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Evaluation of growth of Aylesbury ducks

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Keywords

Pass Transistor, three-dimensional integrated circuit (3D IC), differential signal transmission.

Abstract

This study aims at evaluating growth performance, carcass characteristics, phenotypic correlations and heritability estimates of body measurements of Aylesbury ducks. The dataset contained records of 105 birds consisting of (15) males and (30) females parents (p), (30) males and (30) females offspring respectively. Body weight (BW) and the following linear body parameters were recorded at starter and finisher phases namely body length (BLT), body depth (BDP), beak length (BKLT), breast width (BRSWT), thigh circumference (TC), wing length (WL), keel length (KL) and shank length (SL). At finisher phase (12 weeks) carcass parameters determined included pre-slaughter live weight (PSLW), slaughter weight (SW), carcass weight (CW), gizzard weight (GW), small intestine weight (SIW), large intestine weight (LIW),liver weight (LVW), heart weight (HW), gizzard width (GWD), small intestine length (SIL) and large intestine length (LIL). Result showed that significant differences ($P< 0.05$) were observed between the sexes with males recording higher final weight and daily weight gain than the females at the finisher phase while no significant differences ($P>0.05$) were observed in initial weight, daily feed intake and feed conversion ratio (FCR) of both sexes. There were significant differences ($P<0.05$) between body weight and linear body traits in both sexes. The females noticeably were higher at the early phase of growth whereas, the males outperformed them at the later phase. The regression of body weight on linear body parameters showed significant relationships between traits, with high coefficient of determination (R^2) in both starter and finisher phases. The log linear regression equations of log-transformed and allometric growth equations for 12-weeks, showed reliable allometric relationships between body weight and the linear traits. Carcass characteristics of male and female expressed as percent live weight, showed significant differences ($P<0.05$) in pre-slaughter weight, slaughter weight, carcass weight and liver weight in males and females respectively. The male Aylesbury recorded higher values ($P<0.05$) than the females. While no significant differences ($P>0.05$) were observed in eviscerated weight, dressed percent, gizzard, large intestinal, small intestinal and heart weights, gizzard width, large intestinal and small intestinal length. Although males had higher dressing percentage of 86.24% and liver weight of 2.40% than the females with dressing percentage of 85.03% and liver weight of 1.92%. There were strong positive correlations ($P<0.01$) between body weight and all the linear traits at 6 and 12 weeks of age in both sexes. High and positive heritability estimates were obtained for both sexes in body weight and all the linear body parameters with wing length having the highest value of 0.95 and 0.97 in males and females respectively. The significant positive correlation between body weight and linear body traits, with high heritability estimate obtained in this study showed that genetic progress could be made in this breed of duck through direct selection.

Introduction

Ducks are one of the avian species belonging to the order Anseriformes and family Anatidae diverged from (Galliformes) chicken (Tuinen and Hadly, 2004). They have economic, social and ecological value. It is an important poultry genetic resource, domesticated for meat, eggs and down feathers (for making bedding and warm jackets). Ducks are considered as the most preferred poultry after chicken, also known to possess unique disease resistance and adaptability. Nutrient composition of duck meat and eggs are comparable to that of chicken (Tai and Tai, 2001; Adzitey *et al.*, 2012).

Ducks have contributed greatly in the improvement of the nutritional standard of human population (Huque 1996; Pingel, 2009). According to Ksiazkiewicz (1995) ducks have been a source of income and food in many parts of the world such as Asia, China and other countries. Meat and eggs from ducks are good dietary sources of high quality protein, energy and several vitamins (vitamin A, C, E, K, $B_{2,}$ $B_{6,}$ B_{12}) and minerals such as calcium, iron, magnesium, sodium, manganese, copper and zinc (Lorenzo *et al*., 2011).

When properly included as part of a well balanced daily diet, duck meat and eggs supply a substantial portion of the nutrients required by humans (Brown, 2003; Tanaka, 2012). Duck meat like that of chicken can also be used to prepare sausages, meat balls and many other ready-to eat meals (Huda *et al*., 2010; Huda *et al*., 2011; Putra *et al.*, 2011). Ducks have unique advantage over chicken by utilizing foodstuffs that normally go unharvested, control harmful insects, slugs, snails and unwanted aquatic plants, thrive under harsh condition with limited shelters, resist diseases and parasites and also converts feed efficiently (Holderread,1982; Adzitey and Adzitey, 2011; Adzitey *et al.*, 2011).

