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Original Contribution

RELATIONSHIP BETWEEN SOME BODY MEASUREMENTS AND LIVE WEIGHT IN ADULT MUSCOVY DUCKS USING PATH ANALYSIS

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ABSTRACT
Weight and body dimensions (body length (BL), chest circumference (CC), thigh length (TL), shank length (SL) and neck length (NL) were studied using 215 fifteen weeks male and female Nigerian indigenous Muscovy ducks by path analysis. The result showed that the correlation coefficient between live weight and body dimensions on the other hand were 0.89, .94, .87, .88 and .75 (male) and .29, .59, .41, .37, - .10 (female) for BL, CC, TL, SL and NL respectively. The direct effect of chest circumference was higher in both male and female (0.616, .571) with the neck length having the least and negative direct effects on weight for both sexes. Indirect effect of body length through chest circumference was also the highest .chest circumference is the most influential variable and can be included in the model in estimating live weight of both male and female Muscovy duck at 15 weeks of age.

Key words: Correlation, muscovy duck, direct and indirect effect, Path coefficient

INTRODUCTION

Muscovy duck is a common household bird among rural dwellers in Nigeria, and play a significant role as source of protein and income to peasant farmers. The duck is known for its hardiness and resistance to environmental stress (1). The need to improve this bird to meet the ever increasing protein demand amongst the populace is imperative.

The ultimate aim in most animal breeding programme is improvement in the productivity. This can be determined using some phenotypic measurements. Using body measurement can be useful in defining performance in many cases (2). In Muscovy duck many factors can influence adult weight which is one of the main economic traits of the duck. Previous study showed the relationship between body weight and some body measurements in this bird (3). Different explanatory variables may have different contribution to a trait, those with a larger effect on the trait may be the most important to the breeder (4), explanatory variables may have direct or indirect effect on the trait, usually the direct effect are measured using correlation coefficient. However, the indirect effect may confound the correlation coefficient. This may be because another variable may be contributing to the correlation coefficient (5, 6).

To understand the causes of trait association Wright (7) proposed the path analysis which is helpful in partitioning correlation into direct and indirect effect. Path analysis is a standardised partial regression coefficient measuring the direct influence of one variable upon the other and permits separation of correlation coefficient into component of direct and indirect effects. Thus, a crucial evaluation can be made of the specific factor producing correlation (8).

The purpose of this study was to determine the explanatory variable (trait) that is most effective on live weight in terms of the contribution to selection model.

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MATERIALS AND METHODS

The data used for this study was generated from 215 muscovy ducks, (105 male and 110 females) of about 15 weeks of age in august 2008. The birds were reared under semi intensive management system at the Teaching and Research farm of college of agriculture Lafia, Nasarawa State Nigeria. The traits considered include body length (BL), chest circumference (CC), thigh length (TL), shank length (SL), neck length (NL) and body weight (BWT).

Path analysis was used to analyse the data. Path analysis provides a method to investigate direct and indirect effects, it is an extension of the ordinary multiple regression model. Common multiple regression procedure was adopted to fit the following model

BWT =bo+ b1 BL + b2 CC+ b3TL +b4SL +b5NL+error

Where body weight (BWT) was considered as a linear function of body length (BL), chest circumference (CC), thigh length (TL), shank length (SL), and neck length (NL).

Since the data for all traits were standardized, standardized partial regression coefficient obtained from the above equation are called path coefficient. These allow direct comparism of values to reflect the related importance of independent variable (traits) to explain variation in the dependent variables or traits (keskin, 2005).

The indirect effect was calculated as $IE_{yxi} = r_{xixk} P_{yxk}$ (10)

Where r_{xixk} is the correlation coefficient between X_i and X_k variables, P_{yxk} is path coefficient of X_k.

Variance Inflation Factors (VIF) was calculated to measure whether there were any multicollinearity problem among the explanatory variables (9). SPSS (11) statistical package was use f or the analysis.

RESULTS AND DISCUSSION

Descriptive statistics and correlation coefficient for all the traits studied are shown on **Table 1 and 2.**

Table 1. *Descriptive statistics of body measurements by sex*

Parameter	sex	mean se	min	max
BWT	male	2.61±0.08	2.10	3.50
	Female	1.64±0.30	1.30	2.10
BL	male	26.1±0.43	22.0	29.0
	Female	24.5±0.17	22.0	27.0
CC	male	14.7±0.26	12.0	19.8
	Female	13.8±0.10	11.2	14.5
TL	male	7.72 ±0.08	7.00	9.00
	Female	7.47±0.50	7.00	8.00
SL	male	5.50±0.06	5.00	6.00
	Female	5.27±0.02	5.00	s5.50
NL	male	11.9±0.14	10.2	14.1
	Female	11.4±0.09	10.0	13.5

Body length (BL); chest circumference (CC); thigh length (TL); shank length (SL); neck length (NL).

