Research Article

Relationship of Hemoglobin Types and Blood Groups with Bodyweight and Dimensions in Unimproved Awassi Ewes

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Abstract | The study was conducted on 216 ewes of unimproved Awassi sheep breed to determine the effect of hemoglobin type and blood group on body weight and dimensions. Results showed a significant effect (P<0.05) of hemoglobin type on live body weight, the highest body weight was noticed in ewes with hemoglobin AB^{Hb} compared with the lowest body weight which was noticed in ewe group with hemoglobin B^{Hb} namely, 43.93 and 36.81 Kg respectively. No significant effect of blood group on live body weight. Interaction among hemoglobin types and blood groups effected significantly (P<0.05) on body weight, the highest body weight was in group with $AB^{Hb}R$ genotype (45.25 kg) while the lowest body weight was in group with $B^{Hb}D$ genotype (34.75 kg). Results showed a significant effect (P<0.05) of hemoglobin type on some of body dimensions. The longest body was in ewe groups with hemoglobin B^{Hb} while the shortest body was in hemoglobin type A^{Hb} namely, 66.5 and 62.43 cm respectively. The highest hip width and heart girth were noticed in group with hemoglobin A^{Hb} namely, 29.81 and 99.12 cm respectively while least values were noticed in the group with hemoglobin B^{Hb} namely, 27.75 and 95.18 cm respectively. The highest values were noticed in group with blood group R namely, 32.25 and 72.66 cm respectively. Interaction among hemoglobin types and blood groups effected significantly (P< 0.05) on body dimension, ewes with $B^{Hb}B$ genotype had a longer body than the other groups (68.50 cm). The group with $A^{Hb}R$ had a wider shoulder than the other groups (31.25 cm) while the group with $B^{Hb}R$ had a wider hip and higher shoulder compared with the other groups.

Keywords | Awassi sheep, Blood types, Body weight, Dimensions.

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INTRODUCTION

The Iraqi sheep of Awassi breed contributes production to meat and wool production .The breed is well adapted to harsh conditions and capable of producing and reproducing under these circumstances (Salman and Abdalla, 2014; Al-Salihi KA, 2012). Awassi is contribute of 58.2% from Iraqi sheep and the productive performance is faced by many difficulties under the classical breeding systems (AL-Barazanji and Othman, 2013; Ishaq and Ajeel, 2013). This breed is an important source of meat and plays other socio-economic roles especially in the lives of rural and nomadic dwellers in Iraq. In recent years, analysis of genetic markers based on blood protein polymorphism has become a tool for studying genetic differentiation among population or phylogenetic and evolutionary studies (Shoyombo et al., 2015). Elisa et al. (2010) referred that blood components are undoubtedly essential biological characteristics and warrant consideration for the study of a breed. Hemoglobin, an important erythrocyte protein inherited byco-dominance in a Mendelian fashion and controlled by two alleles has been reported to be a useful marker through which many economic traits with which it is associated have been improved in domestic animals (Akinyemi and Salako, 2010). In sheep, the existence of three major Hb types (AA, AB, and BB) caused by Hb A and Hb B genes and the existence of some rare Hb types have been reported in the sheep (Akpa et al., 2011).

Due to blood groups in sheep, there were seven blood groups (A, B, C, D, M, R and X) which are exactly identical with those found in goats so we can use the same re

Table 1: Chi- square distribution of hemoglobin types and blood groups in Awassi ewes

Factors	Hemoglobin types			Blood groups			
Genotypes	A^{Hb}	AB^{Hb}	B^{Hb}	A	B	D	R
Observed No.	53	94	69	39	54	107	16
%	24.54	43.52	31.94	18.06	25.0	49.54	7.40
x^2	12.002**			82.92**			

Interaction												
Genotypes	A^{Hb} A	A^{Hb} B	A^{Hb} D	A^{Hb} R	AB^{Hb} A	AB^{Hb} B	AB^{Hb} D	AB^{Hb} R	B^{Hb} A	B^{Hb} B	B^{Hb} D	B^{Hb} R
Observed No.	10	19	20	4	16	21	52	5	13	14	35	7
%	4.63	8.81	9.26	1.85	7.41	9.72	24.07	2.31	6.02	6.48	16.20	3.24
x^2	114.57**											

(** P<0.01)

agents for detecting blood groups for both species (Rocha et al., 1998).

