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Growth Performance and Carcass Characteristics of Japanese Quail (*Coturnix Coturnix Japonica*) Raised on Deep Litter System in South Western Nigeria

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ABSTRACT

Quail is a robust small bodied and easy to keep the bird. They can adapt to any climatic condition. Therefore the growth performance and carcass characteristics of this bird was determined using One hundred and twenty (120) Japanese quail (*Coturnix coturnix japonica*) were raised on a deep litter system. Two experimental diets (starter diet and layer diet) were given to the birds. The average weight and performance characteristics of the birds were determined. Carcass characteristics of selected birds (five males and five females) were slaughtered when the birds reach six (6) weeks of age. According to the results obtained, sex did not have any significant (P>0.05) effect on the performance characteristic. Also, most of the parameters of the carcass characteristic were not influenced (P>0.05) by sex. Age was found to have significant (P<0.05) effect on the performance characteristics. It was discovered that most of the body measurements were good estimators of each other because of the positive phenotypic correlations existing among them. The increment in body weight was found supportive of the haematological parameter.

Introduction

In Nigeria, poultry contributes significantly to the animal protein supply to the populace. The poultry population was put at 114.3 million, comprising 82.4 million chickens and 31.9 million other poultry animals, including pigeons, ducks, guinea fowls, and turkeys (RIM, 1992). Diversification into livestock production with short generation intervals will be a viable tool in improving the shortage of protein among the populace in Nigeria, as reported by NVRI (1994). The quail is robust small-bodied, and easy to keep the bird. It belongs to the species Galliformes, whose ancestral wild species is widely distributed in Europe, Asia and North Africa. They are hardy birds that can adapt to any climatic condition though they prefer a temperate climate. They are resistant to most poultry diseases. However, poor management can predispose them to bacterial, viral, fungi and parasitic diseases. Japanese quail, the smallest farmed avian species (Panda and Singh 1990), is getting more important for commercial egg and meat production. It has marked advantages such as fast growth, early sexual maturity, high egg production rate, short generation interval and short incubation period. In the last years, it has been observed that the quails benefited as much as hens both for their meats and eggs. Therefore, commercial quail breeding has become widespread (Altinel *et al.*, 1996). This study was aimed to provide helpful information on the growth performance and carcass characteristics of Japanese quail raised in a commercial (natural) production system with which farmers in southwestern Nigeria could be encouraged to go into commercial Japanese quail production.

Materials and Methods

Experimental Materials

One hundred and twenty (120) Japanese quails used for this experiment were obtained from the National Veterinary Research Institute (NVRI) (Vom, Jos, Plateau State, at their Ikire outstation, Osun State.

Experimental Diets

Two (2) experimental diets were formulated and prepared in the Nutrition Laboratory of the Federal University of Technology, Akure. One is the starter diet and the other the layers' diet. The basal and proximate compositions of the experimental diets are shown in tables 1 and 2, respectively.

Table 1. Basal composition of the experimental diet(%)

Ingredients	Starter diet	Layers diet
Maize	59.16	54.81
SBM	35.17	21.07
Fish meal (65 %)	1.6	2.1
Oyster shell	1.6	8.4
Methionine	0.22	0.21
Lysine	0.16	0.21
Broiler premix	0.24	--
Salt	0.24	0.25
Bone	1.6	2.1
Wheat offal	--	10.54
Layers premix		0.25
Total	100	100

SBM = Soya beam meal.

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Table 2. Proximate composition of the experimental diets

Nutrients	Starter diet	Layers diet
Metabolizable energy	2829.6	2696
Crude protein	19.76	18
Ether extract	3.8	3.90
Crude fibre	3.36	2.91
Lysine	1.3	0.9
Methionine	0.6	0.42
Calcium	0.9	3.7
Phosphorus	0.45	0.35

The metabolizable energy is in kcal while others are in percentages.

Experimental Layout

The average weights of the quails were monitored from week one till the 22nd week of age. Also, performance characteristics were monitored from week 4 till week 6. Carcass characteristics were taken when the quails were six weeks of age.