In many parts of the world particularly Asia, China, Europe and some African countries duck meat and eggs have been highly rated, while in Nigeria ducks have been neglected despite all its attributes (Ojedapo *et al*., 2012). They further reported that although poultry out numbers all other forms of livestock in Nigeria and are found throughout the country wherever there is human settlement. However, ducks are not as common as chickens. Oluyemi and Ologhobo (1997) in their review showed that ducks consisted only about ten percent of Nigerian poultry. Therefore, there is need to increase the production of livestock using intensive system particularly those poultry species that can withstand stressful environment, resist disease attacks and produce efficiently. In addition, Eberhart and Washburn (1993) suggested the need to breed birds with more natural resistance to heat. Ducks having proved to possess above mentioned qualities and manifest what Nwachukwu *et al.* (2006) defined as productive adaptability which is the ability of animal species to give acceptable level of production in a stressed environment, they are considered suitable poultry genetic resource for production in harsh environments.

In order to utilize these unique characteristics of ducks and exploit their productive and disease resistant capabilities; some genetic improvement techniques such as selective breeding, crossbreeding and high tech-breeding methods should be employed as tools.

Aim

The aim of the study is evaluation of growth of Aylesbury ducks while the specific objectives of the study are to:

1. Determine the growth performance of male and female Aylesbury ducks from 2 to 12 weeks of age
2. Determine growth rate of different body structures in relation to overall body growth.

Materials and Methods

Location of study

The study was conducted at Poultry Unit of Teaching and Research Farm, Michael Okpara University of Agriculture Umudike Abia state. Umudike lies between latitude 05^0 $29'^N$ longitude 07^0 $33'^E$ and altitude of 122m above sea level. The town lies within the humid rain forest zone of South Eastern Nigeria and has a bimodal rainfall pattern with a total annual rainfall range of 1700mm to 2100mm. The minimum and maximum daily temperature of the area range from 18.0^0 to 23.0^{0c} and from 26^{0c} to 36^{0c}, respectively while the humidity range from 57.0% to 91.0%. The climatic data were taken from the meteorological station of the National Root Crop Research Institute, Umudike. This area is described as hot-humid tropics.

Experimental birds and their management

Management of parent population

The parents used in the study consist of 15 males and 30 females of Aylesbury ducks, which were obtained from the Poultry Unit of Teaching and Research Farm, of Michael Okpara University of Agriculture, Umudike. The Aylesbury ducks population were housed in open sided conventional poultry house. Commercial(Top feeds brand) layer mash containing 18% C.P and 2800kcal/kg M.E was used to feed birds at 150g/bird/day and water was supplied on regular basis in plastic water troughs. About 18 hours of light were provided consisting of 12 hours of natural and 6 hours artificial light. The birds were mated at the ratio of 1:2 to ensure adequate fertility. Egg collection from the laying birds was done daily, cleaned and were set weekly in the incubator.

Management of ducklings

The fertile eggs were hatched in four batches. Prior to arrival of the progeny, the brooding house was cleaned and disinfected. The ducklings were brooded in batches in deep litter pens. Each pen measured 3.4m x 1.40m proving enough space for feeding, drinking and exercise. Heat was provided using hurricane lanterns and 100watts electric bulbs for the birds. Commercial starter marsh containing 22% crude protein (Cp) and 2800kcal/kg (M.E) for the first six weeks and finisher ration containing 20% (C.P) and 2900kcal/kg (M.E) was fed to them for the remaining six weeks. Water was given *ad libitium* throughout the rearing period.

