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Study of Factors Effecting Body Measurements in Local Black Goat and Cyprus Goat at Nine Months of Age

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ABSTRACT

The aim of the research was to know the effect of some factors on the body dimensions of goats at the age of nine months. This study was conducted at the ruminant research station of the General Authority for Agricultural Research/Ministry of Agriculture. The study included the analysis of 123 records belonging to 46 local animals and 77 Cypriot animals for the genetic and non-genetic factors on body dimensions at the age of nine months. The general average of abdominal depth, chest width, abdominal width and the height of the back area at the age of nine months were 30, 10.9, 11.7 and 57.31 cm, respectively. There was highly significant effect of the genetic group on the height of the posterior region. At the same time, the rest of the studied traits did not affect the result of the genetic group. There was no significant effect of each animal's sex and type of birth on the dimensions at the age of nine months. In contrast, the width of the abdomen was significantly affected as a result of the month of birth, while the other dimensions were not affected. The mother's age at birth significantly affected the depth of the abdomen, while the rest of the studied body dimensions were unaffected. Also, the regression on the weight of nine months was highly significant for all measurements at the age of nine months. It can be concluded that there was a group of factors that had an effect on the dimensions of the body at the age of marketing (nine months), which is a determinant of increasing the marketing growth through the increase or decrease of the physical dimensions of it.

Key words: Local goats, Cypriot goats, body dimensions, genetic, non-genetic factors

INTRODUCTION

Goats are an important part of animal production in many countries of the world because of their ability to withstand harsh environmental conditions and poor pastures, and are characterized by their small size and ease of breeding (Dhuha *et al.*, 2021), especially in Iraq. Goats come in third place after sheep and cows, as they reached approximately 645622 heads of goats in 2008. The size and shape of the body are considered important characteristics in meat animals. Animals are usually evaluated theoretically, which is a subjective method of judgment (Sheikh *et al.*, 2022).

Body weight is an important economic trait in selecting animals for the purpose of improving traits of economic value. These traits are closely related to other variables such as age, breed and external appearance. Body measurements can overcome the problems associated with evaluation in view of the size and shape of the goat's body and its development. Body measurements in animals have been used to estimate body weight (Bryony *et al.*, 2020), especially in societies where scales are not readily available such as rural areas. Body measurements are the main method of weighing animals without a scale based on a certain number of body characteristics that can be easily measured. Adhab (2014) and Adhab *et al.* (2015) noted that body measurements varied with age and body weight change. The differences in body weight and its dimensions are affected by several characteristics, some of which are genetic and some are not genetic, such as sex, breed, type of birth, weight and age of the mother at birth (Muayad *et al.*, 2016; Ta *et al.*, 2017). Therefore, this research was aimed at knowing the effect of some of these factors on the body dimensions of goat births at nine months.

MATERIALS AND METHODS

The study was conducted at the ruminant research station of the General Authority for

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Agricultural Research, Ministry of Agriculture. One hundred twenty-three records belonging to 46 local animals and 77 Cypriot animals were analyzed for the characteristics of body dimensions (abdominal depth, chest width, belly width, body height at the background) at the age of nine months, using a tape measure 0.1 cm. Every animal was in a natural standing position on flat ground to take measurements of the dimensions of the body. As for the depth of the abdomen, it was measured by the same tape and was measured from the upper part of the abdominal region of the animal to its lower part to one of the sides as for the width of the body in the chest and the width of the body. In the abdomen, it was measured using a 0.1 cm caliper, and with regard to measuring the height of the body at the back, it was measured by the measuring tape perpendicularly from the upper end of the rear body to the ground. The data were analyzed using the General Linear Model (GLM) method within the statistical program SAS 2012 for the purpose of studying the effect of fixed factors (Fixed effects).

The effect of genetic group, animal sex, type of birth, the month of birth and mother's age at birth on the traits under study was studied, assuming the following mathematical model (Model Fixed):

$$Y_{ijklmn} = m + G_i + S_j + T_k + M_l + A_m + b2(zi\text{-}z\text{-}) + e_{ijklmn}$$

Where,

Y_{ijklmn}: observational value n related to genotype i, animal sex j, birth type k, month l, and mother's age at birth m.

μ: the general average of the studied traits.

G_i: the effect of animal genetic group i (Cypriot, local).

S_j: the effect of the sex of the animal j (male, female).

T_k: the effect of birth type k (single, twin, triple, quadruple).

M_l: the effect of month-year of birth l: (March, April).

A_m: the effect of maternal age at birth m: (2, 3, 4, 5, 6 and 8).

b2 (zi-z-): the effect of the mother's weight at birth as a continuous variable.

e_{ijklmn} : The random experimental error of the experimental unit, which is normally and independently distributed, with a general mean of zero and a variance of s^2_e.

The correlation coefficient was calculated among several traits. The prediction equations for some traits were calculated based on simple linear regression and the use of the coefficient of determination (R^2) estimated (Bashar, 2019) to describe the effects of factors on the traits studied. The data were statistically analyzed using the SAS statistical program 2012. The equations describing the forecast were as follows:

$Y_x = a + b\ (x_i)$

$A = y\ b\ x$

Y: The predicted (dependent) trait.

a: intercept of the slope line.

b: the regression coefficient.