Performance Characteristics

The parameters measured for performance characteristics include; body weight, body length, neck length, keel length, chest girth, thigh length and shank length. A total of One hundred and twenty (120) quails were used during this experiment for six consecutive weeks.

Statistical Analysis

Data collected were subjected to statistical analysis using:

•Statistical Analytical System (SAS) (2008), NC, USA

•For analysis of variance of Carcass characteristics and performance characteristics.

•To perform the Duncan Multiple Range Test on the parameters analysed

•To find the means and standard errors of all the parameters analysed

•For the heritability, repeatability phenotypic correlations and environmental correlations.

Results

Table 3.Overall mean and standard error of body measurements

Parameter	Mean	Standard Error
Body Weight	113.8	2.41
Body Length	20.19	0.22
Shank Length	9.52	0.09
Neck Length	4.76	0.06
Chest Girth	6.5	0.07
Keel Length	4.8	0.05
Back Length	14.4	0.09
Thigh Length	4.4	0.06
Wing Length	11.6	0.06

Table 4. Duncan Multiple Range Test for Body Measurements

Parameters	Means at ages 4 – 6 weeks					
	4		5		6	
	Male	Female	Male	Female	Male	Female
Body weight	97.50^{a}	96.10^{a}	11.13^{a}	111.41^{a}	125.21^{b}	139.48^{a}
Body length	18.35^{a}	18.96^{a}	21.25^{a}	19.57^{a}	21.38^{a}	21.63^{a}
Shank length	8.14^{a}	8.33^{a}	9.95^{a}	9.49^{a}	10.57^{a}	10.65^{a}
Necklength	3.69^{a}	4.00^{a}	5.20^{a}	5.23^{a}	5.07^{b}	5.42^{a}
Chestgirth	6.56^{a}	6.08^{b}	6.61^{a}	6.76^{a}	6.36^{a}	6.69^{a}
Keel length	4.73^{a}	4.23^{b}	4.81^{a}	5.04^{a}	4.96^{a}	5.20^{a}
Back length	11.73^{b}	12.73^{a}	15.79^{a}	14.89^{b}	16.03^{a}	16.01^{a}
Thigh length	4.03^{a}	4.14^{a}	4.88^{a}	4.49^{a}	4.52^{a}	4.53^{a}
Wing length	10.87^{a}	$10,95^{a}$	$12,15^{b}$	12.51^{a}	11.69^{a}	11.71^{a}

Means with different superscripts along the rows are significantly ($P<0.05$) different write means with some superscripts along the rows are not significantly ($P>0.05$) different.

Table 5. Heritability estimates of body measurements

	BW	BL	SL	NL	CG	KL	BCL	TL	WL
BW	1.85	1.04	1.01	0.87	0.68	1.00	0.94	0.65	0.51
BL		1.56	1.04	0.98	0.86	1.07	1.01	0.88	0.68
SL			2.97	0.95	0.93	1.04	0.98	0.87	0.67
NL				2.96	1.20	1.03	0.99	1.04	0.90
CG					0.22	1.04	1.11	1.43	1.36
KL						1.31	1.05	0.97	0.79
BCL							3.57	0.98	0.81
TL								0.94	1.07
WL									2.75

BW = Body Weight, BL = Body Length, SL = Shank Length, NL = Neck Length, CG = Chest Girth, KL = Keel Length, BCL = Back Length, TL = Thigh Length, WL = Wing Length.

Table 6. Estimates of environmental correlation among parameters of body measurements

	BW	BL	SL	NL	CG	KL	BCL	TL	WL
BW	1.00	-1.98	-1.42	-1.23	0.35	-2.11	-1.24	0.83	-0.79
BL		1.00	-1.55	-1.54	0.24	-2.65	-1.45	4.22	0.98
SL			1.00	-1.07	0.47	-1.96	-1.06	3.19	-0.75
NL				1.00	0.52	-1.94	-1.07	3.93	-1.02
CG					1.00	0.57	0.51	-2.18	0.61
KL						1.00	-1.91	5.64	-1.40
BCL							1.00	3.42	-0.88
TL								1.00	4.25
WL									1.00

BW = Body Weight, BL = Body Length, SL = Shank Length, NL = Neck Length, CG = Chest Girth, KL = Keel Length, BCL = Back Length, TL = Thigh Length, WL Wing Length.