Parameters measured

The following parameters were measured:

Body weight: This was taken with a sensitive top-loading scale of 5000g capacity at day-old and at weekly intervals.
Body length: It was measured as length of the body from the base of the bill to the tail near the uropygial oil gland.
Breast width: This was measured as the region of largest breast expansion when the bird was positioned ventrally.
Body depth: This was measured as the circumference of the body under the wing through the anterior border of the breast bone crest and the central thoracic vertebrae.
Wing length: This was measured as the distance from the shoulder joint to the extremity of the terminal phalangx.
Shank length: This is the distance from the hock-joint to the extremity of the digitus pedis.
Thigh circumference : This was measured as the area of highest thigh expansion.
Bill length: This was measured as the base of the bill to the terminal point of the bill.
Keel length: This was measured as the length of the cartilaginous keel bone, from the v-joint to the end of the sternum. All linear body parameters were taken with a tailor tape in centimeters.
Weight gain: This was calculated by subtracting the initial weight of the previous week from the present week.
Feed intake: Daily feed intake was recorded as feed consumed after subtracting the left over feed from known quantity given the previous day using a sensitive loading top scale.
Feed conversion ratio (FCR): This was determined as feed consumed over weight gain.

$$FCR = \frac{\text{Amount of feed consumed by birds}}{\text{Weight gain of the bird}}$$

$$\text{Dressing percentage} = \frac{\text{Dressed weight}}{\text{Pre-slaughter live weight}} \times \frac{100}{1}$$

Experimental design / statistical analysis

Ducklings for the study were generated in 4 batches. They were vent-sexed and identified with indelible ink marker. Data on growth performance, body weight and linear body traits and carcass evaluation between the two sexes were analyzed using independent t-test procedure as outlined by Snedecor and Cochran (1989). The formula is as follows:

$$t = \frac{\bar{x}_a - \bar{x}_b}{s_d} \quad \ldots (1)$$

where

$\bar{x}_a$ = mean of group A (male)
$\bar{x}_b$ = mean of group B (female)
s_d = standard error of difference between means

Simple linear regression was employed to determine the growth traits that best predict body weight in the starter and finisher phases of growth. The model is as follows:

$Y_i = a + bX + e \ldots (2)$

Where Y_i = Dependent variable (body weight)

a = Intercept on Y- axis
b = regression coefficient
X = Independent variable (linear body measurements)
e = Random error, identically and independently, normally distributed, with zero mean and constant variance [iind(o, σ^2)]

Pearson product moment correlation coefficients between body weight and linear traits at 6 and 12 weeks of age in the starter and finisher phases respectively were computed. The heritability estimates for body weight and linear traits were obtained separately for males and females through the regression of mid-parent values on offspring values according to Ibe (1998). The formula for heritability of combined components is as follows:

$h^2 = b_{op}$

Where h^2 = Heritability
b = Coefficient
o = Offspring value
p = Mid- parent value

Allometric growth equation described by Cock (1963) was used to determine growth rate of different body structures in relation to overall body growth. Least squares estimates of the initial growth constant, α, and the coefficient of allometry, β, were obtained by fitting the log-transformed linear equations: $\log_{10} Y = \log_{10}\alpha + \beta\log_{10}W$. The estimate, α of the initial growth constant was numerically determined by the formula: α= antilog ($\log Y - \beta\log_{10}W$). The allometric growth equation is as follows:

$Y = \alpha W^{\beta}$

α = Growth constant
β = Coefficient of allometry
W= Body weight
Y= Linear structural body parameters e.g Body length, breast width

Results and Discussion

Mean growth performance of male and females

Table 1 shows the mean growth performance of male and female ducks. Significant differences ($p < 0.05$) were observed in final body weight and daily weight gain, whereas no significant differences ($p > 0.05$) were observed in initial weight, daily feed intake and feed conversion ratio (FCR) between male and female ducks. The males had higher final weight (1502.50g) and higher daily weight gain (103.81g) than the females at 12 weeks of age. The feed conversion ratio (FCR) value for male ducks shown in Table 4.1 was lower than that of females. This showed that feed conversion was more efficient in males than the females.

