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Advances in Animal and Veterinary Sciences

Research Article

Some of the Body Measurements and their Role as Predictors of Final Weight Using all Possible Regressions Procedure in Commercial Broilers

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Abstract | The profitability of any chicken industry related to increasing the production. Therefore, most of the breeders are looking for some traits that can measure in early age to select the best birds. However, several studies were conducted on ruminates, but there are few studies in the broiler. Therefore, the current study aimed to investigate the effect of sex on some of body measurements (body length (BL), shear bone length (SBL), body circumstance (BC), chest width (CW), leg length (LL), and thigh circumstance (TC) along with the estimation of the correlation coefficients among these measurements and body weight to evaluate the body measurements as predictors of final body weight using all possible regression procedure. A total of 60 chicks Ross 308 broilers (30 male and 30 female) were used. Results indicated that the effect of sex was not significant on all body measurements at the 1st and 2nd week except the body circumstance (BC) at the 2nd week. Whereas, the effect of age was significant ($P<0.05$) on the SBL, BC, CW at age of 3rd, 4th and 5th week. All of the correlation coefficients among body measurements were significant ($P< 0.05$). The R^2 estimated by all possible regressions procedure to predict the final weight showed that The R^2 increased with increasing the number of predictors and with advanced age and ranged 0.24-0.51, 0.41-0,76, and 0.63-0.89 at 1st, 2nd, and 3rd weeks respectively. The results of the present study showed that the correlations between the body measurements and body weight are significant.

Keywords | Ross 308, Body measurements, All possible regressions procedure, Correlation, Body weight.

Editor | Kuldeep Dhama, Indian Veterinary Research Institute, Uttar Pradesh, India.
Received | October 19, 2018; **Accepted** | December 02, 2018; **Published** | December 29, 2018
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Citation | Al-Nedawi AM (2019). Some of the body measurements and their role as predictors of final weight using all possible regressions procedure in commercial broilers. Adv. Anim. Vet. Sci. 7(3): 181-186.
DOI | http://dx.doi.org/10.17582/journal.aavs/2019/7.3.181.186
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

INTRODUCTION

The profitability of poultry industry depends on the fast growth rate during the shortest period to decrease the cost of consumed diet and the risk of breeding along with increasing the production to meet the increasing demands of low price and high quality of meat (Prince, 2002). The breeders always are looking for tools that assist them to select the posterior birds. Several methods were adopted to accomplish this aim such as: identify the better function that fit the growth curve in broiler to determine the optimal period of breeding (Al-Samarai et al., 2015; Al-Nedawi, 2018), selection of the chicks according to their weight at first day as this trait effects the performance of broilers through later stages of age (Morris et al., 1968; Al-Murrani, 1978) and prediction of the total egg production from partial or cumulative egg production during one year after onset laying (Al-Samarai et al., 2008). Moreover, some studies performed to evaluate the relationship between body measurements and live weight in early age with the final weight of birds as a tool for selection (Emmerson, 1997; Ige et al., 2007; Ajayi and Ejiofor, 2009). However, there is another application of body measurements as these measurements could be used to estimate the body weight and called an indirect method when then the direct method (weighting the animal) a scale is not available (Latshaw and Bishop, 2001). The SBL is commonly used to estimate the body weight in the broiler. The linear relationship between SBL and body weight has been recorded many years ago (Lerner, 1937). Latshaw and Bishop, (2001) reported

that the body measurements are accurate predictors of the BW in broilers that weighed between 1.2 and 2.3 kg. The same authors found that the multiple regression of Pelvis width, BC, CW to predict the BW had an R^2 = 0.67. Ajayi et al. (2008) estimated the BW from BC, LL, and TC in Ross and Anak Titan broilers and found that the BW was better predicted by each of these measurements.This study was conducted to investigate the effect of sex on somebody measurements along with an estimation of the correlation coefficients among these measurements and to evaluate the body measurements as predictors of final body weight using all possible regression procedure.

