The effect of Genetic and Non-Genetic factors on Birth and weaning weights in Saanen goats

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Abstract

Analysis of 52 records (kids No. =60¬, Sire No=6, Does No= 52) of Saanen goats presented in Rasan animal farm in Halabja plain, the age of goats ranged between (21.4-26.2) months. The aim of this study is to investigate the genetic and non-genetic factors (sex and type of birth) affecting Birth weight (BW), Weaning Weight (WW) and Gain Weight (GW) characteristics of Saanen goats raised under Kurdistan region of Iraq conditions, it also aims at estimating heritability's, BLUP, phenotypic, genetic and their correlations of (BW, WW and GW).The results showed there was significant difference in kid's sex birth weight and weaning weight, but there was significant effect of the type of birth on first lactation stage of milk production, does with single kid produced more milk than does with twin kids. The heritability estimated of BW, WW, and GW, (0.19,0.23 and 0.19) respectively, however, the genetic and phenotypic correlation had positive and highly significant($P \leq 0.01$) effected between BW, WW, and GW, genetic correlation ranged between (0.42 to 0.52) and phenotypic correlation ranged between (0.32 to 0.68). Result demonstrated that the breeding value Blup (Best Linear Unbiased Prediction) of sire (buck) ranged between (0.328 to -0.375). (1.09 to -1.959) and (0.960 to -1.925) for BW, WW and GW. Respectively, it concluded that selection of does and bucks at the population level in planned selection schemes based on BLUP value, heritability and genetic, phenotypic correlation.

Keywords: *Saanen goats, (BW, WW and GW), heritability and BLUP.*

INTRODUCTION

Goats are one of the important sources of animal products due to their relatively easy management under adverse environmental conditions. Because of their resilience and adaptability, they can more readily convert low quality pasture plants and hay with high cellulose levels into meat and milk than other livestock (Simsek and Bayraktar, 2006: Yildirir et al.2019). dairy goats in the developed countries compared with only 19% for the developing world. According to the FAO (2014), goats produced approximately 2.4% of the world's total milk supply during 2012. Livestock serves an important role in rural regions of the world. Goats are raised for production of meat, milk, skin and hair, and they provide subsistence, economic benefits and livelihoods to their owners. (Bolacali, et al. 2017and Zenebe et al.2014). The Saanen

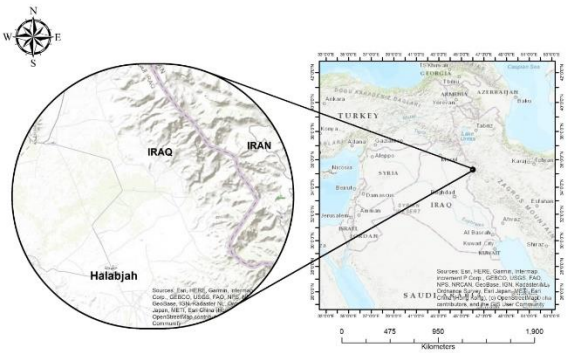
breed is most likely the best developed dairy breed. It has the same position among goat breeds as the Holstein-Friesian among cow breeds (Gökdai, Sakarya, Contiero, & Gottardo, 2020; Underwood et al., 2015). Other attributes of Saanen goats that may be improved, in addition to milk production, include kid birth weight and milk quality (Ralević et al., 2021: Dincel et al. 2019). Owing to its adaptability to different climatic conditions as one of the most significant characteristics of Saanen race, these goats can adapt to different places easily, since their reproduction is high, they usually give birth to twins or triplets (Özder, 2006: Sonu and Basavaprabhu,2020: Ralević et al. 2021). Birth and weaning weights are two of the most available traits goat production systems given that they are easy to measure as well as record. Mature live weight has been positively associated with milk yield and composition in dairy goats (Morris et al., 2011). McManus et al. (2008) and Ocak et al. (2006) revealed a substantial influence of birth type on live weights until the fifth month. According to Dincel et al. (2019), the birth type had no effect on the birth weight. The influence of birth type on weaning weight, on the other hand, was shown to be substantial. McManus et al. (2008) observed that the effect of month of birth on birth and weaning weight was not statistically significant, although the effects of birth type and sex alone on birth weight were.