This observation was in line with the report of Bochno *et al.* (1994) who noted that male ducks grew faster with more efficient feed conversion than females. Tai and Rouvier (1998) also reported drakes to be 50% heavier than female muscovy ducks, that difference in weight and body measurements could be as a result of more efficient feed conversion, which is in agreement with Cahaner and Leenstra (1992), Etuk *et al.* (2006) also reported sex effect; that males were superior to females in converting feed to gain in their study on effects of graded levels of dietary protein and energy on the performance of White Pekin ducklings from day 1 to day 56. The findings of this study are in agreement with their report as males showed lower FCR than females, making them better converters. Nguyen and Brian (2000) obtained daily weight gains of 28.4 g and 29.3 g for local and crossbred Muscovy ducks at four weeks of age, respectively and corresponding feed conversion ratios (FCR) of 4.07g and 4.14g, respectively. They also obtained daily feed intake (as per dry matter basis) of 115 g/bird/day and 119 g/bird/day for the local and crossbred. Whereas, the daily weight gain obtained in male and female Aylesbury in this study is far higher than the values reported by Nguyen and Brian (2000) for Muscovy duck. Brewster (1976) found that FCR of seven and nine week-old Pekin ducklings were 2.78 and 3.44 respectively, while Bagot and Karunajeewa (1978) reported higher FCR at nine weeks. These values are far higher than the values obtained for male (0.58) and female (0.64) ducks respectively in this present study. These higher values suggest that the Aylesbury ducks are better feed converters compared to Muscovy ducks.

Table 1: Mean±SE of growth performance of male and female Aylesbury ducks

Parameter	Mean Value	
	Male	**Female**
Initial weight g	39.17±0.48	38.17±0.48
Final weight g	1502.50±27.07[a]	1358.00±16.36[b]
Daily weight gain g/day/bird	103.81±1.94[a]	93.56±1.18[b]
Daily feed intake g/day/bird	60.28±9.64	60.28±9.64
Feed conversion ratio (FCR)	0.58±0.04	0.64±0.04

[a-b] means in same row with different superscripts are significant ($p<0.05$)

Linear body traits

Table 2 shows the linear body traits of male and female Aylesbury ducks from 2 to 12 weeks of age. Significant differences ($p<0.05$) were observed between the sexes in body length, body depth and beak length at week 2, with males having higher values than females. In week 4, significant differences ($p<0.05$) were recorded only in wing length, with female Aylesbury performing better than the males. The body depth was the only significant parameter in week 6, with female Aylesbury performing better than the males. In week 8, body depth, thigh circumference and wing length were significantly different ($p<0.05$) between sexes. Females had higher values than males in thigh circumference and wing length but not in body depth. In week 10, there were significant differences ($p<0.05$) in body length, beak length and breast width, with males outperforming females. In week 12, significant differences were noticed in keel length, shank length and body weight with males performing better than the females.

The sex significant difference in weight and other body measurements, with the males having higher weight and larger body dimensions than female ducks, has been reported in previous studies for example Baeza *et al*. (2001); Etuk *et al. (*2006); Kleczek *et al.* (2006); Ogah *et al*. (2009) and Yakubu (2009). These investigators were of the opinion that the variations in the gender might result from genetic composition and level of inbreeding in the population under consideration. Conversely in this present study, the female Aylesbury showed higher values ($p<0.05$) than the males in wing length (4th and 8th week), thigh circumference (8th week), and body depth (6th week). The females were noticeably higher at the starter phase in body depth; whereas, the males outperformed them at the finisher phase, and this was virtually in all the parameters, except for thigh circumference and wing length. The 12 week body weight (1358.00g) obtained in this study compared favourably with the 12 weeks body weight of female Muscovy ducks (1245.76 g) obtained by Teguia *et al.* (2008).

Solomon *et al.* (2006); Perez (1985) and Holderread, (1978) reported higher values for body weight in Pekin and Muscovy ducks respectively. These values were higher than 1.502 kg and 1.358 kg obtained in the present study for body weight at 12 weeks in male and female Aylesbury ducks. The difference could be attributed to genetic factors, which portrayed the Aylesbury ducks as inferior meat breed to Pekin and Muscovy.