Table 7. Repeatability Estimates of Body Measurements.

	BW	BL	SL	NL	CG	KL	BCL	TL	WL
BW	0.86	0.07	0.10	0.12	0.40	0.20	0.05	0.46	0.28
BL		0.65	0.07	0.08	0.60	0.10	0.06	0.11	0.24
SL			0.34	0.01	0.07	0.01	0.02	0.01	0.10
NL				0.35	0.33	0.02	0.03	0.04	0.06
CG					0.03	0.90	0.03	0.12	0.29
KL						0.51	0.03	0.13	0.18
BCL							0.12	0.02	0.05
TL								0.30	0.14
WL									0.45

BW = Body Weight, BL = Body Length, SL = Shank Length, NL = Neck Length, CG = Chest Girth, KL = Keel Length, BCL = Back Length, TL = Thigh Length, WL Wing Length.

Table 8. Estimates Of Phenotypic Correction Among Parameters Of Body Measurements.

	BW	BL	SL	NL	CG	KL	BCL	TL	WL
BW	1.00	0.41	0.54	0.44	0.15	0.47	0.57	0.67	0.20
BL		1.56	1.04	0.98	0.86	1.07	1.01	0.88	0.68
SL			2.97	0.95	0.93	1.04	0.98	0.87	0.67
NL				2.96	1.20	1.03	0.99	1.04	0.90
CG					0.22	1.04	1.11	1.43	1.36
KL						1.31	1.05	0.97	0.79
BCL							3.57	0.98	0.81
TL								0.94	1.07
WL									2.75

BW = Body Weight, BL = Body Length, SL = Shank Length, NL = Neck Length, CG = Chest Girth, KL = Keel Length, BCL = Back Length, TL = Thigh Length, WL Wing Length.

Table 9. Overall Means and Standard Error of Carcass Characteristics

Parameter	Mean	Standard Error
Live weight	126.42	4.39
Dressed weight	92.91	0.30
Eviscerated weight	79.15	0.61
Breast muscle weight	233.71	6.41
Breast muscle length	54.24	1.51
Shank weight	20.58	0.75
Shank length	46.40	1.81
Drumstick weight	58.37	1.92
Drumstick length	36.44	1.65
Thigh weight	78.46	3.08
Thigh-length	27.91	1.46
Head weight	54.36	1.84
Head length	33.87	1.52
Wing weight	83.40	2.94
Wing length	85.96	2.74
Gizzard weight	26.47	1.05
Back weight	198.47	7.13
Heat weight	73.83	2.68
Liver weight	11.30	0.46
Neck weight	22.77	1.79
Neck length	46.94	2.26
Chest weight	33.66	1.95

Table 10. Duncan Multiple Range Test for Carcass Characteristics

Parameter	Male	Female
Live weight	118.84^{a}	134.00^{a}
Dressed weight	93.14^{a}	92.68^{b}
Chest weight	80.88^{a}	77.42^{b}
Breast muscle weight	237.46^{a}	229.96^{a}
Breast muscle length	55.16^{a}	53.32^{a}
Shank weight	21.36^{a}	19.80^{a}
Drumstick weight	66.28^{a}	50.4^{b}
Drumstick length	37.50^{a}	35.38^{a}
Thigh weight	80.64^{a}	76.16^{a}
Thigh length	$27,90^{a}$	27.92^{a}
Head weight	58.24^{a}	50.48^{a}
Head length	36.14^{a}	86.50^{a}
Wing weight	85.90^{a}	80.90^{a}
Wing length	89.92^{a}	82.00^{a}
Gizzard weight	25.22^{a}	27.72^{a}
Back weight	192.78^{a}	204.16^{a}
Heat weight	11.22^{a}	11.38^{a}
Liver weight	16.94^{b}	28.60^{a}
Neck weight	46.66^{a}	47.22^{a}
Neck length	32.78^{a}	34.54^{a}

Table 11. Heritability Estimates of Carcass Characteristics.