Several studies in sheep have already linked these blood groups as a markers to production traits and environmental adaptations (Templeton et al., 2010). Al-Habobi (2012) found a significant effect of blood group on daily weight gain, fertility percentage and prolificacy in Awassi ewes. The major aim of this study is to focus on the genetic diversity among Awassi breed individuals in hemoglobin types and blood groups and attempt to use it as a genetic markers or indicators in selection programs to improve the breed performance.

MATERIALS AND METHODS

Experimental Animals and Management

Data were made available on 216 ewes of unimproved Awassi sheep breed reared in private farm in the middle of Iraq through the year 2017. The experimental animals were in the same age and the flock is housed under semi-open sheds and can be fed on the concentrated ration consuming (500 – 600) gm / head / day approximately . Green roughages such as Alfalfa and clover can be added throughout the season. Annual routinely operations on sheep such as dipping and washing with chemicals in order to kill extra parasites so sheep will be ready to mating after hand wool shaving and regular operations to improve the health status of the flock.

Blood Samples Analysis

Two blood samples from each ewe were taken from jugular vein using disposable syringes containing anticoagulant factors (EDTA). Electrophoresis cellulose acetate method (Kaneko et al., 2008) used to determine the hemoglobin types from the first blood samples for all individuals. Second blood samples were used to determine the types of blood groups by using special kits manufactured by Randox company.

Statistical Analysis

Results of traits included live body weight and body dimensions were statistically analyzed by using SAS (2012) software program. Allele frequencies for hemoglobin types and blood groups polymorphisms were determined by direct counting from phenotypes and Chi- square test was used to determine the significant differences among phenotypes.

Factorial experiment (4*3) was used to determine the effect of factors on traits according to the linear model as follows:

$$Y_{ijkl} = \mu + H_i + B_j + (HB)_{ij} + e_{ijkl}$$

where:

μ: overall mean.

Hi: effect of hemoglobin type (A^{Hb} , AB^{Hb} and B^{Hb})

Bj: effect of blood group (A , B , D and R)

(HB)ij: effect of interaction

eijkl: residual error.

Duncan's multiple range test (1955) was used to compare differences between the means.

RESULTS AND DISCUSSION

Results represented a significant differences (P<0.01) in hemoglobin types distribution in the sample that studded (Table 1), the ratios of blood hemoglobin were 43.52, 31.94 and 24.54% for AB^{Hb}, B^{Hb} and A^{Hb} respectively. Blood groups also differed significantly (P<0.01) among ewes groups, the highest ratio was noticed in D group (49.54%) while the lowest ratio was noticed in R group (7.40%). According to the interaction among hemoglobin and blood groups, A significant differences (P<0.01) among groups

Table 2: Effect of hemoglobin types and blood groups on body weight in Awassi ewes

Factors	**Means ± S.E**						
	Hemoglobin types			**Blood groups**			
Genotypes	A^{Hb}	AB^{Hb}	B^{Hb}	A	B	D	R
Body weight Kg	40.62 ±0.79^{b}	43.93 ±1.14^{a}	36.81 ±0.69^{c}	39.25 ±0.70^{a}	39.66 ±0.85^{a}	40.66 ±2.54^{a}	42.25 ±1.69^{a}

Interaction												
Genotypes	A^{Hb} A	A^{Hb} B	A^{Hb} D	A^{Hb} R	AB^{Hb} A	AB^{Hb} B	AB^{Hb} D	AB^{Hb} R	B^{Hb} A	B^{Hb} B	B^{Hb} D	B^{Hb} R
Body weight Kg	37.0 ± 0.70^{cd}	39.75± 0.85^{abcd}	42.00± 2.50^{abc}	43.75± 1.70^{ab}	44.75 ±1.79^{a}	40.50± 2.98^{abcd}	45.24± 2.05^{a}	45.25 ±2.09^{a}	36.00 ±1.08^{d}	38.75 ±1.31^{bcd}	34.75 ±1.75^{d}	37.75 ±0.62^{cd}

Values within each subclass with different superscripts differ significantly ($P<0.05$).

