PRINCIPAL COMPONENTS ANALYSIS APPLIED TO LIVE BODY WEIGHT AND CARCASS TRAITS IN ISA BROWN AND KURDISH LOCAL ROOSTERS

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Abstract - The study was conducted in the poultry unit at Gardarash station, college of Agriculture, University of Salahaddin, during June – July 2014. A total of (53) roosters aged 6 months were belongs to Kurdish local roosters (N=41), and ISA brown (N= 12). The live body weights of the rosters as well their carcass measurements were described earlier.Means, and standard errors where calculated using descriptive statistics of SPSS/PASW. T test was used to test the differences between the two groups in their studied traits. Person's coefficients of correlation among carcass traits were estimated for each group. Data were generated for the principal component factor analysis. Anti-image correlations, Kaiser-Meyer- Olkin measures of sampling adequacy rotation component matrix, and Bartlett's Test of Spherity were computed to test the validity of the factor analysis of the data sets. The appropriateness of the factor analysis was further tested using communalities.

Kurdish local roosters were superior ($P<0.05$) comparing with ISA brown roosters in many traits including TolWt, ThiWt, NecWt, HerWtandWinWt. Not significant differences were observed ($P>0.05$) in LivWt, LeWt, BacWt, CheWt, LiverWt, andGizWt.In Kurdish local roosters, the highest positive and significant correlation was found between TolWt and ThiWt (0.970) while the lowest value was found between HerWt and GizWt (0.170) which was not significant. In ISA brown roosters, the highest positive and significant correlation was found between TolWt with LeWt (0.978) while the lowest value was found between HerWt and GizWt (-0.051) which was negative and not significant.

Results of the Bartlett test of sphericity for carcass measurements of Kurdish local roosters (chi square= 644.757, $p<0.000$), and ISA brown (chi square=149.409, $p<0.000$) were significant. The communalities ranged (0.499 – 0.957) and (0.629 – 0.966), in Kurdish local roosters, and ISA brown roosters respectively.

Two principal components were extracted from Kurdish local roosters with eigenvalues of the first (7.177) and second (1.152) principal component. Also the same components were extracted from ISA brown roosters, and were (7.403), and (1.487) on the same trend respectively.

It can be concluded that the correlations between each pair were mostly positive and significant in both groups, which indicate that measuring any trait can be used as indicator to have a good idea about the other traits.The three principal components that extracted from black, white, and ISA brown roosters can be used for genetic improvement, body size characterization, and also to predicting carcass parts weight.

Keywords - Poultry Genetic Groups, Carcass, PCA, and Body Weight.

I. INTRODUCTION

Local chicken represents an important resource of meat in the local poultry market of many countries. Therefore, to achieve these local chickens to their suitable production, it must be characterized. The first step of the characterization of local chicken falls on the knowledge of the variation of morphological and production traits (Delgado et al., 2001). The body weight is used as one of the selection criteria whereas the carcass traits are valuable market requirements (Pertile et al., 2014). And also strain and sex effects on carcass traits had been reported by (Ahn et al., 1995; Cherian et al., 1996; Jaturasitha et al., 2008; Zhao et al., 2009).

The live weight and carcass traits of the Kurdish local chicken were studied faithfully. Hermiz (2014) found differences between the chicks hatched to exceed in their body weights and weekly gains at all stages that resulted from different groups. Also, in order to have chicks with high meat quality it's important to select roosters according to their body weight to be parents (Hermiz et al., 2016).

According to many results, Principal components analysis (PCA) is a multivariate procedure could be solve Agricultural problems (Rotaru et al., 2012). Also has been used to describe the relationship between body measurements and body size in chicken (Ibe, 1989; Yakubu et al., 2009).

The objective of this study was to examine the relationship between the carcass weight and the body parts in two genetic groups of Kurdish local chickens and ISA brown strain, by using principal components analysis.

II. MATERIALS AND METHODS

The study was conducted in the poultry unit at Gardarash station, college of Agriculture, University of Salahaddin, during June – July 2014. A total of

(53) roosters aged 6 months were belongs to Kurdish local roosters (N=41), and ISA brown (N= 12). The live body weights (LivWt) of the rosters were recorded on weekly basis to 6 months of age. The carcass measurements namely thigh weight (ThiWt), leg weight (LeWt), Back weight (BacWt), Neck weight (NecWt), Chest weight (CheWt), Liver weight (LiverWt), Heart weight (HerWt), Gizzard weight (GizWt), and Wing weight (WinWt) were measured at 6 months of age as described by Hermiz et al. (2016).