	LW	DSW	EW	BMW	BML	SW	SL	DRW	DL	TW	TL	HW	HL	WW	GW	BW	BL	HTW	LN	NW	NL	LN
LW	1.13	-	- 1.34	-	-	- 2.57		1.12	-	-	-	-1.12	-1.29	-	-1.04	2.67	-	-1.12	-	1.17	-	-
DSW			-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EW			2.30	-	-	3.59	-	1.13	-	-	-	1.27	1.49		1.47	-1.95	-	1.26	-	-1.11	-	-
BMW																						
BML																						
SW						0.06	-	3.38				3.46	3.16		2.37	-7.38	-	2.32		-3.24	-	-
SL																						
DRW								3.04				1.05	1.27		1.26	-2.05	-	1.17	-	-1.08		
DL																						
TW																						
TL																						
HW												1.62	1.39		1.23	-2.14	-	1.19	-	-1.22		
HL													0.79	-	1.33	-2.56	-	1.23	-	-1.38		
WW																						
WL															0.71	-2.97	-	1.12	-	-1.30		
GW																0.29	-	-2.33	-	2.11		
BW																						
BL																		1.07		-1.22		
HTW																						
LN																				2.62		
NW																						
NL																						

LW = Live weight, DW = Dressed weight, EW = Eviscerated weight, BMW = Breast muscle weight, BML = Breast muscle length, SW = Shank weight, SL = Shank length, DRW = Drumstick weight, DL = Drumstick length, TW = Thigh weight, TL = Thigh length, HW = Head weight, HL = Head length, WW = Wing weight, WL = Wing length, GW = Gizzard weight, BW = Back weight, HTW = Heat weight, LN = Liver weight, NW = Neck weight, NL = Neck length, CW = Chest weight.

Table 12. Repeatability Estimates of Traits of Carcass Characteristics.

	LW	DSW	EW	BMW	BML	SW	SL	DRW	DL	TW	TL	HW	HL	WW	WL	GW	BW	BL	HTW
LW	0.39	-0.71	-0.12	-0.07	0.04	0.24	0.10	0.63	0.08	0.24	0.18	0.82	0.72	0.22	0.31	0.68	0.10	0.55	-0.02
DSW		0.00	0.50	0.37	-0.46	-0.62	-5.2	-0.5	-0.50	0.3	0.15	-0.65	0.57	0.81	-.50	0.25	-.48	-.89	-.36
EW			0.73	0.19	-0.33	0.5	0.19	0.14	-0.50	-.13	-.15	-.20	-.16	0.87	0.02	0.10	0.07	0.26	-0.48
BMW				0.00	-0.58	0.12	0.64	-0.83	-.43	-.68	0.21	-.79	-.11	0.09	0.85	0.77	0.10	0.81	0.28
BML					0.00	-0.01	-0.06	0.36	-0.09	-0.06	-.17	0.11	0.48	-.06	0.03	-.75	-.06	0.18	-0.12
SW						0.15	0.01	0.70	0.00	0.35	-.19	0.92	0.35	0.02	0.12	-.3	.02	0.20	-.38
SL							0.00	0.76	0.04	0.06	-0.19	0.33	0.21	0.00	0.06	-.71	-0.03	0.12	0.02
DRW								0.31	0.45	0.98	0.21	0.56	0.43	0.73	0.67	-.28	0.96	0.43	0.56
DL									0.00	0.04	-0.17	0.33	0.24	-0.02	.06	-0.5	0.01	0.16	-.11
TW										0.00	-.19	0.35	0.07	.01	0.23	0.38	-0.01	0.80	-.07
TL											0.00	-.15	-.18	-.18	-.18	-0.2	-.19	-.18	-0.21
HW												.69	0.43	.60	0.72	-0.4	0.48	0.89	0.06
HL													0.21	0.09	0.48	0.11	0.28	0.57	-0.44
WW														0.00	0.17	0.85	0.00	0.24	-0.10
WL															0.21	0.63	0.05	0.37	-0.01
GW																0.08	-.98	-0.02	-.28

