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Effect of Sex-linked Feathering Genes on Some Blood Parameters of Baladi Chickens

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Abstract. 240 late and early feathering Saudi Arabian Baladi chicks were used to study the effect of feathering genotype on some blood parameters. Similar number of SCW Leghorn chicks were used for comparison. All the chicks were subjected to standard management practices. 10 males and 10 females were randomly selected from each genotypic group for blood parameters determination. Blood samples were drawn via heart puncture at 6,12 and 20 weeks of age. Blood parameters determined were cholesterol, total protein, uric acid, total lipid and packed cell volume.

Early feathering Baladi had higher ($P \leq .05$) serum cholesterol than their late feathering peers whereas both had statistically similar uric acid, total lipid and packed cell volume values. Leghorn had statistically similar cholesterol and total protein as Baladi but had lower ($P \leq .05$) uric acid, total lipid and packed cell volume than Baladi. Males had significantly ($P \leq .05$) higher cholesterol and packed cell volume and lower total protein than females. Cholesterol, uric acid and total lipid values decreased ($P \leq .05$) whereas total protein and packed cell volume increased ($P \leq .05$) with age.

Introduction

Information concerning the effect of feathering genotype on blood parameters are lacking. Katanbaf *et al.* [1] observed no significant differences in plasma glucose, soluble protein and total lipid at 49 days of age among early and late feathering females. The present study was therefore conducted to investigate in Saudi Arabian Baladi, the effect of feathering genotype on some blood parameters and to compare Baladi values with those of early feathering Leghorn.

Materials and Methods

240 late (LB) and early (EB) feathering Saudi Arabian Baladi chicks were obtained from the Baladi population which has been randomly bred for several years in the experimental livestock farm of the Animal Production Department, College of Agriculture, King Saud University. Ten males (M) and 10 females (F) were randomly selected from each genotypic group for blood parameters studies. Blood samples were drawn via heart puncture at 6,12 and 20 weeks of age. Blood samples were also obtained from similar number of early feathering males and females SCW Leghorns (EL) bred under similar conditions for many years for comparison. The chicks were grown in an electrically heated battery up to 3 weeks of age, thereafter moved to floor pens in an environmentally controlled house where the maximum and minimum temperature ranged between 29-31 and 24-28°C, respectively. The chicks of each genotypic group were vaccinated against Newcastle disease using vaccines at 4 days (Hitchner B1) with reinforcing vaccinations at 25 days (Hitchner B1) and (Lasota) at 70 days of age.

All the birds received conventional rations (Table 1) at the different age periods [2]. Light was maintained at 8h light: 16h dark from one week of age up to the end of the experimental period. Feed and water were offered ad libitum throughout the experimental period. Serum was separated by centerifugation for 15 min at approximately 3000 r/m from nonheparinized blood after clotting at room temperature. Cholesterol (CHOL), uric acid (URI), total protein (TP) and total lipid (TL) were determined using commercial reagents kits (Randox Laboratories Ltd, Ardmore Diamond Road, Crumlin, Co. Antrim, United Kingdom, BT29-4QY) and packed cell volume (PCV) by micro hematocrit method. Data collected were subjected to statistical analysis using SAS [3] general linear model (GLM), KSU computer center, according to the following model:

$$Y_{ijkl} = M + G_i + A_j + S_k + (GA)_{ij} + (GS)_{ik} + (AS)_{jk} + (GAS)_{ijk} + e_{ijkl}$$

where:

Y_{ijkl} is the 1^{th} observation of i^{th} genotype, j^{th} age and k^{th} sex
$(GA)_{ij}$ is the interaction between genotype and age
$(GS)_{ij}$ is the interaction between genotype and sex
$(AS)_{jk}$ is the interaction between age and sex
$(GSA)_{ijk}$ is the interaction between genotype, age and sex
e_{ijkl} is the random error associated with the Y_{ijkl} observation

Table 1. Commercial diets used in the experiment[1]

Calculated composition	Starter 1-6 wk	Grower 7-11 wk	Developer 12-20 wk
Crude protein %	21.00	16.00	13.65
Crude fat %	3.00	3.00	3.00
Crude fiber %	3.5	4.50	5.50
Calcium %	1.00	1.00	1.00
Phosphorus %	0.65	0.60	0.60
Salt %	0.45	0.40	0.35
Met. Energy K.Cal/K.G.	2970	2904	2692

[1] Manufactured by Grain Silos and Flour Mills Organization, Riyadh, Saudi Arabia.