Means, and standard errors where calculated using descriptive statistics of SPSS/PASW for windows 19(SPSS, 2011). T test was used to test the significant differences between the two groupsin their carcass traits. Person's coefficients of correlation (r) among carcass traits were estimated for each group.Data were generated for the principal component factor analysis. Anti-image correlations, Kaiser-Meyer-Olkin measures of sampling adequacy rotation component matrix, and Bartlett's Test of Spherity were computed to test the validity of the factor analysis of the data sets (Jolliffe, 2002). The appropriateness of the factor analysis was further tested using communalities, which represent the amount of the variable that is accounted for by the component (Wuensch, 2005).

III. RESULTS AND DISCUSSION

Mean, standard error, and p values of the carcass measurements of Kurdish local roosters and ISA brown were present in table 1. Kurdish local roosters were superior (P<0.05) comparing with ISA brown roostersin many traits includingTolWt, ThiWt, NecWt, HerWtandWinWt. Not significant differences were observed (P>0.05) in LivWt, LeWt, BacWt, CheWt, LiverWt, andGizWt.

Coefficient of correlations of live weight and carcass measurements of the Kurdish and ISA brown roosters were presents in table 2. In Kurdish local roosters, the highest positive and significant correlation was found between TolWt and ThiWt (0.970) while the lowest value was found between HerWt and GizWt (0.170) which was not significant. Highly significant (p<0.01) positive correlation was recorded for LivWt with TolWt, ThiWt, LeWt, BacWt, NecWt, CheWt, WinWt, LiverWt, HerWt, and GizWt, (0.955, 0.908, 0.942, 0.886, 0.541, 0.619, 0.909, 0.489, 0.605, and 0.388) respectively. No significant correlations were observed between CheWtwith each ofNecWt (0.234), LiverWt (0.255), HerWt (0.285), and GizWt, (0.175). In ISA brown roosters, the highest positive and significant correlation was found between TolWt with LeWt (0.978) while the lowest value was found between HerWt and GizWt (-0.051) which was negative and not significant. Highly significant positive correlation was recorded between LivWtwith each ofTolWt, ThiWt, LeWt, BacWt, NecWt, CheWt, and WinWt, (0.926, 0.848, 0.900, 0.939, 0.731, 0.865, and 0.820) respectively.No significant correlations were observed between each pair of GizWt with the other traits except those with CheWt (0.540) and LiverWt (0.517). The correlations between each pair of the studied traits were mostly positive and significant in both groups, which indicate that measuring any trait can be used as indicator to have a good idea about the other traits.

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was computed for Kurdish local roosters, and ISA brown roosters. Results of the Bartlett test of sphericity for carcass measurements of Kurdish local roosters (chi square= 644.757, p<0.000), and ISA brown (chi square=149.409, p<0.000) were significant. Eigenvalues, percentage of the total variance along with rotated components matrix and communalities of the carcass measurements of the Kurdish local roosters and ISA brown roosters were presents in table 3. The communalities ranged (0.499 – 0.957) and (0.629 – 0.966), in Kurdish local roosters, and ISA brown roosters respectively.

Two principal components were extracted from Kurdish local roosters with eigenvalues (7.177) of the first principal component (PC1), (1.152) for the second principal component (PC2), The two principal components accounted for (75.722) % of the total variance in the (11) variables. PC1 had high loadings on TolWt (0.976), LivWt (0.961), ThiWt (0.945), LeWt (0.942), WinWt (0.928), BacWt (0.868), and HerWt (0.703). PC2 was highly loaded with GizWt (0.672).

In ISA brown roosters, two principal components were extracted accounted for (80.819)% of the total variance with eigenvalues (7.403), and (1.487) for PC1, PC2 respectively. PC1 was most correlated with LivWt (0.977), TolWt (0.949), BacWt (0.942), LeWt (0.939), ThiWt (0.864), CheWt (0.853), WinWt (0.839), and NecWt (0.803). PC2 was most correlated with GizWt (0.610).

CONCLUSION

The correlations between each pair were mostly positive and significant in both groups, which indicate that measuring any trait can be used as indicator to have a good idea about the other traits. The three principal components that extracted from black, white, and ISA brown roosters can be used for genetic improvement, body size characterization, and also to predicting carcass parts weight.

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Table1: Rooster weight and Carcass components of the two genetic Lines and Isa brown strain.

	Kurdish local roosters, N=41			ISA brown roosters, N=12			F	Sig.
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean		
LivWt	2445.37	354.21	55.32	2365.00	232.74	67.19	3.115	.084
TolWt	325.24	54.47	8.51	316.25	30.46	8.79	4.071	.049
ThiWt	179.51	29.32	4.58	169.17	14.75	4.26	5.578	.022
LeWt	145.98	27.35	4.27	146.25	16.80	4.85	3.876	.054
BacWt	455.85	70.66	11.03	418.75	51.04	14.73	2.374	.130
NecWt	99.59	28.58	4.46	96.58	16.02	4.62	4.951	.031
CheWt	399.15	83.92	13.11	376.25	38.09	10.99	3.293	.075
LiverWt	34.51	6.10	.95	30.00	4.26	1.23	1.477	.230
HerWt	16.68	2.76	.43	12.58	2.57	.74	8.161	.006
GizWt	36.34	6.80	1.06	37.92	7.22	2.08	.025	.876
WinWt	106.83	15.68	2.45	98.33	9.13	2.64	4.026	.049

Live body weight= LivWt, Total weight of thight + leg= TolWt, Thigh weight= ThiWt, Leg weight= LeWt, Back weight= BacWt, Neck weight= NecWt, Chest weight= CheWt, Liver weight= LiverWt, Heart weight= HerWt, Gizzard weight= GizWt, Wing weight= WinWt.