Table 2: Linear body traits (cm) in male and female Aylesbury ducks from 2 to 12 weeks of age

Week	Sex	BLT	BDP	BKLT	BRSWT	TC	WL	KL	SL	BWT
2	M	22.67 ±0.35[a]	15.53 ±0.27[a]	3.87 ±0.05[a]	7.45 ±0.12	5.87 ±0.16	6.53 ±0.02	4.18 ±0.08	3.65 ±0.08	189.83 ±6.72
	F	21.17 ±0.61[b]	14.30 ±0.31[b]	3.65 ±0.09[b]	7.38 ±0.18	5.71 ±0.21	6.27 ±0.26	4.38 ±0.18	3.50 ±0.09	163.33 ±12.65
4	M	33.33 ±0.44	21.15 ±0.25	5.18 ±0.08	9.98 ±0.56	8.92 ±0.09	12.10 ±0.27[b]	6.78 ±0.19	5.02 ±0.02	500.33 ±9.78
	F	32.33 ±0.53	20.98 ±0.41	5.17 ±0.07	9.52 ±0.57	8.77 ±0.15	13.75 ±0.48[a]	6.77 ±0.19	5.03 ±0.02	508.33 ±23.01
6	M	37.73 ±0.27	22.78 ±0.41[b]	5.58 ±0.12	13.93 ±0.33	10.22 ±0.19	19.80 ±0.52	7.67 ±0.24	5.22 ±0.07	792.67 ±9.25
	F	37.20 ±0.47	24.43 ±0.57[a]	5.67 ±0.09	13.92 ±0.16	10.02 ±0.16	21.17 ±0.86	8.25 ±0.36	5.12 ±0.04	795.17 ±33.57
8	M	42.78 ±0.39	28.85 ±0.42[a]	6.45 ±0.11	16.12 ±0.13	11.02 ±0.14[b]	27.52 ±0.24[b]	10.88 ±0.16	5.32 ±0.06	1140.33 ±20.37
	F	42.80 ±0.64	27.68 ±0.35[b]	6.43 ±0.08	15.70 ±0.19	11.48 ±0.14[a]	28.27 ±0.15[a]	10.80 ±0.18	5.25 ±0.06	1139.83 ±29.91
10	M	47.25 ±0.41[a]	31.37 ±0.42	6.80 ±0.09[a]	16.52 ±0.11[a]	14.80 ±0.09	28.33 ±0.25	11.50 ±0.16	5.47 ±0.02	1353.17 ±22.20
	F	43.62 ±0.41[b]	30.52 ±0.43	6.50 ±0.05[b]	16.12 ±0.13[b]	14.87 ±0.23	28.68 ±0.17	11.63 ±0.18	5.42 ±0.03	1299.83 ±21.64
12	M	46.33 ±0.26	32.25 ±0.32	6.92 ±0.14	16.80 ±0.12	15.50 ±0.15	28.82 ±0.27	12.48 ±0.14[a]	5.60 ±0.05[a]	1502.50 ±27.07[a]
	F	45.32 ±0.48	31.97 ±0.40	6.65 ±0.06	16.73 ±0.13	15.52 ±0.23	28.98 ±0.11	11.98 ±0.11[b]	5.47 ±0.02[b]	1358.00 ±16.36[b]

[a-b] Means with different superscripts between sexes in each column are significantly different at $p<0.05$; BLT- Body length; BDP- Body depth; BK+LT-Beak length, BRSWT- Breast width; TC-Thigh circumference; WL-Wing length; KL-Keel length; SL-Shank length; BWT-Body weight; SEM- Standard error of mean.

Log linear and allometric growth equations and distribution coefficients for linear growth parameters at 12 weeks

Table 3 showed the log linear and allometric growth equations and distribution coefficients of linear growth parameters at 12-weeks in Aylesbury ducks. All regressions were significant ($p<0.01$) with small standard errors. Positive allometric relationships were established between body weight and the following linear traits: body length, body depth, breast width, thigh circumference, wing length and keel length. The coefficients of allometry were unbiased. This showed a disproportionate growth and suggested that, the above mentioned linear body traits grew faster than the whole body whereas, shank length and beak length showed negative allometric growth. This simply means that they had a slower growth rate than the entire body. There was no isometric growth in the study when comparing the various coefficients of allometry growth with coefficient of isometric growth (0.33) stated by (Cock, 1963) as an indication of equal rate of growth between any component part and the body as a whole. The finding of the present study agreed with Tzeng and Becker (1981) who reported that growth for each body structure might not be the same. Likewise, Koops and Grossman (1991) were of the same view that, different components of the body have different growth rates. A positive relationship among various physiological traits was also reported in growing chicks and pigeons (Gavin *et al*., 1998).