Results

Cholesterol (CHOL): Genotype (G) had a significant effect at the .05 level of probability whereas effects of sex (S), age (A) and G*A were significant at the .01 level of probability. On the other hand, G*S, S*A and G*S*A effects were not significant. EL had similar CHOL value as Baladi but EB had significantly ($P \leq .05$) higher value than their LB counterparts (Table 2). CHOL value was significantly ($P \leq .05$) higher in males than females, and in six weeks compared to 12 and 20 weeks old birds which had statistically similar values (Table 2). On the other hand, EL had significantly ($P \leq .05$) the lowest at 6 and 12 weeks and highest CHOL values at 20 weeks of age, whereas EB and LB had similar values at all ages (Table 2).

Total Protein (TP): Genotype (G) effect was not significant whereas those of sex (S) and age (A) were significant at the .05 and .01 level of probability, respectively. Similar effects were noticed for G*S and G*A while those of S*A and G*S*A were not significant (Table 2). EB, LB and EL had similar TP values but the value of males was significantly ($P \leq .05$) higher than that of females. In general TP values increased significantly ($P \leq .05$) with age and reached its highest at 12 weeks of age thereafter decreased but was still higher than that at 6 weeks of age (Table 2). On the other hand, LB at 6 weeks and EB at 20 weeks of age had significantly ($P \leq .05$) higher values than EL and LB, respectively otherwise the different experimental groups had similar TP values at 12 weeks of age (Table 2). Figure 1 shows that LBF had significantly ($P \leq .05$) higher value than LBM, ELF and ELM but similar to those of EBF and EBM which did not differ significantly from the other groups.

Table 2. Effect of feathering genotype (G), sex (S) and age (A) in weeks on cholesterol (CHOL), total protein (TP), uric acid (URI, total lipid (Tl) and packed cell volume (PCV) of baladi and leghorn

Parameters	CHOL (mg/dl)	TP (g/l)	URI (mg/dl)	TL (g/l)	PCV %
Genotype (G)	*	N.S.	**	**	**
EB1	115.25±1.84[a]	41.97±0.59	5.19±1.15[a]	4.70±0.11[a]	26.47±0.32[a]
LB2	108.67±1.97[b]	41.85±0.63	5.62±0.17[a]	4.62±0.12[a]	26.80±0.35[a]
EL3	112.34±1.91[ab]	40.29±0.61	4.92±0.16[b]	4.17±0.11[b]	23.05±0.34[b]
Sex (S)	**	*	N.S.	N.S.	**
F	107.02±1.58[a]	42.13±0.51[a]	5.40±0.13	4.38±0.09	24.78±0.28[a]
M	117.16±1.53[b]	40.61±0.49[b]	5.09±1.13	4.62±0.09	26.11±0.27[b]
Age (A)	**	**	**	**	**
6	131.97±2.13[a]	37.43±0.69[a]	7.32±0.18[a]	5.91±0.13[a]	22.94±0.38[a]
12	104.32±1.76[b]	45.83±0.56[b]	3.95±0.15[b]	4.27±0.10[b]	25.87±0.31[b]
20	99.98±1.81[b]	40.85±0.58[c]	4.47±0.15[c]	3.31±0.11[c]	27.51±0.32[c]
G*A	**	**	**	**	N.S.
EB.6	141.93±3.51[a]	37.80±1.13[ab]	6.61±0.29[a]	6.43±0.21[a]	24.63±0.62
LB.6	134.56±3.81[a]	39.88±1.23[a]	8.86±0.32[b]	5.60±0.22[b]	24.01±0.69
EL.6	119.43±3.76[b]	34.61±1.21[b]	6.48±0.31[a]	5.70±0.22[b]	20.17±0.65
EB.12	109.31±2.95[d]	45.41±0.95[c]	4.67±0.25[d]	4.58±0.17[d]	26.68±0.51
LB.12	103.28±3.12[d]	46.77±1.00[c]	3.09±0.26[e]	4.40±0.18[d]	27.39±0.56
EL.12	100.36±3.05[f]	45.31±0.98[c]	4.08±0.25[f]	3.82±0.18[e]	23.53±0.54
EB.20	94.52±3.05[g]	42.71±0.98[d]	4.30±0.23[g]	3.09±0.18[g]	28.10±0.53
LB.20	88.19±3.28[g]	38.89±1.06[e]	4.90±0.27[g]	3.86±0.19[h]	28.99±0.57
EL.20	117.23±3.05[h]	40.96±0.98[de]	4.19±0.25[g]	2.99±0.18[g]	25.45±0.54
G*S	N.S.	*	N.S.	N.S.	N.S.
S*A	N.S.	N.S.	N.S.	*	**
G*S*A	N.S.	N.S.	N.S.	N.S.	N.S.

