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ESTIMATING BODY WEIGHT FROM MORPHOMETRIC MEASUREMENTS OF BARKI GOATS RAISED UNDER SEMI-ARID CONDITIONS

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SUMMARY

Twenty-four Barki kids (12 males and 12 females) were weighed and measurements of height at withers (H), heart girth (G) and body length (L) taken biweekly for the first 24 weeks of life. This study aimed to test if the body weight of the growing Barki kids could be estimated from body measurements. The relationship was also examined on 70 non-pregnant adult does. Body weight of male and female Barki growing kids was significantly ($p<0.01$) and positively correlated with studied body measurements (L, G and H). Heart girth was a reliable predictor for estimating body weight of the growing male Barki kids ($r=0.89$) and adult Barki does ($r=0.96$) when using it alone. To increase the accuracy of prediction, more than one body dimension can be used. It was deduced that the body weight of Barki goats can be estimated in the field using morphometric measurement taken with tape.

Keywords: Barki goats, body weight, heart girth, body length, body height and prediction

INTRODUCTION

Goats are well adapted the dry areas of the tropics, where there is usually a shortage of food for humans and animals (Timon, 1985, and Egwu *et al.*, 1995). Therefore, the goat is an important animal under semi-arid conditions. This importance is related to their role and advantage over other livestock. Also, goats represent a major component of family income in arid and semi-arid regions as they are the main source of meat, milk, hair and skin (Guirgis, 1988). Goats have the advantage that they use marginal land, low capital investment and have low risk, and low labor requirements as they often herded by children.

Under field conditions in rural and desert, body weight may not be easy to measure, but linear body dimensions could be easier measured. Body measurements have been used by several investigators to predict body weight in different breeds of Indian goats (Valdez *et al.*, 1982; Bhattacharya *et al.*, 1984, Mukherjee *et al.*, 1986, Singh *et al.*, 1987 and Pander *et al.*, 1989), in the West Africa Dwarf goats (Tizikara and Chiboka, 1988), on Australian Merino and male Somali goats (Nigm *et al.*, 1995), and on Sahel goats (Mohamed and Amin, 1996).

Variation in body size is one of the criteria used in classifying breeds of goats (Devendra and Burns, 1983). Also, measurements of various body conformation are of value judging the quantitative characteristics of meat and are also helpful in developing suitable selection criteria (Bose and Basu, 1984, Sarma *et al.*, 1984, and Islam *et al.*, 1991).

The aim of this study was to estimate body measurements of the Barki goat and correlation between body weight and measurements of heart girth, body length and height at withers to predict body weight from linear measurements.

MATERIALS AND METHODS

Barki goat, the predominant breed in the North Western Coastal desert is adapted to the nomadic or wide grazing on the sparse vegetation of the desert. They are small in size, with fine head, long hair coat, mostly black in color but some individuals are brown with white spots on the head or the legs. They are multipurpose goats and used for production of meat, milk, hair and skin. They are considered to be hardy goats, which could stand well the scarcity of food and water. The average mature doe weight ranges from 19.9 to 30.9 kg, average dressing percentage is 40% (Haider, 1982).

Data were collected on twenty-four Barki growing kids (12 males and 12 females) and seventy non-pregnant adult does. The animals belonged to Maryout Research Station, of the Desert Research Center, located 180 km North West of Cairo. The goats were kept in open shaded pens, provided with a source of fresh water. Kidding took place during February- March 2000. Upon birth kids were identified with permanent metal ear tags. Body weight and sex were recorded. Kids were kept with their dams all the time up to weaning at an average age of three months. Kids from single birth were selected at random for the study.

The kid to be measured was strapped and weighed using a flat balance. Body weight (BW) was recorded to the nearest 0.1 kg when the animal was stable. Body measurements of the kids were taken using a measuring tape to the nearest 0.1 cm as follows; 1) body length (L), the distance between the point of shoulder and the pinbone, 2) withers height (H), the vertical distance between ground and the point of withers, 3) heart girth (G), the smallest circumference of the body just behind the shoulder. The height at withers (H) was taken on a flat surface when the animal was standing upright. All measurements were carried out individually for each kid on the exact age starting from birth and then biweekly up to 24 weeks. For the adult does (non-pregnant does), aged 2-5 years, the same morphometric measurements were recorded once. The data of growing kids and adult does were analyzed, correlation between biweekly body weight and corresponding body dimensions and stepwise regression was developed using SAS (1995).