BW																0.00	0.23	-0.06
BL																	0.36	0.66
HTW																		0.00
LN																		
NW																		
NL																		

LW = Live weight, DW = Dressed weight, EW = Eviscerated weight, BMW = Breast muscle weight, BML = Breast muscle length, SW = Shank weight, SL = Shank length, DRW = Drumstick weight, DL = Drumstick length, TW = Thigh weight, TL = Thigh length, HW = Head weight, HL = Head length, WW = Wing weight, WL = Wing length, GW = Gizzard weight, BW = Back weight, HW = Heat weight, LN = Liver weight, NW = Neck weight, NL = Neck length, CW = Chest weight.

Table 13. Phenotypic Correlations Among Parameters Of Carcass Characteristics.

	LW	**DSW**	**EW**	**BMW**	**BML**	**SW**	**SL**	**DRW**	**DL**	**TW**	**TL**	**HW**	**HL**	**WW**	**WL**	**GW**	**BW**	**BL**	**HTW**
LW	1.00	0.12	-0.47	-0.16	-0.74	-0.82	-.89	-0.85	-0.71	-0.59	-0.61	-0.84	-0.72	-0.71	-0.97	0.10	0.84	-0.86	0.29
DSW		1.00	0.59	0.21	-0.13	-0.13	-0.18	0.16	-0.14	0.13	-0.35	0.09	-0.24	0.23	-0.16	-0.20	0.28	0.02	0.08
EW			1.00	0.63	0.15	0.51	0.36	0.64	0.12	0.23	-0.05	0.48	0.42	0.54	0.48	-0.45	-0.30	0.62	0.12
BMW				1.00	-0.07	0.40	0.19	0.04	-0.16	0.02	0.03	-0.06	0.14	0.36	0.27	-0.24	-0.33	0.30	0.18
BML					1.00	0.65	0.74	0.58	0.68	0.61	0.63	0.69	0.35	0.70	0.69	0.05	-0.68	0.54	-0.23
SW						1.00	0.88	0.60	0.67	0.36	0.55	0.57	.68	0.78	0.85	-0.17	-0.75	0.88	-0.02
SL							1.00	0.64	0.69	0.51	0.65	0.70	0.67	0.74	0.92	-0.06	0.81	0.87	-0.16
DRW								1.00	0.55	0.48	0.27	0.91	0.71	0.51	0.77	-0.33	-0.54	0.76	-0.14
DL									1.00	0.39	0.59	0.51	0.47	0.61	0.63	0.25	-0.53	0.59	-0.29
TW										1.00	0.55	0.57	0,20	0.57	0.52	-0.21	-0.60	-0.37	-0.18
TL											1.00	0.31	0.38	0.51	0.60	0.26	-0.73	0.39	-0.13
HW												1.00	0.59	0.55	0.79	-0.35	-0.56	0.75	-.022
HL													1.00	0.25	0.74	-0.27	-0.55	0.79	0.22
WW														1.00	0.69	-0.02	-0.66	0.67	-0.24
WL															1.00	-0.12	-0.86	0.90	-0.23
GW																1.00	0.00	-0.32	-0.31
BW																	1.00	-0.65	0.19
BL																		1,00	-0.07
HTW																			1.00
LN																			
NW																			
NL																			

LW = Live weight, DW = Dressed weight, EW = Eviscerated weight, BMW = Breast muscle weight, BML = Breast muscle length, SW = Shank weight, SL = Shank length, DRW = Drumstick weight, DL = Drumstick length, TW = Thigh weight, TL = Thigh length, HW = Head weight, HL = Head length, WW = Wing weight, WL = Wing length, GW = Gizzard weight, BW = Back weight, HW = Heat weight, LN = Liver weight, NW = Neck weight, NL = Neck length, CW = Chest weight.