Table 3: Effect of hemoglobin types and blood groups on body dimensions in Awassi ewes

Body dimensions (Cm) ± S.E						**Hb**	
H.G	**H.H**	**S.H**	**H.W**	**S.W**	**B.L**		
99.12±1.25^{a}	70.50±0.69^{a}	68.43±0.92^{a}	29.81±0.67^{a}	28.31 ±0.90^{a}	62.43± 0.78^{b}	A^{Hb}	
97.56±1.05^{ab}	71.18±0.82^{a}	65.43±1.46^{a}	29.56 ±0.68^{a}	27.87 ±0.67^{a}	66.2±5 0.79^{a}	AB^{Hb}	
95.18±1.02^{b}	71.25±0.79^{a}	67.00± 1.87^{a}	27.75± 1.00^{b}	26.18±0.84^{a}	66.50± 0.55^{a}	B^{Hb}	
Blood group							
97.50±0.95^{b}	71.16±1.73^{ab}	67.83± 0.85^{a}	28.00± 0.85^{b}	26.25± 1.65^{a}	64.16± 1.55^{a}	A	
99.75±0.85^{a}	69.66±0.85^{b}	65.80± 0.49^{a}	27.58± 0.62^{b}	26.25 ±0.40^{a}	65.91± 1.58^{a}	B	
100.0±1.4^{a}	71.08±1.31^{ab}	66.00± 2.13^{a}	28.33± 0.47^{b}	28.58±0.62^{a}	64.75± 1.58^{a}	D	
99.98±0.99^{a}	72.66±1.83^{a}	68.16± 3.86^{a}	32.25± 0.96^{a}	28.75±0.88^{a}	65.41± 1.49^{a}	R	
Interactions (Hb xBlood group)							
97.50±3.95^{a}	70.00±2.02^{a}	67.25± 0.85^{ab}	27.25± 0.85^{cde}	25.25± 1.64^{bcd}	62.50 ±1.53^{bcd}	A	
99.75±2.85^{a}	69.75±1.73^{a}	68.50± 0.28^{ab}	29.25 ±0.62^{abcd}	27.00 ±0.45^{abcd}	62.00±1.57^{cd}	B	A^{Hb}
100.0 ±4.33^{a}	70.25±1.85^{a}	68.50± 0.64^{ab}	30.75 ±0.47^{abc}	29.75± 0.62^{abc}	61.00± 1.58^{d}	D	
99.25±2.40^{a}	72.00±1.66^{a}	69.50± 3.86^{ab}	32.00± 1.91^{ab}	31.25 ±2.39^{a}	64.25± 1.75^{abcd}	R	
99.00±3.90^{a}	71.50±2.70^{a}	66.75± 4.51^{ab}	29.25 ±0.62^{abcd}	25.25± 1.79^{bcd}	64.00 ± 1.77^{abcd}	A	
94.50± 3.08^{a}	70.25± 1.92^{a}	69.00± 2.12^{ab}	28.50± 1.93^{bcde}	27.50± 1.04^{abcd}	67.25± 1.54^{ab}	B	
98.00±2.28^{a}	70.00±1.37^{a}	61.50± 1.32^{ab}	28.75± 1.43^{bcde}	28.25± 0.47^{abcd}	67.00± 2.04^{ab}	D	AB^{Hb}
98.75±2.56^{a}	73.00±1.73^{a}	64.50± 2.50^{ab}	31.75± 1.03^{ab}	30.00±1.22^{ab}	66.75± 0.85^{abc}	R	
96.25± 3.09^{a}	72.00±1.47^{a}	69.50± 2.06^{ab}	27.50 ±1.50^{cde}	27.75 ±1.10^{abcd}	66.00± 1.08^{abc}	A	
97.25± 3.64^{a}	69.00±1.35^{a}	60.00± 3.34^{b}	25.00± 1.08^{e}	24.25± 2.56^{d}	68.50± 0.50^{a}	B	B^{Hb}
94.50± 2.56^{a}	73.00±2.19^{a}	68.00± 4.84^{ab}	25.50± 1.19^{de}	27.75± 0.25^{abcd}	66.25 ±1.10^{abc}	D	
92.75±3.85^{a}	73.00 ±2.61^{a}	70.00± 2.87^{a}	33.00 ±1.41^{a}	25.00 ±1.77^{cd}	65.25±1.25^{abcd}	R	

Values within each subclass with different superscripts differ significantly ($P < 0.05$).
B.L: body length, S.W: shoulder width, H.W:hip width,S.H: shoulder hight, H.H: hip height and H.G: heart girth.

the highest ratio was noticed in ewes with AB^{Hb}D genotype (24.07%) while the lowest ratio was in ewes with AB^{Hb}R (2.31%).