MATERIALS AND METHODS

Experimental Birds

The present study was conducted in the poultry farm, College of Agricultural Engineering Science, University of Baghdad during the period from 15/10 to 27/11/2017. A total of 60 chicks (Ross 308) (30 female and 30 males) purchased from a commercial hatchery were used. The birds were wing tagged at day-old. Birds were bred in a floor pen. The light is provided for 22 h per day. All birds were subjected to a vaccine against Newcastle disease and infectious bronchitis on the 10thday of age and against Gambaro disease at 17 days of age. The ingredient and the nutrient composition of the basal diet given to the birds are as mentioned by Al-Nedawi (2018). The drinking water and feed were supplied ad libitum. Birds were weighed at one day old and each week for 5 weeks.

Data Collection

The body weight and body measurements used in this study included body weight in day-old and the weekly body weight till the 5th week, body length (BL), shear bone length (SBL), body circumstance (BC), chest width (CW), leg length (LL), and thigh circumstance (TC). All body measurements were performed using a tape rule in centimeter (cm).

Statistical Analysis

The data were subjected to analysis using SAS (2010) and significant differences between means were assessed using independent t-test. Pearson's correlation coefficients were estimated among studied traits. All possible regressions procedure was applied and the results of simple and multiple regressions presented as coefficient of determination (R^2) to evaluate the validity of measurements as predictors to final weight.

RESULTS AND DISCUSSION

Effect of Sex on Some Body Measurements

The results of the effect of sex on body measurements were significant ($P<0.05$) only on the BC in the 1st and 2nd weeks (Table 1, 2) whereas in the 3rd week of age the differences were significant ($P<0.05$) in the SBL, BC, and, CW (Table 3). The significant differences in the body measurements due to sex increased to four traits in the 4th week of age (Table 4) and five in the 5th week of age (Table 5). The males are superior the females in most of the body measurements. Similar results were obtained by Adedibu and Ayorinde (2011) who stated that" sex influenced the body measurement (wing length, thigh length, drumstick length, shank length, body length, body girth and keel length) in the Arbor Acre and Anak broilers". Also, Olawumi, (2015) reported that there was a significant ($P<0.05$) effect of the house x sex interaction on wing length, TC, and BW in quail birds. On the other hand, Ojo et al. (2014) showed that the effect of sex was significant only on BC at 6th week while the effect was not significant on SBL and TC at age of 2nd , 4th , 6th and 8th weeks in Japanese quail. The differences in body measurements could be attributed to the differences in the quantity of bone tissue as the females have a smaller bone tissue of the tibiotarsus as compared with males (Rose et al.,1996).

The Correlation Coefficients Among Body Measurements

In all five weeks of age,the correlation coefficients among body measurements were significant ($P<0.05$). Also, the correlations between body measurements and body weight at each week were significant ($P<0.05$) (Table 6, 7, 8, 9, 10). These results confirmed the association between body weight and body measurements. The results of the present study agreed with results obtained by Ige et al. (2016) who found that the correlation between body measurements and body weight ranged from 0.72 to 0.93 in Hubbard and 0.86 to 0.98in Arbor acre. Also, the results of the current study are in the line of the results obtained by Tyasi et al. (2017) who used the path analysis and showed that the SBL and BL have a higher direct effect on body weight in the indigenous Chinese Dagu chickens.

The Correlations Between Body Measurements and Final Weight

However, the correlations between body measurements and final weight were not significant in the 1stweek, the correlation was significant ($P<0.05$) between final weight and BL in the 2nd week. The results of the 3rd week showed that all correlation coefficients between final weight and body measurements were significant ($P<0.05$). All possible regressions procedure showed the simple and multiple regressions using body measurements and body weight at 1st week of age were not useful and the values of R^2 were low (0.14-0.21) (Table 11). Concerning the body measurements and body weight at 2nd week of age the results revealed that the R^2 values were low and ranged (0.21-0.31)

Table 1: Some body measurements at 1st week according to sex in the Ross 308 broilers.