RESULTS AND DISCUSSION

Average biweekly changes in body weight and body measurements of Barki growing males and females and their standard error (SE) were calculated. All body measurements of kids (L, H, and G) and body weights showed progressive increase through the first 24 weeks of age. Growing males kids significantly exceeded the females in body weights from birth to 24 weeks of age. Average body weight at birth

for males was 2.5 ± 0.09 kg compared to 2.0 ± 0.09 for females. At weaning (12 weeks) the average body weight of males was 6.2 ± 0.19 kg compared to 5.3 ± 0.19 for females, while at 24 weeks the average body weight of males was 9.8 ± 0.27 compared to 8.9 ± 0.27 kg for females.

Estimates of the correlation coefficients between body weight and studied body dimensions are presented in Table 1. Body weight of male and female kids was significantly (P<0.01) and positively correlated with body measurements. Similar results were found by Worman *et al.* (1990) for Tswana goat, Ifut *et al.* (1991) on Nigerian goats, Islam *et al.* (1991) and Khan *et al.* (1992) on Bengal goats, Nigm *et al.* (1995) on Australian Merino males and male Somali goats, Mohamed and Amin (1996) on Sahel goat kids.

Table 1. Correlation coefficients between biweekly body weight and the corresponding body measurements of Barki growing kids

Body measurements	Correlation coefficients	
	Male	Female
Body length (L)	0.83**	0.90**
Withers height (H)	0.79**	0.87**
Heart girth (G)	0.89**	0.88**

** P <0.01, df: 155.

The results revealed that the highest correlation coefficients was that between body weight and body length for females (0.90) followed by that between body weight and heart girth for males (0.89). Whereas, the withers height for males got the lowest correlation with body weight r= 0.79. These results are in agreement with numerous previous studies indicating that heart girth is the best body dimension used for predicting body weight.

Similar results were reported by Ifut *et al.* (1991) who stated that body length and heart girth gave the best prediction of body weight for females up to 22 months of age (r = 0.62 - 0.90 and 0.58- 0.74, respectively). Khan *et al.* (1992) on Bengal goats showed that correlation between heart girth and body weight for male and female accounted for 0.75 and 0.79, respectively.

The attained results from correlation analysis cast light on prediction of body weight of growing Barki kids using their body measurements. Tables 2 and 3 represent the multiple regression equations derived for estimating body weight of growing male and female Barki kids, respectively using one variable (G, L, and H) alone as a single predictor. In order to increase accuracy of body weight prediction, more than one dimension was used (G+L, G+H, L+H and G+L+H) as suggested by Mohammed and Amin (1996).

It may be deduced from the obtained results that heart girth is a reliable predictor for estimating body weight of the growing Barki kids when using it alone. To increase the accuracy of prediction, more than one body dimension can be used.

Average of body weight (BWD), Body length (L), heart girth (G), and body height (H) of non-pregnant adult Barki does and standard errors of each are presented in Table (4).

Table 2. Regression prediction equations for body weight (BW) in kg for growing male kids and related coefficients of determination (R^2)

Variables	Prediction equations	R^2
G	BW = [0.35 10.47.	0.80
L	BW = [0.44 11.71.	0.70
H	BW = [0.46 13.35.	0.62
G + L	BW = [0.20 x L (cm)] + [0.24 x G (cm)] - 13.43.	0.87
G + H	BW = [0.06x H (cm)] + [0.32 x G (cm)] - 11.33.	0.80
L + H	BW = [0.31 x L (cm)] + [0.18 x H (cm)] - 13.85.	0.72
G + L + H	BW= [0.26 x L(cm)]-[0.16 x H (cm)]+[0.30 x G (cm)]-11.92.	0.88

G; heart girth, L; body length, h; body height.

Table 3. Regression prediction equations for body weight (BW) in kg for growing female kids and related coefficients of determination (R^2)

Variables	Prediction equations	R^2
G	BW = [0.35 10.45.	0.77
L	BW = [0.39 x L (cm)] - 9.98.	0.81
H	BW = [0.49 14.29.	0.76
G + L	BW = [0.27 x L (cm)] + [0.12 10.54,	0.82
G + H	BW = [0.21x H (cm)] + [0.21 12.59.	0.79
L + H	BW = [0.30 x L (cm)] + [0.12 11.39,	0.81
G + L + H	BW = [0.25 x L (cm)] + [0.06 x H (cm)] + [0.10 x G (cm)] - 11.11.	0.82

G; heart girth, L; body length, h; body height.