[a,b] Means within the same column with different superscripts differ significantly ($P < .05$).

* ($P \leq .05$). ** ($P \leq .01$). N.S. Nonsignificant.

[1] Early feathering baladi.

[2] Late feathering baladi.

[3] Early feathering leghorn.

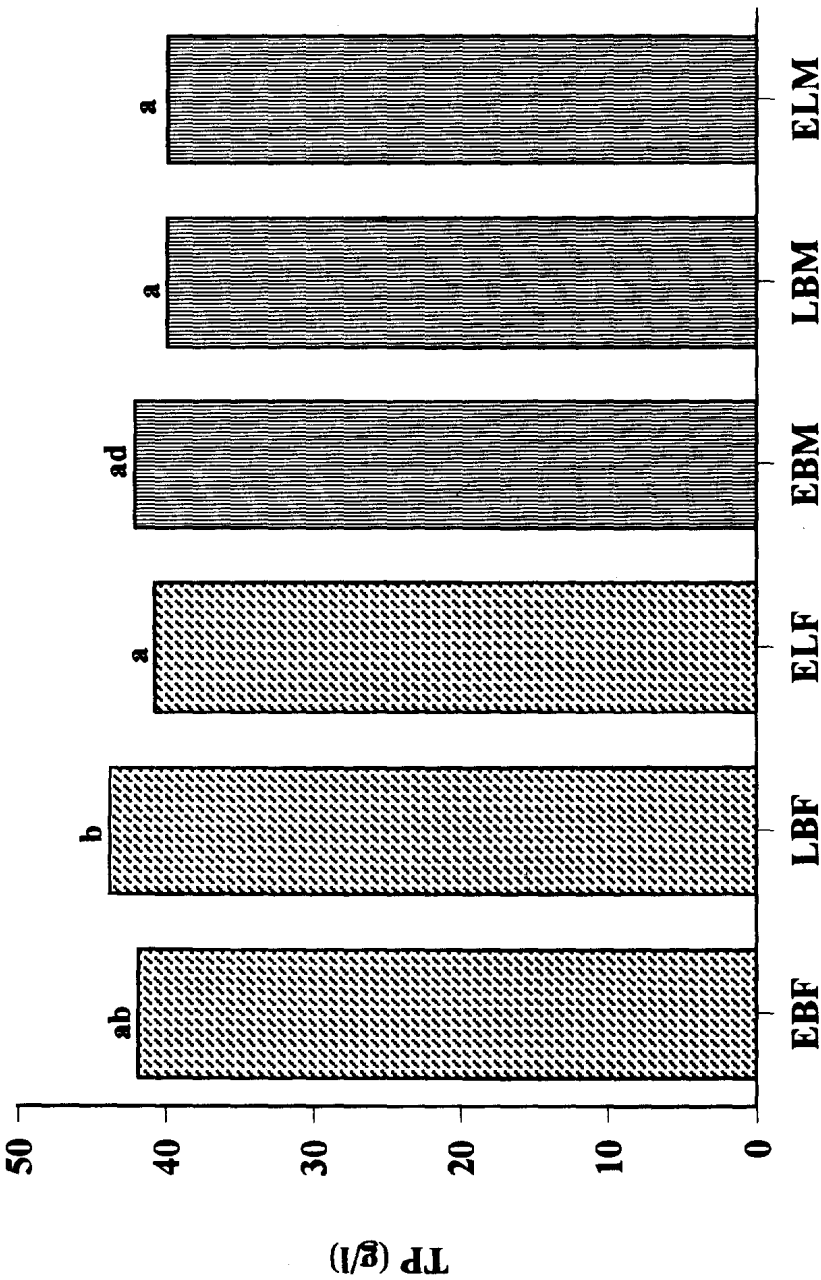

Fig. 1. Effect of G*S on total protein (g/l) concentration in blood of baladi and leghorn chickens.