The differences in hemoglobin types and blood groups is very important method to exploit it in the indirect selection for many economical traits which are correlated positively with the blood characters. Many factors affected and change the distribution of blood characters such as volume of sample that studded, breed and location. The results of this study was accordance with Rocha et al. (1998) who reported that the blood groups are differ in distribution within the same breed of sheep while Baranowski et al. (2000) referred that the hemoglobin type is differ according breed, herd and region of studying.

Results showed a significant effect ($P<0.05$) of hemoglobin type on live body weight (Table 2), the highest body weight was noticed in ewes with hemoglobin AB^{Hb} compared with the lowest body weight which was noticed in ewe group with hemoglobin B^{Hb} namely, 43.93 and 36.81 Kg respectively. No significant effect of blood group on live body weight. The interaction among hemoglobin types and blood groups effected significantly ($P<0.05$) on body weight , the highest body weight was noticed in group with $AB^{Hb}R$ genotype (45.25 kg) while the lowest body weight was in group with $B^{Hb}D$ genotype (34.75 kg).

The current data were in accordance with those of Al-Haboby (2012) who stated that birth weight of Turkish Awassi ewes did not affected by blood groups. Many studies reported that the blood type are related strongly with many of economical traits in sheep and other species of mammals. Dally et al. (1980) referred to the genetic relationship among blood groups and production performance in many species and he suggested that this relationship is resulted from genetic pleiotropy while Pieragostini et al. (2005) that the studying the relationship of blood type is more difficult in animals than the human because of the large number of genes and alleles responsible for varied phenotypes in animals compared with human. In sheep, Rasmussen et al. (2010) pointed that the huge differences among pure breeds and crossbreeds in blood types which partially contributed of the ability of crossbreeds to achieve high body weights compared with the pure breeds.

Results showed a significant effect ($P<0.05$) of hemoglobin type on some of body dimensions (Table 3). Body length affected significantly by hemoglobin type, the longest body was in ewe groups with hemoglobin B^{Hb} while the shortest body was in hemoglobin type A^{Hb} namely, 66.5 and 62.43 cm respectively.

Hip width and heart girth differed significantly ($P<0.05$) according to hemoglobin type, the highest values were noticed in group with A^{Hb} namely, 29.81 and 99.12 cm respectively while least values were noticed in the group with hemoglobin B^{Hb} namely, 27.75 and 95.18 cm respectively. No significant effect of hemoglobin type on shoulder width, shoulder height and hip height.

Blood groups effected significantly ($P<0.05$) on hip width and hip height, the highest values were in group with blood group R namely, 32.25 and 72.66 cm respectively. Heart girth also affected significantly by blood group, the highest value was found in ewes with blood group D (100 cm) compared with the lowest value which found in ewes with blood group A (97.50 cm). Body length, shoulder width and shoulder height did not affected significantly by blood groups.

Interaction among hemoglobin types and blood groups effected significantly ($P<0.05$) on body dimension, ewes with $B^{Hb}B$ genotype had a longer body than the other groups (68.50 cm). the group with $A^{Hb}R$ had a wider shoulder than the other groups (31.25 cm) while the group with $B^{Hb}R$ had a wider hip and higher shoulder compared with the other groups namely, 33.0 and 70.0 respectively. Hip height and heart girth were also affected significantly by the interaction between hemoglobin type and blood group, the highest hip was found in ewes with $AB^{Hb}R$, $B^{Hb}D$ and $B^{Hb}R$ genotypes (37.00 cm) while the heart girth increased significantly ($P<0.05$) in ewes with $A^{Hb}D$ genotype compared with the others groups.

A few studies about the direct relationship of blood types with body dimensions because the body dimensions are affected by many factors such as breed, sex, parity and nutrition therefore, we can exploit the correlation between body weight and body dimensions to explanation the indirect effect of blood type on body dimensions through it effect on body weight. Sowande and Sobola (2008) referred that the body weight is correlated highly and positively with all body dimensions in African dwarf sheep. Kumar et al. (2011) demonstrate that the hemoglobin type is related with many economical traits in Garlore sheep.

CONCLUSION

In summary, our present study indicated that the hemoglobin types and blood groups are considered a fast, easy and efficient method to predict of many economical traits in unimproved local Awassi ewes and we can exploit the genotype of blood components from hemoglobin and blood groups in the indirect marker assisted selection to shorten the breeding process of sheep.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHORS CONTRIBUTION

All authors contributed equally.

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