Table 4. Average body weight (kg) and body measurements (cm) of adult Barki does ± standard error (SE)

Variable	Mean	Standard error
Body weight (BWD)	26.57	0.46
Body length (L)	60.33	0.48
Heart girth (G)	71.34	0.62
Withers height (H)	65.20	0.43

df: 69

The correlation between body weight of the adult does and morphometric measurements was significant and positive. Heart girth (G) was the highest correlated (r=0.96) with body weight (BWD) compared to body height (H) (r= 0.47) and body length (L) (r= 0.33). These results are in agreement with those obtained by Nigm *et al.* (1995) who reported that heart girth had the highest correlation coefficient with body weight with r = 0.88 followed by body length (r=0.70), then body height (r = 0.68) and with Varade *et al.* (1997), who reported that heart girth and body length of adult female goats were significantly and positively correlated with body weight.

Contrarily, Mohammed and Amin (1996) showed that the correlation between heart girth and body weight of adult Sahel goats was less when compared with body length and withers height. The authors attributed this finding to body conformation of Sahel, environmental differences and the age of the adult does.

Equations for prediction of body weight of adult does (BWD) in kg from body dimensions are presented in Table 5.

Table 5. Regression prediction equations for body weight (BW) in kg for adult does and related coefficients of determination (R^2)

Variables	Prediction equations	R^2
G	BWD = [0.90 37. 71.	0.93
L	BWD = [0.23 x L (cm)] + 12. 73.	0.11
H	BWD = [0.42 1.06.	0.22
G + L	BWD = [0.06 x L (cm)] + [0.88 39.77.	0.94
G + H	BWD = [0.87 x G (cm)] + [0.08 x 40.65.	0.94
L + H	BWD = [0.12 x L (cm)] + [0.36 4.35.	0.24
G + L + H	BWD = [0.86 x G (cm)] + [0.06 x H (cm)] + [0. 04 x L 41.50.	0.94

G; heart girth, L; body length, h; body height.

Birth weight of male and female growing kids were significantly ($P<0.05$) and positively correlated with weight at weaning ($r = 0.58$ and 0.59, respectively) and weight at 24 weeks of age ($r = 0.45$ and 0.34, respectively). The equations derived from birth weight of male (BRWM) and female (BRWF) growing kids to predict weight at weaning at 6 month of age are presented in Table (6).

Table 6. Prediction equations for weaning and 6 month weight (kg) for males and females and related coefficients of determination (R^2)

Prediction equation	R^2
WWM = [1.12 x BRWM (kg)] + 3.44.	0.34
WWF = [1.52 x BRWF (kg)] + 2.31.	0.35
PWM = [1.12 x BRWM (kg)] + 7.07.	0.21
PWF = [1.65 x BRWF (kg)] + 5.68.	0.15

WWM; weaning weight of male, WWF; weaning weight of female
PWM; weight at 6 month for male, PWF; weight at 6 month for female

Results showed that predictive values are indeed very low and earlier weights cannot be accurately used to predict later weights.

CONCLUSION

The results of the present study revealed that body weight of Barki growing kids was significantly and positively correlated with studied body measurements (L, G and H). These results are in agree with numerous previous studies indicating that heart girth is the best body dimension used for estimating body weight.

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تقدير وزن الجسم من المقاييس الجسمية للماعز البرقى المرباة تحـــت الظـــروف شـــبه الصحراوية.

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كان الهدف من الدراسة هو إختبار ما إذا كان من الممكن تقدير وزن جسم الجداء النامية من مقاييس الجسم (طول الجسم و محيط الصدر و إرتفاع الجسم) . وقد تم وزن ٢٤ جدي برقى (١٢ ذكراً و١٢ أنثى) وكذلك تم تسجيل إرتفاع الجسم ومحيط الصدر وطول الجسم خلال الستة شهور الأولى من الحياة. واختبرت أيضاً هذه العلاقة على ٧٠ عنزة ناضجة غير حامل. إرتبط وزن الجسم فى ذكور و إناث جداء البرقى النامية إيجابياً ومعنوياً (احتمال اقل من ٠,٠١) مع مقاييس الجسم المدروسة. وكان محيط الصدر أكثر المقاييس دقة فى تقدير وزن الجسم فى جداء ذكور البرقى النامية (ر= ٠,٨٩) و الماعز البرقى الناضجة (ر= ٠,٩٠) حينما استخدم هذا المقياس بمفرده . ولزيادة دقة التنبؤ تم إستخدام أكثر من مقياس. و من ذلك يمكن إستنتاج أنه يمكن تقدير وزن جسم الماعز البرقى عمليا باستخدام مقاييس الجسم بواسطة شريط متري.