The aim of this study is to investigate the genetic (heritability, genetic correlation and phenotypic correlation and Blup) and non-genetic factors (sex and type of birth) factors affecting birth, weaning and gain weights in Saanen goat.

MATERIAL AND METHOD

Location: Saanen goat project, the Rasan farm is located in Halabja province -North of Iraq (latitude 35.161336° "N, longitude 46.034659° "E). (Figure.1)

Figure.1. Halabja Province location



Management and Feeding: animals distributed to the specific pen based on their situation (pregnancy pen, dry does pen, buck pen, kids pen), and kids after 3 days of birth were separated to the kids pen.

The goats were given of 1200 g /day of concentrate, 1200g/day maize silage and 900g / day Alfalfa. Feed is provided to the animal as mixture three times a day. kids after 3 days of birth were feed on the replacement milk and gradually feed on concentration until weaning age.

Weighing; Farm provided by ELDA system for management and weighing animals were weighted automatically linked with computer to record their weight based on their ear tag number.

Statistical Analysis: The following linear additive model was used in the statistical analysis system (SAS, 2012):

$$Yijk = \mu + Si + Tj + eijk$$

Where:

yijk = individual observation of birth and weaning weights (kg)

μ = general mean, common element to all observations

Si= fixed effect of the ith sex of kids (1 and 2)

Tj= fixed effect of the jth type of birth (1 and 2)

Eijkl = random error, N (0, δ 2 e)

Tests of significance for the differences between means were carried out according to Duncan (1955).

The sire components of variance and covariance from the multivariate analyses were used for the estimation of genetic parameters using the following:

h 2 =4 δ 2 d / δ 2 d+ δ 2 e

Where:

δ 2 d is the sire component of variance

δ 2 e is the environmental component of variance,

RESULTS AND DISCUSSION

Birth and Weaning weigh

Sex of kids had significant affect ($P \leqslant 0.01$) were females heavier 3.77kg at birth weight than male 3.43kg, (Table 1), these findings were disagreement with those obtained by (Raoof,2009 and Akdag, et al.2011) for birth weight. The effect of sex could be explained by the effect of sex hormones, while estrogen restricting the growth of long bones of body. androgen acts as anabolic hormone. The effect of sex is a result of physiological functions mainly attributed to sex hormones, while estrogen restricting the growth of long bones of the body, androgens act as anabolic hormone, promoting muscle growth rate (Brito et al., 2011; Ralević et al., 2021). However, the effect of sex had not significant at weaning and gain weights. Single born kids were heavier at birth than twins, they were 3.85 and 3.34 kg for single and twin, birth weight respectively, single born kids were heavier and significant ($P \leqslant 0.01$). at weaning and gain weights than twins, they were 17.94,15.85 and 14.09,12.50 kg for single and twin, weaning and gain weights respectively (Table 1). Raoof (2009) reported that the effect of type of birth on body weight may due to the fact that, twin development is competing for the number of nutritive materials in the mother uterus, and it may be attributed to the number of cotyledons. During the post-natal period, they were sharing mother's milk, and therefore each kid would receive less milk than single reared kids. these findings were disagreement with those obtained by (Akdag, et al.2011), but this study agree with Sodiq (2012) who obtained the significant effect of sex and type of birth-on-birth weight in Ettawah Grade goats, and with Mahal (2013) on Black Bengal goats in Bangladesh. Controversy, Yildirir et al. (2019) reported higher birth weight of Saanen kids male 3.42 kg compared to female 3.26 kg and their weight at weaning age were 22.11 kg male, 18.50 kg female. They resulted heavier weight of single born kids at birth 3.56 kg and 21.16 kg at weaning weight compared to twin kids birth weight 3.04 kg and 18.63 kg weaning weight. Furthermore, Dicel et al (2019), showed highly significant differences for birth weight of Saanen kid's sex type where male kid weigh was 3.24 kg and female 2.85 kg and their weaning weight was different significantly 13.27 kg male, 11.25 kg female. Their study also resulted the highly significant differences for birth type (single

and twin) in their birth and weaning weight. Single birth kids' weight was 3.52 kg and their weaning weight 13.76 kg. Twin kids birth weight 3.02 kg and weaning weight 12.16 kg. It is well established that goat breeding circumstances impact the birth weight of the kid. Birth weight variance can be attributed to various husbandry and breeding circumstances, as well as genotype-phenotype interaction. Another explanation for different assessed weights could be weaning stress, which affects kid's growth (Gokdal et al. 2017).