Ibe and Nwachukwu (1989) reported that breast width, keel length, and thigh circumference of broilers showed positive allometric growth in their study. They further stated that a situation where consumers' preference was for specific chicken parts, birds that showed faster growth of these body parts relative to the overall body growth might be preferred. The structural body parts that showed disproportionate growth relative to overall body are the portions of carcass with greater economic value. Trenkle and Marple (1983) stated that attempt had been made to alter the conformation of animals to shift the muscles mass toward the carcass of greater economic value. Ibe and Nwakalor (1987) recommended breeding for specific body structures which showed allometric instead of isometric growth. Therefore structural body parts that showed positive allometric growth with high coefficient of allometry in this present study could be selected for and improved upon in subsequent generation of the Aylesbury ducks.

Table 3: log linear and allometric growth equations and distribution coefficients for linear growth parameters at 12-week period in Aylesbury duck

Linear parameters	Log-linear	SE	R^2 %	Allometric	Correlation with body weight
Body length (BL)	Y= .56 + .35W	0.01	99.00	$BL=3.63^{35}$	0.994
Body depth (BD)	Y= .36 + .36W	0.22	97.00	$BD=2.29^{.36}$	0.983
Beak length (BKL)	Y= -.05 + .28W	0.02	97.00	$BK=0.89^{.28}$	0.986
Breast weight (BRW)	Y= -.07 + .41W	0.04	92.00	$BR=0.85^{.41}$	0.959
Thigh circumference (TC)	Y= -.24 + .44W	0.34	93.00	$TC=0.57^{.44}$	0.963
Wing length (WL)	Y= -.88 + .75W	0.03	98.00	$WL=0.13^{.75}$	0.990
Keel length (KL)	Y= -.51 + .45W	0.03	96.00	$KL=0.31^{.45}$	0.980
Shank length (SL)	Y= .14 + .20W	0.23	88.00	$SL=1.38^{.20}$	0.939

SE = Standard error. $Y=Log_{10}$ (linear parameter), $W=log_{10}$ (body weight)

Conclusion

The result of this study revealed evidence of sexual dimorphism in favour of males. The male Aylesbury ducks performed better in growth and carcass parameters than females. Linear body traits showed variation in performance of both sexes, where females performed better than males at starter phase in body depth and males outperformed them at the finisher phase, virtually in all the parameters, except in thigh circumference and wing length. The variations in linear body measurements of Aylesbury ducks could also be attributed to gene expression at different stages of growth in each gender. The regression of body weight on linear body parameters showed strong significant relationships between traits, with high coefficient of determination (R^2) in starter phase and little variation in finisher phase. This implied that body weight was highly dependent on growth of other component parts of the body and that linear body traits were reliable in predicting body weight without bias. In the starter phase wing length was the best predictor of body weight in both sexes whereas thigh circumference (TC) and keel length (KL) appeared to be the best predictors of body weight in males and females Aylesbury duck at finisher phase.

Positive correlation coefficients were observed between body weight and linear body measurements in both phases. This showed that increase in body weight is associated with the corresponding increase in linear body parameters. Information on correlation would help breeders to select and improve this breed of duck better. Similarly, positive allometric growth relationships were observed between body weight and various body structural parts of greater economic value, with these body parts growing faster than the whole body, except shank length and beak length which had slower growth rate than the overall body. The high heritability values obtained for both sexes in body weight and linear body parameters with wing length having the highest values of 0.95 and 0.97 in males and females were indication that variability due to additive gene action was higher than the non-additive component and genetic progress could be made through direct selection.

References

Adzitey, F., Rusul G. and Huda, N.(2012). Prevalence and antibiotic resistance of Salmonella serovars in ducks, duck rearing and processing environments in Penang, Malaysia. Food Res. Int. 45(2): 947-952.

Adzitey, F, Huda, N. and Gulam R. (2011). Comparison of media for the isolation of Salmonella (XLD and Rambach) and Listeria species (ALOA and Palcam) in naturally contaminated duck samples. Internet Journal of Food Safety 13:20-25.