??	BL	SBL1	BC1	CW	LL	TC
Male	20.25±0.30	5.56±0.14	13.08±0.13	10.65±0.21	6.08±0.08	7.37±0.22
Female	19.84±0.25	5.40±0.15	12.86±0.08	10.60±0.17	5.72±0.12	7.00±0.21
P	NS	NS	*	NS	NS	NS

NS= not significant
*=P<0.05

Table 2: Some body measurements at 2ndweek according to sex in the Ross 308 broilers.

??	BL	SBL	BC	CW	LL	TC
Male	30.31±0.32	10.08±0.24	21.14±0.23	14.54±0.11	7.17±0.17	8.25±0.16
Female	30.36±0.28	9.95±0.23	20.34±0.16	14.50±0.09	6.86±0.15	8.13±0.15
P	NS	NS	*	NS	NS	NS

NS= not significant
*=P<0.05

Table 3: Some body measurements at 3rd week according to sex in the Ross 308 broilers.

??	BL	SBL	BC	CW	LL	TC
Male	40.13±0.20	12.30±0.14	31.05±0.23	16.47±0.15	22.88±0.14	12.02±0.20
Female	39.72±0.20	11.75±0.15	30.44±0.18	15.75±0.11	22.72±0.21	11.61±0.18
P	NS	**	*	**	NS	NS

NS= not significant
*=P<0.05
**=P<0.01

Table 4: Some body measurements at 4th week according to sex in the Ross 308 broilers

??	BL	SBL	BC	CW	LL	TC
Male	45.75±0.37	13.69±0.14	36.63±0.38	20.97±0.17	22.98±0.18	15.88±0.21
Female	44.19±1.28	13.02±0.17	34.63±0.44	20.19±0.23	22.84±0.20	15.25±0.20
P	NS	**	**	**	NS	*

NS= not significant
*=P<0.05
**=P<0.01

Table 5: Some body measurements at 5th week according to sex in the Ross 308 broilers

??	BL	SBL	BC	CW	LL	TC
Male	50.11±0.37	15.80±0.14	51.83±0.44	22.44±0.17	24.47±0.18	16.11±0.21
Female	49.78±1.28	14.88±0.17	42.88±0.38	21.50±0.23	22.63±0.20	15.16±0.20
P	NS	**	**	**	**	*

NS= not significant
*=P<0.05
**=P<0.01

Table 6: Correlation coefficients among some body measurement at 1st week in the Ross 308 broilers.

	SBL	BC	CW	LL	TC	W1	W5
BL	0.52*	0.35*	0.34**	0.43**	0.45**	0.33*	0.13
SBL		0.44*	0.42**	0.45*	0.44**	0.44*	0.07
BC			0.38*	0.34*	0.41*	0.32*	0.11
CW				0.27	0.37*	0.35*	0.05
LL					0.94**	0.36*	0.09
TC						0.34*	0.08

W1							0.21

*=P<0.05
**=P<0.01

Table 7: Correlation coefficients among some body measurement at 2nd week in the male Ross 308 broilers

	SBL	BC	CW	LL	TC	W2	W5
BL	0.39*	0.42*	0.37*	0.28*	0.31*	0.35*	0.32*
SBL		0.30*	0.38*	0.70**	0.81**	0.33*	0.14
BC			0.41	0.34*	0.44*	0.28*	0.17
CW				0.47**	0.36*	0.37*	0.16
LL					0.90**	0.23*	0.11
TC						0.23*	0.10
W2							0.46**

*=P<0.05
**=P<0.01

Table 8: Correlation coefficient among some body measurement at 3rd week in the Ross 308 broilers

	SBL	BC	CW	LL	TC	W3	W5
BL	0.44*	0.16	0.39*	0.68**	0.57**	0.24*	0.29*
SBL		0.46**	0.57**	0.36*	0.50**	0.30*	0.30*
BC			0.31*	0.49**	0.61**	0.29*	0.36*
CW				0.57**	0.44**	0.30*	0.31*
LL					0.41*	0.39*	0.28*
TC						0.42*	0.39*
W3							0.57**