Table 2. *Correlation matrix between traits above diagonal male below diagonal female*

	BWT	BL	CC	TL	SL	NL
BWT		.89 **	.94**	.87**	.88**	.75**
BL	.29		.89**	.83**	.84**	.80**
CC	.59	.30		.80**	.80 **	.81**
TL	.41	.46	.12		.83**	.78**
SL	.37	.25	.13	.16		.73**
NL	.-.10	.42	.21	.23	-.28	

**=P<0.01

The correlation between live weight and the body measurements in males were all positive and significant (p<0.01) while in female none of the correlation were large enough to be significant (p>0.05), similarly negative correlation was found between body weight and neck length and also between shank length and neck length. Chest circumference had the highest correlation coefficient 94% for male and 59% for female with body weight. This similar trend was recorded by Mendes et al (12) in American Bronze Turkey under different lightening programme.

Tables 3 and 4 present the direct and indirect effects including variance inflation factors VIF and regression coefficient for male and female ducks.The highest regression coefficient of 95.1% was recorded for the male ducks, while for the female was recorded 58.1%. The coefficients in **table 2**, **3, and 4** were used to calculate direct and indirect effects. The values for direct are the path coefficient that measures the direct effect of each independent variable on the explanatory variables. Values of diagonal measures the indirect effects on the dependant variables. In male only one of the path coefficient (direct effect) related to chest circumference was large(P<0.01) this indicate that one unit change in standard deviation in the chest circumference variable resulted in 0.616 unit change in standard deviation in the Y (weight). Indirect effect of body length 0,548 on Y through chest circumference was highest among all indirect effects male duck. Similarly in female direct effect or path coefficient related to chest circumference was large (P<0.01), with correspondent indirect effect of body length 0.171 through chest circumference as the highest among the indirect effects.

Regression equations was constructed for the ducks in **tables 3 and 4** for male and females, the coefficient in these equations are the path coefficient. For both sexes chest circumference had the largest effect on live weight, while neck length had the least contribution to the model with negative and non significant effect. There were no multicollinearity problems among the explanatory variables, since the VIF values was smaller than 10 in all cases (9) **(Table 3 and 4).**

Table 3. *Path analysis direct and indirect effects (Male duck)*

Trait	Direct effect	se	VIF	R^2	indirect effect				
					BL	CC	TL	SL	NL
BL	**0.099**	0.015	6.536	.951		0.088	0.082	0.083	0.079
CC	**0.616**	0.022	5.469		0.548		0.493	0.496	0.499
TL	**0.272**	0.061	4.420		0.226	0.217		0.226	0.212
SL	**0. 226**	0.080	4.392		0.190	0.181	0.188		0.165
NL	**-.204**	0.032	3.539		-0.163	-0.163	-0.159	-0.149	

Y= 0.099BL+.616CC+0.272TL+0.226SL -.204NL

Table 4. *Path analysis direct and indirect effects (female duck)*

Trait	Direct effect	se	VIF	R^2	indirect effect				
					BL	CC	TL	SL	NL
BL	**.028**	0.025	1.714	.581		0.000	0.013	0.001	0.012
CC	**.571**	0.032	1.123		0.171		0.069	0.074	0.120
TL	**.365**	0.076	1.273		0.168	0.044		0.058	0.084
SL	**.164**	0.170	1.330		0.041	0.021	0.026		-.046
NL	**-.269**	0.043	1.519		-0.113	-0.056	-0.062	0.075	

Y=0.028BL +0.571CC +0.365TL +0.164SL -.269NL

The result of path analysis indicated how the independent variables influences the dependent variable directly and indirectly and explain the reasons of correlation between characters, wrong conclusions and wrong selection could arise if based on phenotypic correlations only

CONCLUSION

In the study, path analysis indicated that chest circumferences have the highest direct effect on body weight for both male and female muscovy ducks. Indirect effect of body length through chest circumference was highest among all indirect effect similarly in both sexes. Increase in chest circumference was associated with increase in body weight in this bird. It can be proposed that this trait may be used as a criteria for selecting adult muscovy duck.

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