Uric Acid (URI): Genotype (G), age (A) and their interaction (G*A) had a significant ($P \leq .01$) effect upon URI whereas sex (S), G*S, S*A and G*S*A effects were not significant. EB and LB had similar URI values but their values were significantly ($P \leq .05$) higher than those of EL (Table 2). Males and females did not differ significantly with respect to URI values (Table 2). In general URI values significantly ($P \leq .05$) decreased with age and reached its lowest at 12 weeks then increased significantly ($P \leq .05$) upto 20 weeks of age but were still lower than those obtained at 6 weeks of age (Table 2). LB had significantly ($P \leq .05$) the highest and lowest URI value at 6 and 12 weeks of age, respectively whereas EB had significantly ($P \leq .05$) higher value than EL at 12 weeks of age. On the other hand, EB and EL groups had statistically similar URI values at 6 weeks and both did not differ from LB at 20 weeks of age (Table 2).

Total Lipid (TL): Genotype (G), age (A) and their interaction (G*A) had a significant effect at the .01 level and S*A at the .05 level of probability whereas the effects of sex (S), G*S and G*S*A were not significant. EB and LB had statistically similar TL values but their values were significantly ($P \leq .05$) higher than those of EL (Table 2). TL values of males and females did not differ significantly whereas they significantly ($P \leq .05$) decreased with age and reached their lowest at 20 weeks of age (Table 2). EB and EL had significantly ($P \leq .05$) the highest and lowest TL values at 6 and 12 weeks of age, respectively. LB had similar values as EL at 6 weeks and as EB at 12 weeks of age but had significantly ($P \leq .05$) higher value than EB and EL which did not differ significantly at 20 weeks of age (Table 2). Figure 2 shows that TL values significantly ($P \leq .05$) decreased with age within each sex. However, males had significantly ($P \leq .05$) the highest values at 6 week of age followed by females of the same age otherwise males and females within each age group had similar values.

Packed Cell Volume (PCV): Genotype (G), sex (S), age (A) and S*A had a significant ($P \leq .01$) effect upon PCV values while the effects of G*S, G*A and G*S*A were not significant. EL had significantly ($P \leq .05$) lower value than EB and LB which had statistically similar values whereas females had significantly ($P \leq .05$) lower PCV value than males (Table 2). PCV values significantly ($P \leq .05$) increased with age and reached its highest at 20 weeks of age (Table 2). Figure 3 shows that males had the highest PVC value at 20 weeks of age whereas males and females were similar and had significantly ($P \leq .05$) the lowest value at 6 weeks of age but females had similar value at 12 and 20 weeks of age and did not differ significantly from males at 12 weeks of age.