*=P<0.05
**=P<0.01

Table 9: Correlation coefficient among some body measurement at 4rd week in the Ross 308 broilers

	SBL	BC	CW	LL	TC	W4	W5
BL	0.47**	0.34*	0.46**	0.41*	0.41*	0.38*	0.38*
SBL		0.36*	0.39*	0.57**	0.33*	0.37*	0.45**
BC			0.36*	0.39*	0.32*	0.62**	0.56**
CW				0.66**	0.35*	0.36*	0.39*
LL					0.33*	0.54**	0.43*
TC						0.48**	0.47**
W4							0.74**

*=P<0.05
**=P<0.01

Table 10: Correlation coefficient among some body measurement at 5rd week in the Ross 308 broilers

	SBL	BC	CW	LL	TC	W3
BL	0.46*	0.41*	0.60**	0.41*	0.65**	0.37*
SBL		0.54**	0.45*	0.55**	0.34*	0.35*
BC			0.57**	0.58**	0.52**	0.58**
Chest W				0.55**	0.39*	0.44**
LL					0.48**	0.72**
TC						0.81**

*=P<0.05
**=P<0.01

Table 11: Some criteria to evaluate the validity of all possible regressions procedure according to body measurements at 1st week.

No. of variables	R^2	Adjusted R^2	The variable
1	0.14	0.23	W1
2	0.17	0.24	BL1 W1
3	0.20	0.26	BL1 SBL1 W1
4	0.21	0.26	BL1 SBL1 LL1 W1
5	0.21	0.27	BL1 SBL1 LL1 BC1 W1
6	0.21	0.27	BL1 SBL1 LL1 BC1 TC1 W1
7	0.21	0.27	BL1 SBL1 BC1 CW1 LL1 TC1 W1

Table 12: Some criteria to evaluate the validity of all possible regressions procedure according to body measurements at 2nd week.

No. of variables	R^2	Adjusted R^2	The variable
1	0.21	0.19	W2
2	0.28	0.26	BC2 W2
3	0.29	0.27	SBL2 BC2 W2
4	0.30	0.29	SBL2 LL2 BC2 W2
5	0.31	0.29	SBL2 BC2 TC2 LL2 W2
6	0.31	0.29	SBL2 BC2 CW2 LL2 TC2 W3
7	0.31	0.29	BL2 SBL2 BC2 CW2 LL2 TC2 W2

Table 13: Some criteria to evaluate the validity of all possible regressions procedure according to body measurements at 3rd week.

No. of variables	R^2	Adjusted R^2	The variable
1	0.33	0.32	W3
2	0.36	0.34	BL3 W3
3	0.39	0.37	BL3 BC3 W3
4	0.41	0.39	BL3 LL3 CW3 W3
5	0.42	0.40	BL3 BC3 CW3 LL3 W3
6	0.42	0.40	BL3 SBL3 BC3 CW3 LL3 W3
7	0.42	0.40	BL3 SBL3 BC3 CW3 LL3 TC3 W3

(Table 12). The values of R^2 at the 3rd week of age were the highest and ranged 0.33-0.42 (Table 13). These results are expected because of the prediction of final weight will be more accurate along with advanced age of the bird.

CONCLUSION

The results of the present study showed that the correlations between the body measurements and body weight are significant. In other words, the body measurements could be used for the prediction of the body weight. The results also, showed the prediction of final weight depending on the body weight and body measurements are more accurate by using body measurements and body weight at the 3rd week of age as predictors of the final weight.

ACKNOWLEDGMENTS

The author would like to thank Pof. Dr, Firas Rashad Al-Samarai, at Department of Veterinary Public Health, College of Veterinary Medicine, University of Baghdad for helping in the statistical analysis of data.

CONFLICT OF INTEREST

There is no conflict of interest.

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