Adzitey, F. and Adzitey, S.P. (2011). Duck production: has a potential to reduce poverty among rural households in Asian communities-a mini review. Journal World's Poult. Res. 1(1): 7-10.

Baeza, E., Williams, J., Guemene, D. and Duclos, M.J. (2001). Sexual dimorphism for growth in Muscovy ducks and changes in insulin-likegrowth factor I (IGF-I), growth hormone (GH) and triiodothyronine (T3) plasma levels. Reprod. Nutri. Dev. 41(2):173-9.

Bagot, I. and Karunajeewa, H. (1978). The effect of strain, sex and diet on growth andcarcase characteristics of meat-type ducks Aust. 3 ExpAgric. Anim. Husb. 18(93): 527-532.

Brewster, R. (1976). Proc. First Aust. Poult. and Stock Feed Conk. Vol. 2: 357.

Brown, R .(2003). The body fat review: the problem with animal protein. Available at http://www.bodyfatguide.com/AnimalProtein.htmaccessed on 17 February 2012.

Cahaner, A. and Leenstra, F. (1992). Effects of high temperature on growth and efficiency of male and female broilers from lines selected for highweight gain, favourable feed conversion, and high or low fat context. Poult. Sci.71:1237-1250.

Cock, A.G. (1963). Genetic studies on growth and form in the fowl. (1) Phenotypic variation in the relative growth pattern of shank length and body weight. Genet. Res. 4: 167-192.

Eberhart, D .E and Washburn,W. (1993) Assessing the effect of the naked neck gene on chronic heat stress resistance in two genetic Poultry populations. Science 72: 1391- 1399.

Etuk, I. F, Ojewola, G.S. and Abasiekong, S.F. (2006). Performance of Muscovy Ducks under three management systems in South Eastern Nigeria. International Journal of Poultry Science 5 (5): 474-476.

Gavin, A, Konarzewski M, Wallis I. and McDevitt R. (1998) Relationship between metabolic rate and organ size in two strains of chicken. Br Poult Sci. 39 Suppl():S51-2.pub med.

Holderread, D. (1978). Raising the home ducks (Breed profiles) Publisher Garden way, Inc.Pownal, Vermont.20-21.

http://www.cipav.org.co/lrrd13/2/adad 132 htm.

Holderread, D.(1982) Raising the home duck flock:A complete guide. Garden way publication Corvallis, Oregon. pp 1-3.

Huda, N, Lin O.J, Ping Y.C. and Nurkhoeriyati T. (2010). Effect of chicken and duck meat ratio on the properties of sausage. International Journal of Poultry Science 9 (6): 550-555.

Huda, N, Putra A.A and Ahmad R. (2011). Potential application of duck meat for development of processed meat products. Current Res. Poult. Sci. 1:1-11.

Huque, Q.M.E. (1996) Improving skills of the small farmers in poultry management. 20th World's. Poultry Congress, New Delhi, India, Vol. 1, 47-60.

Ibe, S.N. and Nwachukwu, E.N.(1989). Effect of Feed Restriction on Broiler Performance: Conformation Traits And Isometry Growth.Nig. Journal Anim. Prod.15, 177-184.

Ibe, S.N.(1998). An introduction to Animal Genetics and Breeding 1st ed. Longman Nigeria Plc. Pp.78.

Kleczek, K, Wawro, K, Wilkiewicz-Wawro, E. and Makowski, W. (2006). Multiple regression equations to estimate the content of breast muscles, meat and fat in Muscovy ducks. Poultry Science, 85, 1318-1326.

Koops, W.J and Grossman, M. (1991). Application of a multiphasic growthfunction to body composition in pigs. Journal of Anim. Sci. 69, 3265- 3273.

Książkiewicz, J.M. (1995). Duck breeding strategy. In: 11th Proc. Inter. Symp. "Current Problems in Avian Genetics", Balice 111-119.

Lorenzo, J.M, Purriños, L, Temperán, S, Bermúdez, R, Tallón, S. and Franco, D.(2011). Physicochemical and nutritional composition of dry-cured duck breast. Poult. Sci. 90: 931-940.

