot Climates.2nd ed. CAB International, Wallingford, UK.pp. 387.

Dudley-Cash, W. A. 1998. Digestible amino acid requirements revised and extended for broilers. *Feedstuffs* (July 6, 1998): 11:15.

Duncan, D. B. (1955) New Multiple Range Test. Biometrics 11: 1-42.

Elliot, M. (2002).Applied pullet nutrition of light weight pullet strains.Pp 102.

Emmert, J. L., and D. H. Baker. 1997. Use of the ideal protein concept for precision formulation of amino acid levels in broiler diets. *J. appl. Poultry Res.***6**:462.

Food and Agricultural Organisation of the United Nations.2007. AGA Website, Animal Feed Resources Information System, Rome, Italy.

Food and Agricultural Organisation of the United Nations.2010. AGA Website, Animal Feed Resources Information System, Rome, Italy.

Green, S. 1987. *Digestibilities of Amino Acids in Foodstuffs for Poultry and Pigs*. Digestibility Rep. 8/87. Commentry, France: Rh'ne-Poulenc Nutrition Laboratories.

Han, Y., and D. H. Baker. 1993. Effects of sex, heat stress, bodyweight and genetic strain on the lysine requirement of broiler chicks. *Poultry Sci.* **72:**701.

Hurwitz, S., and S. Bornstein. 1973. The protein and amino acid requirements of laying hens: Suggested models for calculation. *Poultry Sci.* **52***:*1124.

Jurgens, M .H. (2002).Animal feeding and Nutrition.9th Ed. Kendall/Hunt Pub.Coy. Iowa, USA.588pp.

Kellems and Church (2010), Livestock feeds and feedingPp, 6th ed., Pearson education, Inc., Preantice Hall, New Jersey. 711Pp.

Leeson, S., 2007. Poultry nutrition health: Dietary allowances. *Feedstuffs (Reference Issue)*, **78**(38): pp. 45-53.

Leeson, S., and J. D. Summers. 1997. *Commercial Poultry Nutrition*. 2d ed. Guelph, Ontario, Canada: University Books.

Lundgren, T., ed. 2007. Feed marketing distribution. *Feedstuffs (Reference Issue)* 78(38): 4-15.

Macdonald, P; Edwards, R.A; Greenhalgh, J. F. D and Morgan, C. A. (2002). Animal Nutrition, 6th Ed. Pearson Education (Singapore) Press Ltd.,Delhi. 693pp.

Najime, D. (2003). Effect of processing on the utilization of soyabeans by broiler chickens.Unpublished M.Sc Thesis AbubakarTafawaBalewa University, Bauchi, Nigeria.

North, M. C., and D. Bell. 1990. Commercial Chicken Production Manual. 4thed. New York: Van Nostrand Reinhold.

Obioha F. C. (1992). Poultry production in the tropics.Acena publishers Enugu Nigeria.Pp 8.

Obi, I. U. (2002).Statistical methods of detecting differences between treatment means and research methodology issues in laboratory and field experiments.2nd Ed. Express Publ. Ltd. Enugu.Pp13-21.

Oformata, G.E.K.,1975. Soil Erosion.In : Nigeria in Maps. Eastern States. Benin, Ethiope Pub. House.Pp 43-45.

Okonkwo, W.I., Akubuo, C.O., 2007. Trombe Wall System for Poultry Brooding. Int. J. Poult Sci. 6(2), 125-130.

Oluyerni, J.A. and P.A. Roberts (2000).Poultry Production in Warm Wet Climates.2nd edition.Specrum Books Ltd., Ibadan, Nigeria.244 p.

Parsons, C. 1990. *Digestibility of Amino Acids in feedstuffs and Digestible Amino Acid Requirements for Poultry*. St. Louis, MO: BioKyowa Inc.

Roush, W. B., and T. L. Cravener. 1997. Artificial neural network predication of amino acid levels in feed ingredients. *Poultry Sci.* **76**:721.

SAS Institute Inc. (2006). Statistical Analysis System Institute ,SAS® 9.1.3 Output delivery system: User's guide, volumes 1 & 2. Cary, NC: Author.

Scott,M. L., M. C. Nesheim , and R. J. Young.1982. *Nutrition of the Chicken*.Ithaca,NY: M. L. Scott and Associates.

Sibbald, I. R. 1986. *The T. M. E. System of Feed Evaluation: Methodology, Feed Composition Data and Bibliography.* Tech. Bull. 1986-4E. Ottawa, Canada: Agriculture Canada.

Smith, A.J. (2001). Poultry.The Tropical Agriculturalist.2nd (revised) ed. Macmillan Education Ltd. U.K. Pp 1 – 73.