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CANONICAL CORRELATION ANALYSIS OF BODY MEASUREMENTS AND CARCASS TRAITS OF CROSS BRED RABBIT POPULATION

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Abstract: In this study, canonical correlation analysis was applied to estimate the relationship between body measurements and carcass traits of 28 male cross bred rabbits of about 12 weeks of age, reared under semi intensive system. Four body measurements, pre-slaughter weight (PSW) , body length (BL), chest circumference (CC), and ear length (EL) as predictor variable while dressing percentage (DP) , hot carcass weight (HCW) and cold carcass weight (CCW) as criterion variables. Pre-slaughter weight and body length had significant (P<0.001) simple correlation coefficients with the carcass traits except for dressing percentage. The three canonical variate pairs ranged between .99 to .42 and only the first pair was significant (P<0.001). From the analysis pre-slaughter weight and body length can be regarded as the main factors as live measurement traits, while dressing percentage did not have pronounced effect on the emerged criterion variables.

Keywords: Cross bred rabbit, carcass, body measurements, canonical correlation.

Introduction

The rabbit (*oryctologus cuniculus*) appears to be the most sustainable means of producing high quality animal protein for expanded population of lesser developed countries like Nigeria, with an estimated rabbit population of about 1.7million (RIM 1992). Because of high reproductive potential which encompasses high fecundity and prolificacy, short generation interval, gestation length and early sexual maturity (*Mancha and Chollom, 2011*)

Associations among live body measurements were established through the examination of correlation among them (*Chineke, 2005*). Studies of interrelationship among body measurements also find their application in selection

and breeding. The magnitude of the correlation between live body measurements and raw meat yield was reported to be a valuable indicator for selecting high meat yielding strain of turkey *MacNeil (1969)* and in pig (*Ogah et al., 2011).* One valuable statistical tool for effective prediction of multiple sets of traits is canonical correlation analysis, as demonstrated by (*Akbas and Takma 2005 and Ogah et al., 2009)* As in large animals, it will be desirable if farmers could determine from pre-slaughter measurements carcass traits when animals are suitable for slaughtering. Researches on predicting optimum finishing criteria for other livestock have been reported by *Dolezel (1993)* and *Minchi et al. (2009)* for cattle. This study was undertaken to quantify rabbit linear traits and determine the most useful measurements that could predict carcass traits.

Materials and Methods

Animal and their management

The experiment was carried out on 28 male cross bred rabbits (crosses of NewZealand white , Chinchilla and California white). The rabbits were reared at the Teaching and Research Farm of College of Agriculture, Lafia, Nasarawa State, Nigeria. Located between latitude 08. 30^0 N and longitude 08. 32^0E, with annual rainfall ranging from 952-1988 mm, and a mean monthly precipitation of 150 mm. Its minimum and maximum daily temperatures average 20-37^0C. Lafia has a mean relative humidity at noon varying between 14 and 74%.

They rabbits were placed in a rearing cages in pairs and fed *ad libitum* on commercial diet containing 17% crude protein, 2300kcal/kg digestible energy and 14% crude fibre and supplemented with legumes and water supplied regularly. All animals were treated and medicated for the period under consideration. At 12 weeks of age the rabbits were prepared for slaughter after data on body measurements and weight were taken following the standard procedure by *Newton and Penman (1990).*

Measurement of traits

Prior to slaughtering, and after 12 hours fasting, the pre-slaughter weight (PSW), body length (BL) , chest circumference (CC) and ear length(EL) of each rabbit was taken as described by *Chineke (2005).* The carcass traits, dressing percentage (DP), hot carcass weight (HCW) and cold carcass weight (CCW) were obtained using the procedure as described by *Blasco et al.(1993*) and reported by (*Pinna et al., 2004).*

Canonical correlation analysis was used to examine the relationship between two sets of the traits using PROC CANCORR procedure of SAS (1999). It outlines the linear combination of two sets (*Johnson and Wichern, 1986 and*

Haier et al., 1998) as described by *Akbas and Takma (2005)* and *Ogah et al. (2009).*