X_i: the independent trait.

y, x = Mean for y_i, x_i

RESULTS AND DISCUSSION

Body height at the rear reached 58.31 and 56.32 cm for the Cypriot and local goats, respectively. At the same time, the rest of the characteristics did not differ significantly between the Cypriot and local goats (Tables 1 and 2). These results agreed with those of Sheriff *et al.* (2021) and Takele *et al.* (2021). However, Salem (2016) did not find a significant difference in body dimensions when studying Shami and local goats. Similarly, Ali *et al.* (2016) did not find the effect of the genetic group on the dimensions of the body in local and Turkish sheep. In the present study, there were no significant effects of animal sex and type of birth on body dimensions at the age of nine months. Similar results were reported by Salem (2016), who indicated no effect of sex on body dimensions. However, Akhtar *et al.* (2021) and Takele *et al.* (2021) found effect of age and gender factors on body's dimensions and body weight. The type of birth did not have a significant effect on all the dimensions of the body studied. This was in consistent with Al-Sultani and Azzawi (2019) who studied on sheep at weaning, as well as with Salem (2016), who studied on the body dimensions of the Shami and local goats at weaning (Sheriff *et al.*, 2021).

As for the month of birth, March was superior

Table 1. The mean of least squares ± standard error of the factors affecting the dimensions of the body at the age of nine months

Factors affecting	The number of views	The depth of the abdomen	Chest width (cm)	Abdominal width (cm)	Back height (cm)
Overall average	123	30	10.9	11.7	57.31
Genetic group					
CY	77	0.37±29.79a	0.16±10.84a	0.14±11.66a	58.31± 0.58a
Local	46	0.40±30.21a	0.17±10.96a	0.15±11.74a	0.64±56.32b
Sex					
Male	60	0.32±30.09a	0.14±10.84a	0.12±11.65a	0.51±57.55a
Female	63	0.35±29.91a	0.15±10.96a	0.13±11.75a	0.55±57.07a
Birth type					
Single	32	0.28±29.73a	0.12±10.93a	0.11±11.64a	0.45±57.17a
Twin	70	0.19±30.30a	0.08±11.15a	0.07±11.91a	0.30±57.51a
Triple	19	0.37±29.94a	0.16±10.86a	0.14±11.77a	0.58±58.09a
Quad	2	1.09±30.04a	0.47±10.66a	0.43±11.47a	1.73±56.49a
Birth month					
March	48	0.40±29.58a	0.17±10.80a	0.15±11.44b	0.63±57.33a
April	75	0.37±30.42a	0.16±11.00a	0.14±11.96a	0.58±57.30a
Mother's age at birth (years)					
2	38	0.38±30.61a	0.16±10.95a	0.15±11.86a	0.61±57.57a
3	19	0.45±30.77a	0.19±10.98a	0.17±11.69a	0.71±58.34a
4	17	0.46±29.48b	0.20±10.97a	0.18±11.74a	0.73±56.22a
5	18	0.42±29.57b	0.18±10.87a	0.16±11.75a	0.66±57.45a
6	15	0.49±29.51b	0.21±10.89a	0.19±11.68a	0.77±57.06a
8	16	0.44±30.06b	0.19±10.74a	0.17±11.47a	0.70±57.24a
Regression on body weight at age					
9 months (cm/kg)	-	0.04±0.65	0.017±0.176	0.015±0.179	0.06±0.97

Different letters within the same column mean significant differences.

Table 2. Analysis of variance (mean squares) for factors affecting body dimensions at nine months of age

Sources of contrast	Degrees of freedom	Abdominal depth	Chest width (cm)	Abdominal body width (cm)	Back body height
Genetic group	1	1.60^{NS}	0.14^{NS}	0.06^{NS}	36.50**
Sex	1	0.84^{NS}	0.30^{NS}	0.27^{NS}	5.64^{NS}
Birth type	3	2.10^{NS}	0.61^{NS}	0.54^{NS}	3.61^{NS}
Birth month	1	6.77^{NS}	0.35^{NS}	2.56**	0.008^{NS}
Maternal age at birth	5	6.42*	0.13^{NS}	0.33^{NS}	8.29^{NS}
Regression on weight at nine months of age	1	577.87**	41.31**	43.05**	1253.28**
Error	110	2.20	0.41	0.33	5.49

*,**Significant at P=0.05 and P=0.01 levels, respectively. NS-Not Significant.

to April in the attribute (the width of the body at the abdomen), as it reached 11.44 and 11.96 cm for the months of March and April, respectively. These results differed from what was reached by Ali *et al.* (2016), who found that the month of birth did not affect the growth characteristics at weaning in local and Turkish Awassi sheep.