Nguyen, T. K. D. and Brian O.R. (2000). Effect of brewery waste replacement of concentrate on the performance of local and crossbred growing Muscovy ducks. Workshop-seminar "Making better use of local feed resources" SAREC- UAF. College of Agriculture, Cantho University,Cantho, Vietnam; Swedish University of Agricultural Sciences,Uppsala, Sweden. pp 1-19.

Nwachukwu, E.N, Ibe, S.N. and Ejekwu, K.(2006) Short term egg production and egg quality characteristics of main and reciprocal cross- bred of normal local, naked neck and frizzle chicken x exotic broiler breeder stock in humid tropical environment. Journal of Anim. and vet. Adv. 5 (7):547-551.

Ogah, D.M. and Kabir, M. (2013). Variability in size and shape in Muscovy duck with age; principal component analysis. Biotechnology in Animal Husbandry 29 (3): 493-504.

Ogah, D.M, Alaga, A.A. and Momoh, M.O. (2009). Principal component factor analysis of the morphostructural traits of Muscovy duck. Inter. Journal of Poult. Sci., 8 (11):1100-1103.

Ojedapo, L.O; Amao, S.R; Ameen, S.A; Adedeji, T.A; Ogundipe, R.I and Ige A.O. (2012) Prediction of body weight and other linear body measurement of two commercial layer strain chicken. Asian Journal of Animal Science.6:13-22.

Oluyemi, J.A. and Ologbobo, A.D. (1997) The significance and management of the local duck in Nigeria. Proceedings of the 2nd Annual Conference of Animal Science of Nigeria, Sept. 16-17 Lagos Airport Hotel,Ikeja Lagos Nigeria, PP:96-103.

Perez, R. (1985). Duck - Rearing manual, University of the West Indies, St Augustine, Trinidad.www.lrrd19/7/solo19091.htm.

Pingel, H. (2009). Waterfowl production for food security. Proceedings of the IV World Waterfowl Conference, 11-13 November, 2009, Thrissur, India. Pp. 5-15.Populations. Evolutionary and Breeding Perspectives on Genetic Resource Review article Poultry Congress, New Delhi, India, Vol. 1, 47-60.

Putra, A.A; Huda, N. and Ahmad, R. (2011). Changes during duck meatball manufacturing using different binders after the preheating and heating process. International Journal of Poult. Sci. 10(1): 62-70.

Snedecor, G.W. and Cochran, W.G. (1989) Statistical Methods. 8th Edn. Iowa State University Press, Ames, Iowa.

Solomon, J. K. Q; Austin, R.; Cumberbatch, R. N.; Gonsalves, J. and Seaforth, E . (2006). A comparison of live weight and carcass gain of Pekin, Kunshan and Muscovy ducks on a commercial ration. Livestock Research for Rural Development, 18 (11).

Tai, C. R. and Rouvier, R. (1998). Crossbreeding effect on sexual dimorphism of body weight in intergeneric hybrids obtain between Muscovy and Pekin duck. Genetic Selection Evolution, 30: 163-170.

Tai. C and Tai, J.J.L. (2001). Future prospects of duck production in Asia. Joural Poult. Sci. 38: 99-112.

Tanaka, Y. (2012). Understanding protein and its importance. Available at:http://ezinearticles.com/?Understanding-Protein-and-ItsImportance&id=983562 accessed on 18 February 2012.

Trenkle, A,and Marple, D.N.(1983).Growth and development of meat animals Journal of Anim Sci 57(Suppl.2):273-283.

Tuinen, M. V. and Hadly, E. A. (2004) Error in estimation of rate and time inferred from the early amniote fossil record and avian molecular clocks. Journal of Mol. Eval. 59: 267–276.

Tzeng, R.Y. and Becker, W.A. (1981): Growth patterns of body and abdominal fat weights in male broiler chickens. Poult. Sci. 60, 1101-1106.

Yakubu, A. (2009) An assessment of sexual dimorphism in African Muscovy ducks (Cairina moshata) using morphological measurements and discriminant analysis. In proc. of 4th World Water Fowl Conf. Thrissur India, Pp. 59-63.

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