Results and Discussion

Descriptive statistics of the body measurements and carcass traits are presented in Table 1. The findings were similar to what *Yakubu et al. (2009)* and *Pinna et al. (2004)* reported, but lower than those of *Villalobos et al.(2008),* and *Baiomy and Hassainien (2011),* due to variation in breed and environment. The simple correlations for body measurements and carcass traits in Table 2, were moderate to high between all traits, except for dressing percentage, ranging between -.03 to .99. The pre slaughtering weight had the highest correlation with cold carcass weight (.99), while the least is with dressing percentage (-.03), similar to the observation of *Lukefahr and Ozimba (1991),* implying that body measurements and carcass traits are good predictors of one another. This support the genetic relationship that will be determine in selecting for increase carcass weight. The canonical correlation between the first pair of canonical variables was found to be significant ($P<0.001$) Table 3 . From the likelihood ratio test which was also equal to the significant *Cankaya et al. (2007)* and *Ogah et al. (2009)* reported similar result. Based on this, the paper interpreted the relationship between the first pair of canonical variate as suggested by *Thompson (1984).* The contribution of each pair to the correlated variate is explained by the standardized canonical coefficient of first pair. The coefficient indicates that EL, DP and CCW have negative effect on the two sets, only HCW will tend to increase with increase in body measurements. The cross-loading of the variables further attests to the relationship of pre-slaughter weight and carcass prediction, suggesting that carcass weight is a product of the rabbit live weight.

Table 1. Descriptive statistics of body measurements and carcass traits of mixed breed rabbit population.

Traits	mean±se g	min g	max g	cv
Pre-slaughter weight	1316.9±46.1	1100	1623	11.07
Body length	31.49±0.45	29.8	34.6	4.55
Chest circumference	27.86±1.33	22.6	35.1	11.18
Ear length	10.52±0.14	9.8	11.2	21.08
Dressing percentage	57.8±0.42	55.9	60.0	2.31
Hot carcass weight	761±26.7	618.2	925.4	11.09
Cold carcass weight	641.3±27.0	562.2	810.4	13.32

Table 2. Simple coefficient of correlation between body measurements and carcass traits

	PSW	BL	CC	EL	DP	HCW	CCW
PSW		.95***	.46	.75	-.03	.98***	.99***
BL			.60	.72*	-.06	.92***	.92***
CC				.57	-.43	.37	.38
EL					-.19	.70*	.72
DP						.17	.12
HCW							.99***

PSW=pre-slaughter weight, BL= body length , CC= chest circumference, EL =ear lenght , DP= dressing percentage, HCW= hot carcass weight , CCW = cold carcass weight. *=P<0.05, ***=P<0.001

Table 3.Statistical characteristics of canonical variate pairs

Canonical variate pairs	Eigen values	Canonical corr	F-Value	Prob
1	19727.82	0.999	26.0	0.000
2	0.83	0.674	0.41	0.794
3	0.22	0.421	0.43	0.676

Table 4. Standardized canonical coefficient for the predictor and criterion variables

	Predictor variables					criterion variables		
	PSW	BL	CC	EL		DP	HCW	CCW
V1	.993	.010	.011	-.011	W1	-.233	1.205	-.074

Table 5. Canonical loading of the original variables and their canonical variables

	Predictor variables					criterion variables		
	PSW	BL	CC	EL		DP	HCW	CCW
V1	.999	.938	.466	.643	W1	-.325	.976	.981

Table 6. Cross-loading of original variable with opposite canonical variables

	Predictor variables					criterion variables		
	PSW	BL	CC	EL		DP	HCW	CCW
W1	.999	.938	.466	.642	V1	-.325	.976	.982

Conclusion

It can be concluded that pre-slaughter weight and body length can be regarded as main factors as live measurement traits and prediction of carcass performance can be achieved through body weight and some linear traits, providing valuable information in selection process for increase carcass of rabbit under this environment.

Analiza kanonske korelacije telesnih mera i osobina trupa populacije ukrštenih zečeva

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Rezime

U ovoj studiji, kanonska korelaciona analiza je primenjena za procenu odnosa između telesnih mera i osobina trupa kod 28 muških meleza zečeva, uzrasta oko 12 nedelja, gajenih u polu-intenzivnom sistemu. Četiri telesne mere: telesna masa pred klanje (PSW), dužin tela (BL), obim grudi (CC) i dužina uveta (EL), predstavljale su promenljive vrednosti – prediktori, dok su randman trupa (DP), masa toplog trupa (HCW) i masa ohlađenog trupa (CCW) bile zavisne varijable. Telesna masa pre klanja i dužina tela su imale signifikantne ($P<0.001$) jednostavne koeficijente korelacije sa osobinama trupa osim randmana trupa. Tri kanonska para promenljivih su bili u opsegu između .99 i .42 i samo je prvi par bio značajan ($P<0.001$). Telesna masa pred klanje i dužina tela se mogu smatrati glavnim faktorima, dok randman trupa nije imao izraženi efekat na zavisne varijable u istraživanju.

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