Table 2: Correlation coefficients between carcass components

	TolWt	ThiWt	LeWt	BacWt	NecWt	CheWt	WinWt	LiverWt	HerWt	GizWt	LivWt
Kurdish local roosters											
TolWt	1.00										
ThiWt	.970***	1.000									
LeWt	.964***	.874***	1.000								
BacWt	.817***	.765***	.812***	1.000							
NecWt	.592***	.577***	.566***	.423**	1.000						
CheWt	.564***	.544***	.554***	.513***	$.234^{NS}$	1.000					
WinWt	.900***	.864***	.882***	.800***	.463**	.729***	1.000				
LiverWt	.561***	.599***	.467**	.481**	.492**	$.255^{NS}$	.519***	1.000			
HerWt	.694***	.681***	.652***	.600***	.325*	$.285^{NS}$	.548***	.525***	1.000		
GizWt	.367**	.361*	.346*	.362*	.510***	$.175^{NS}$	.375**	.362*	$.170^{NS}$	1.000	
LivWt	.955***	.908***	.942***	.886***	.541***	.619***	.909***	.489**	.605***	.388**	1.000
ISA Brown Roosters											
TolWt	1.000										

ThiWt	.964***	1.000									
LeWt	.978***	.903***	1.000								
BacWt	.869***	.793**	.834***	1.000							
NecWt	.765**	.682**	.787**	.708**	1.000						
CheWt	.735**	.658*	.679**	.865***	.567*	1.000					
WinWt	.703**	.580*	.696**	.810**	.523*	.863***	1.000				
LiverWt	.490^{NS}	.325^{NS}	.539*	.658*	.532*	.518**	.759**	1.000			
HerWt	.558*	.529*	.591*	.307^{NS}	.381^{NS}	.191^{NS}	.161^{NS}	.207^{NS}	1.000		
GizWt	.333^{NS}	.238^{NS}	.379^{NS}	.474^{NS}	.464^{NS}	.540**	.460^{NS}	.517*	-.051^{NS}	1.000	
LivWt	.926***	.848***	.900***	.939***	.731**	.865***	.820**	.637*	.554*	.388^{NS}	1.000
	TolWt	ThiWt	LeWt	BacWt	NecWt	CheWt	WinWt	LiverWt	HerWt	GizWt	LivWt

Live body weight= LivWt, Total weight of thight + leg= TolWt, Thigh weight= ThiWt, Leg weight= LeWt, Back weight= BacWt, Neck weight= NecWt, Chest weight= CheWt, Liver weight= LiverWt, Heart weight= HerWt, Gizzard weight= GizWt, Wing weight= WinWt.

***** Correlation is significant at the 0.001 level; ** correlation is significant at 0.01 level; * correlation is significant at 0.05 level; NS correlation is not significant.**

Table 3: Eigen values and percentage of total variance along with the rotated component matrix and communalities of the carcass weight components for the two genetic lines and Isa brown strain

Traits	Kurdish local roosters			ISA brawn Roosters		
	PC1	PC2	Communalities	PC1	PC2	Communalities
TolWt	.976		.957	.949	-.254	.966
LivWt	.961	-.123	.939	.977		.961
ThiWt	.945		.895	.864	-.358	.875
LeWt	.942	-.110	.899	.939	-.235	.938
WinWt	.928	-.180	.894	.839	.348	.825
BacWt	.868	-.118	.768	.942	.113	.901
HerWt	.703		.499	.483	-.690	.709
LiverWt	.636	.371	.542	.681	.420	.640
NecWt	.631	.558	.709	.803		.647
CheWt	.630	-.409	.565	.853	.270	.801
GizWt	.460	.672	.663	.508	.610	.629
Eigenvalue	7.177	1.152		7.403	1.487	
% of total Variance	65.248	10.474		67.298	13.521	
KMO	0.817			0.579		
X2	644.757			149.409		
Sig.	0.000			0.000		

Com= communalities, PC= principal component

Live body weight= LivWt, Total weight of thight + leg= TolWt, Thigh weight= ThiWt, Leg weight= LeWt, Back weight= BacWt, Neck weight= NecWt, Chest weight= CheWt, Liver weight= LiverWt, Heart weight= HerWt, Gizzard weight= GizWt, Wing weight= WinWt.

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