As for the effect of the mother's age at birth, it was noted that the ages of 2 and 3 years for the mother gave the highest abdominal depth reaching 30.61 and 30.77 cm, respectively. The characteristics did not differ significantly from the effect of the mother's age at birth from 3 to 8 years in all the studied traits. These results differed from Salem (2016), who found no significant difference in body dimensions except in chest width. Dea *et al.* (2019) found that chest circumference was the best indicator of body weight with a correlation between body weight and other body measurements. Still, there were non-

significant differences between the strains (Fonseca *et al.*, 2021), and the regression of the mother's weight on weight at nine months of age was 0.65, 0.176, 0.179 and 0.97 cm/kg for the studied traits. These results agreed with the findings of Salem (2016), who found that the regression of the mother's weight on body weight at weaning was highly significant in his study on Shami and local goats. Manati *et al.* (2015) and Al-Qasimi *et al.* (2016) showed that the effect of the mother's age at birth on body weight at nine months was not significant. The reason may be that the environmental influences in this stage were higher due to the influence of genetic factors. Takele *et al.* (2021) indicated that traits were significantly affected by age during data recording on 18 morphological traits (Dea *et al.*, 2019; Silva-Jarquin *et al.* 2019).

Measurements of each individual can be influenced by several factors, such as those related to the production system: feed availability, growth, age, number of births and nutritional status. Estimates can also be different due to differences in the genetic merit of the breeds (Mohammed *et al.*, 2019). It was shown that breed effects were important sources of variance for all traits (Selvam *et al.*, 2021). Genetics has major role in any goat meat production program (Gupta *et al.*, 2021), and season has an important role in body weight and measurements (Waiz *et al.*, 2018). As for the phenotypic correlation between body measurements and weight at the age of nine months, the results showed a significant correlation 0.75115, 0.80350 and 0.87987, respectively (Table 3). As for the relationship of the depth of the abdomen with the width of the body at the chest, the width of the body at the abdomen, and the height at the rear, it amounted to 0.78070, 0.80005 and 0.84723, respectively. The relationship between body width at the chest, body width at the abdomen and height at the rear were highly significant. It reached 0.91393 and 0.76676 and the relationship was highly significant between the abdomen's width and the buttocks' height. There was a positive correlation between body weight, body length, chest circumference and tail length, and variation in chest circumference within the same genotype. It may be due to different sample sizes, study

Table 3. Phenotypic correlations between kids' weight and body dimensions at nine months of age

Dimensions	Body weight at nine months	Abdominal depth	Body width at chest	Abdominal width	Body height at the back
Body weight at nine months	-	0.87873**	0.75115**	0.80350**	0.87987**
Abdominal depth	0.87873**	-	0.78070**	0.80005**	0.84723**
Body width at chest	0.75115**	0.78070**	-	0.91393**	0.76676**
Abdominal width	0.80350**	0.80005**	0.91393**	-	0.80817**
Body height at the back	0.87987**	0.84723**	0.76676**	0.80817**	-

**Significant at P=0.01 level.

Table 4. Prediction of simple linear equations for studied traits

Dependent variable (Y)	Independent variable (X)	Prediction equation Y = a + b (X)	Coefficient of determination (R^2)
Weight at nine months	Dam weight at kidding	Y = 13.45 + 0.14 (X)	0.13**
Abdominal depth	Dam weight at kidding	Y = 26.74 + 0.08 (X)	0.08**
Body width at chest	Dam weight at kidding	Y = 9.98 + 0.02 (X)	0.09**
Abdominal width	Dam weight at kidding	Y = 10.28 + 0.03 (X)	0.18**
Body height at the back	Dam weight at kidding	Y = 50.08 + 0.18 (X)	0.16**
Weight at 9 months	Dam age at kidding	Y = 20.39 + (-0.27) (X)	0.01^{NS}
Abdominal depth	Dam age at kidding	Y = 31.60 + (-0.32) (X)	0.04*
Body width at chest	Dam age at kidding	Y = 11.40 + (-0.08) (X)	0.02^{NS}
Abdominal width	Dam age at kidding	Y =12.31 + (-0.10) (X)	0.04*
Body height at the back	Dam age at kidding	Y = 59.35 + (-0.37) (X)	0.02^{NS}

*,**Significant at P=0.05 and P=0.01 levels, respectively. NS-Not Significant.

places, measurement methods, age, etc. (Akhtar *et al*. 2021).

Table 4 shows the prediction of linear equations for the studied traits, and the results were significant in some of the traits studied. Hasana *et al*. (2014), Haile *et al*. (2019) and Sheriff *et al*. (2021) indicated that there were statistically significant correlations between body weight and body measurements that could be used in predicting body weight. Correlation analysis showed that chest circumference had the greatest correlation with body weight and thus could be used as a marker for weight estimation using regression equations and improving genetic merit.

Salim *et al*. (2019) explained the regression coefficient for most of the studied dimensions on the characteristics of the maternal weight at birth. Moreover, the birth weight had a significant effect but not for all the studied traits, with the possibility of relying on the studied illiterate traits and the newborn weight at birth to predict the body dimensions of the newborns at birth. Positive and significant regression was obtained at nine months of age (Waiz *et al*., 2018).

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