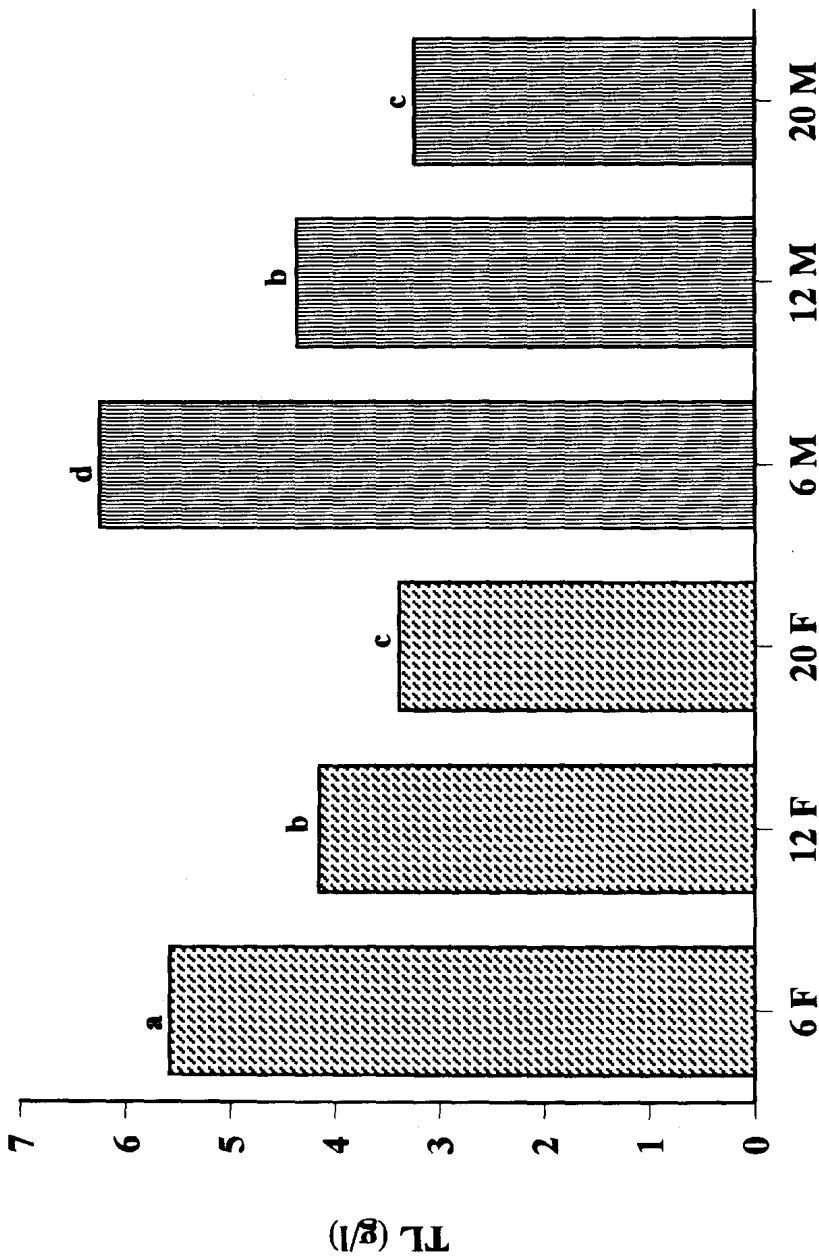

Fig. 2. Effect of S*A on total lipid (g/l) concentration in blood of baladi and leghorn chickens.

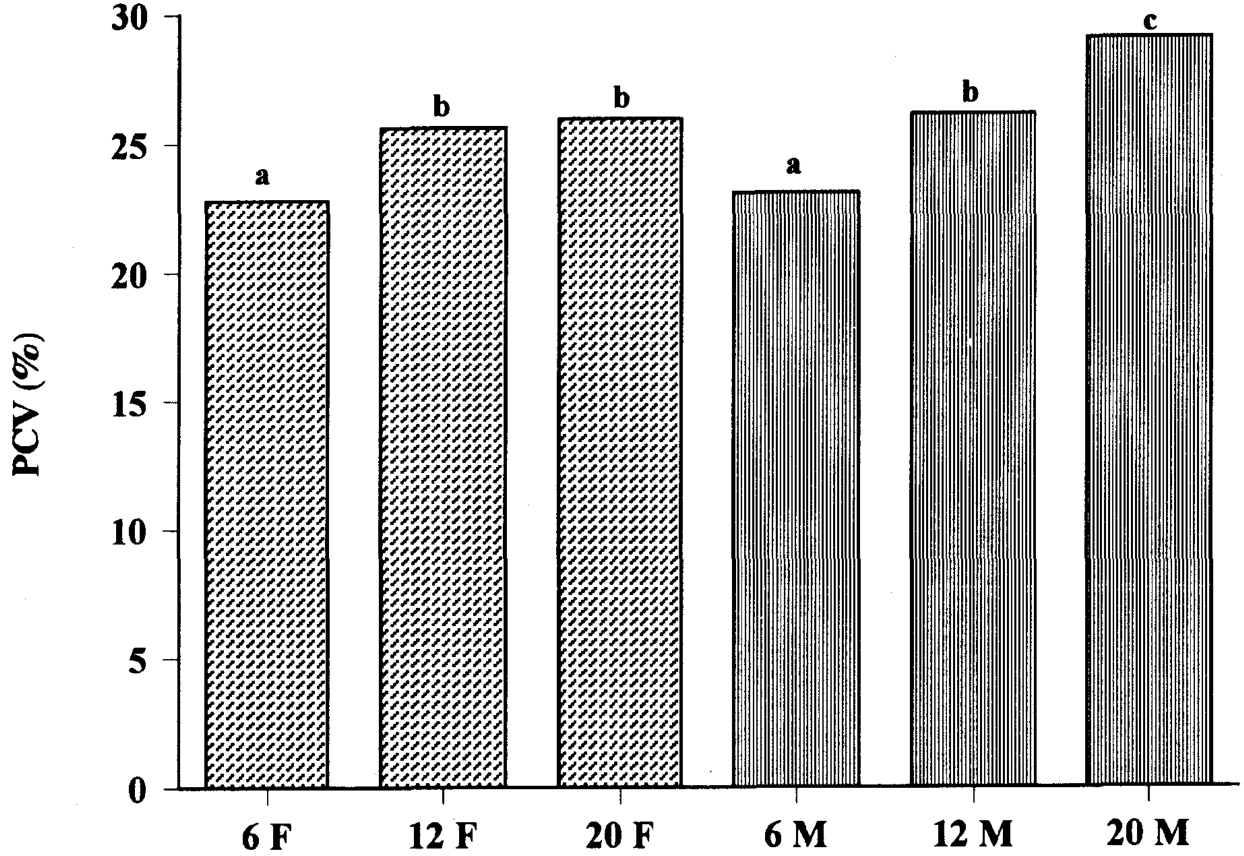

Fig. 3. Effect of S*A on packed cell volume (PCV) in blood of baladi and leghorn chickens.