Effects of Sex on Body Measurements

From table 4, it can be inferred that sex did not have any significant effect (P>0.05) on the bodyweight of the quails in weeks 4 and 5, but there is a marked influence of sex (P<0.05) effect on body length and shank length across the ages. Neck length was affected by sex (P< 0.05) only at week six. The chest circumference and keel length were influenced by sex (P<0.05) only at week 4. Sex exerted significant influence (P<0.05) on back length at weeks 4 and 5. Thigh-length was not influenced by sex (P>0.05) across the ages, and wing length was affected by sex (P<0.05) only at week 5.

Effect of Sex on Carcass Characteristics

From Table 10, It can be deduced that sex did exert significant influence (P<0.05) on the dressed weight, chest weight and liver weight. Sex had no significant influence (P>0.05) on all other parameters of carcass characteristics. Means with the same superscript along the row are not significantly (P>0.05) different, and means with different superscripts along the rows are significantly (P<0.05) different.

Estimates of Phenotypic Correlations among Parameters of Body Measurement

From Table 8, it was discovered that all the body measurement parameters were found to have a very high positive correlation among themselves except between body weight and chest circumference. The body weight and wing length were reduced, but positive phenotypic correlations were recorded. Genetic correlations among them are also positively high except for very few cases. Negative environmental correlations were recorded between parameters like body weight against all other parameters except for chest circumference, where a positive correlation was recorded. Also, all the parameters compared with body length have negative environmental correlations except for chest girth and thigh length.

Chest circumference did not negatively correlate with any other parameters measured except the high length. Keel length has a negative environmental correlation all through except against chest circumference, and the same applies for back length except and wing length that wing length is positively correlated with thigh length

Phenotypic Correlations among Parameters of Carcass Characteristics

From Table 13, positively high, positively low, negatively high, negatively low and zero phenotypic correlations were all found among the parameters of carcass characteristics in various portions. For example, live weight was positively correlated with drumstick weight, gizzard weight, back weight, liver weight, neck weight, and heart weight. In contrast, it had negative correlations with all others.

Discussion

Effect of Sex Body Measurement

From this experiment, sex did not have any significant (P>0.05) effect on body weight at weeks 4 and 5, but sex had a significant effect (P<0.05) on body weight at week six. It suggests that sex does not influence body weight at younger ages than six weeks. Also, it was discovered that sex had a significant influence (P<0.05) on body length and shank length across the ages, indicating that male and female Japanese quails kept under the same condition exhibit different growth patterns according to their sexes. The thigh-length was not affected (P>0.05) by sex across the ages, suggesting that the different growth patterns exhibited according to sexes do not affect the thigh length.

Effect of sex on Carcass Characteristics

The significant influence (P<0.05) of sex on dressed weight reported in this experiment suggests that feathering is influenced by sex in Japanese quails. The result had revealed that blood was not influenced (P>0.05) by sex. The feather remains the only suspected source of the influence of sex on dressed weight. The mean weight of the live female quails used for this experiment was higher than that of males, while the mean of the dressed weight was higher in males than that of the females. So, it can be assumed that female Japanese quails grow more feathers than their male counterparts.

Phenotypic Correlations among Parameters of Body Measurements

The positively high correlation found among the traits of body measurements implied that selection for one would positively influence the other. So, when we intend to select for improved body weight, there will be a corresponding improvement in the body length, shank length etc. However, the correlation between body length and chest circumference, body length and thigh length were positively high. In that case, selection for high body length will support high chest circumference and high thigh length.

This result supports the findings of Adeogun and Adeoye (2004), which said that positive correlation existed among growth performance traits, especially body weight and shank length.

Conclusion

As a result, this study had shown that sex has no significant influence on the parameters of body measurements and carcass characteristics (except for the eviscerated weight drumstick and liver weights) of Japanese quails. Age of quails was a good estimator of most of the parameters of body measurement and that age and sex interaction exerted significant influence on back length and keel length. Also, most of the body measurement parameters are good estimators of themselves as high positive phenotypic correlations exist among them. Therefore, Japanese quails can be reared successfully in the southwestern part of Nigeria commercially without any adverse effect on the growth and performance of the birds.

Reference

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