Table 1: Effect of sex and type of birth in growth traits of kids

Factors	No	Mean ± SE		
		Birth weight (kg)	Weaning weight (kg)	Gain weight (kg)
Overall mean	60	3.56 ±0.09	16.75 ±0.31	13.19 ±0.30
Sex				
Male	23	3.43 ±0.12 b	16.71 ±0.39	13.27 ±0.36
Female	37	3.77 ±0.13 a	16.83 ±0.53	13.05 ±0.52
Level of sig.		*	NS	NS
Type of birth				
Single	26	3.85 ±0.11 a	17.94 ±0.39 a	14.09 ±0.33 a
Twin	34	3.34 ±0.13 b	15.85 ±0.40 b	12.50 ±0.43 b
Level of sig.		**	**	**
Means having with the different letters in same column differed significantly. * (P≤0.05), ** (P≤0.01).				

Heritability, Genetic correlation and phenotypic correlation:

The heritability estimated of BW, WW, and GW, (0.19,0.23 and 0.19) respectively, the results of present study were highly than obtained by (Kuthu, et, all.2015) for yearling weight were (0.12) in Teddy goats. In Beetal goat breed in Pakistan lower estimates of heritability (0.09) for the yearling weight were reported (Ali and Khan,2008). The factors responsible for this difference may be size of data set used, the methods of estimation of heritability, the strong environmental influence, breed differences, effect of inbreeding, locations, time periods and other managemental factors. However, the genetic and phenotypic correlation had positive and highly significant effected between BW, WW, and GW. genetic correlation ranged between (0.42 to 0.52) and phenotypic correlation ranged between (0.32 to 0.68). Miranda et al. (2019) emphasize that the heritability of the production characteristic has been widely examined, showing diverse estimates in different goa breeds across time ranging from 0.17 to 0.68.

Table 2: Genetic parameters of growth traits of kids

Growth traits	BWT	WWT	G. W
BWT	0.19	0.54 **	0.45 *
WWT	0.62 **	0.23	0.67 **
Gain	0.58 **	0.72 **	0.19
Values on Diagonal = Heritability-h^2. Values above Diagonal = rG. Values under Diagonal = rP. * (P≤0.05), ** (P≤0.01). Total No. =60, Sire No=6.			

In the previous decade, publications have continued to indicate differences, such as Thepparat et al. (2015)'s work with many breeds of goats and their crosses (Saanen, Anglo-Nubia, Toggenburg, Alpina, and Thai goats) establishing heritability ranges ranging from 0.11 to 0.30. Garca-Peniche et al. (2012) determined that the estimated h2 for all goat breeds (Alpina, La Mancha, Nubian, Oberhasli, Saanen, Toggenburg) is 0.35.

Blup value

Result demonstrated that the breeding value Blup (best linear unbiased prediction) of sire (buck) ranged between (0.328 to -0.375). (1.09 to -1.959) and (0.960 to -1.925) for BW, WW

and GW. Respectively. It is concluded that selection of does and bucks at the population level in planned selection schemes based on BLUP value, heritability and genetic, phenotypic correlation.

Table 3: BLUP estimate of Sire according to growth traits of kids

No	Birth weight		Weaning weight		Gain weight	
	Sire No	BLUP	Sire No	BLUP	Sire No	BLUP
1	94	0.328	80	1.09	94	0.960
2	80	0.307	94	0.870	80	0.925
3	18	0.298	18	0.829	18	0.879
4	17	0.286	17	0.361	17	0.201
5	15	-0.402	15	-1.191	15	-1.041
6	14	-0.375	14	-1.959	14	-1.925

CONCLUSION

The potential of genetic improvement largely depends on genetic variation of the trait and its relationship with the other traits. Knowledge of Blup, heritability and correlations among various traits is essential for formulating efficient breeding plan and selection strategies. These genetic parameter estimates help in the determination of the selection.

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