Discussion

Information on the relationship of sex-linked feathering genes with blood parameters is almost lacking. Our study revealed higher ($P \leq .05$) serum cholesterol for early compared with late feathering Baladi; otherwise both genotypes had statistically similar total protein, uric acid, total lipid and packed cell volume values. Katanbaf *et al.* [1] also observed no significant differences in plasma glucose, soluable protein and total lipid of early and late feathering females at 49 days of age. Leghorn and Baladi had statistically similar cholesterol and total protein values but uric acid, total lipid and packed cell volume values of Leghrons were lower ($P \leq .05$) than those of Baladi. Similarly was reported by Attia *et al.* [4] with respect to serum cholesterol at 16 weeks of age. However, Shawer *et al.* [5] showed higher protein value for Baladi compared with Leghorn at 2-22 weeks of age which is in disagreement without our finding. Leghorn and Baladi males combined showed higher ($P \leq .05$) cholesterol level and packed cell volume and lower ($P \leq .05$) total protein value than females but both had similar uric acid and total lipid.

These results disagree with those of Shawer *et al.* [5] who found statistically similar protein value for males and females of both breeds at 2-22 weeks af age. On the other hand, Alsobayel *et al.* [6] observed higher uric acid and packed cell volume and lower total protein, cholesterol and total lipid for Baladi males compared with their females counterparts at 14-49 weeks of age. Cholesterol, uric acid and total lipid values decreased ($P \leq .05$) whereas total protein and packed cell volume increased with age. However, Alsobayel *et al.* [6] observed increased cholesterol, packed cell volume and total protein and decreased uric acid values from 14-20 weeks of age. The controversy in those results might be due to age, season and/or some other factors.

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تأثير جينات الترييش المرتبطة بالجنس على بعض معايير الدم في الدجاج البلدي

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(ورد البحث في ١٤١٥/٢/٨هـ؛ وقُبل للنشر في ١٤١٥/١٢/٢٩هـ)

ملخص البحث. استخدم في هذه الدراسة ١٤٠ صوصًا من الدجاج البلدي مبكر ومتأخر الترييش وذلك لدراسة تأثير التركيب الوراثي على بعض معايير الدم، بالإضافة إلى ذلك استخدم ١٢٠ صوصًا لجهورن مبكر الترييش بغرض المقارنة، ربيت الطيور تحت نظم رعاية مناسبة ومن ثم تم عشوائيًا اختيار عدد ١٠ ذكور ومثلها من الإناث لتقدير معايير الدم، وقد تم سحب عينات الدم عن طريق وخز القلب عند عمر ٦ و١٢ و٢٠ أسبوعًا وتم تقدير تراكيز الكولسترول والبروتين الكلي وحمض البوليك والدهن الكلي في بلازما الدم، كذلك تم تقدير حجم كريات الدم عند الأعمار المختلفة.

دلت النتائج على أن مستوى تركيز الكولسترول في بلازما الدم كان أعلى معنويًا ($P \leq 0.5$) في البلدي مبكر الترييش بالمقارنة مع نظيره متأخر الترييش، بينما لم تظهر اختلافات معنوية بين النوعين فيما يخص تركيز المعايير الأخرى، كذلك لم يختلف اللجهورن معنويًا عن البلدي فيما يخص تركيز الكولسترول والبروتين الكلي إلا أنه أظهر قيمًا أقل معنويًا ($P \leq 0.5$) من البلدي فيما يخص حمض البوليك والدهن الكلي وحجم كريات الدم. الذكور كانت أعلى معنويًا ($P \leq 0.5$) من الإناث بالنسبة لقيم الكولسترول وحجم كريات الدم وأقل منها معنويًا ($P \leq 0.5$) فيما يخص البروتين الكلي، تركيز الكولسترول وحمض البوليك والدهن الكلي تتناقص بينما تركيز البروتين الكلي وحجم كريات الدم تتزايد معنويًا ($P \leq 0.5$) مع العمر.