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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Relationship between live weight and body measurements of Kabashi, Ashgar and Nilotic adult rams

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Abstract

This experiment was conducted to examine the relationship between the live weight and body measurements of Kabashi, Ashgar and Nilotic adult rams. Prediction of live animal weight using the body measurements was also aimed. For a period of 45 days (15 days adaptation period followed by 30 days experimental period), 8 Kabashi, 5 Ashgar and 9 Nilotic adult rams of different ages were weekly weighed and their body measurements (scapuloischial length. wither height and heart girth) were taken using a measuring tape. Taking the age of the animal as a covariate, the collected data were tested for the significance of animal type effect using analysis of covariance. The correlations of live weight and measurements of each type were also tested. The regression of the live weight on the measurement of the highest correlation coefficient was calculated for the pooled data and for each type separately. The results revealed that Ashgar sheep significantly excelled Kabashi and Nilotic rams in the examined body measurements and live weight, whereas the Nilotic type was the inferior in all studied traits. Live weight correlated significantly with all of the three body measurements and the highest coefficient for heart girth correlation. The regression of live animal weight on heart girth was significant and had the coefficients of determinations (R^2) 0.60, 0.91 and 0.66 for Ashgar, Kabashi and Nilotic rams, respectively. When the data of the three types of rams was pooled the regression of live weight on heart girth had R^2 = 0.86. The study concluded that for the three type of rams, live animal weight regressed on heart girth in a linear trend and it can be estimated with a satisfactory precision using the formula y = 1.452x-73.247, where y is the live animal weight (kg) and x is the heart girth (cm).

Keywords: rams, Kabashi; Ashgar; Nilotic; weight; measurements

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Introduction

The total population of animals at the end of the year 2009 in the countries of Sudan and South Sudan was estimated to be about 140.9 million heads of cattle, sheep, goats and camels. The sheep represents 36.6% of this huge number (MOARF, 2010). According to Mcleroy (1961), sheep of these two countries are classified into five basic and three fused ecotypes. The basic ecotypes are Desert, Nilotic, Arid equatoria, Arid upland and West African Fulani whereas the fused ecotypes are the crosses of these types those distributed along the adjacent boundaries of the territories of the main ecotypes. From numerical point of view only 2 pure ecotypes are important, and these are Desert that resembles 65% to 75% and Nilotic that resembles 12% of the total sheep population, their crosses (El Fung and Baggara sheep) are about 18% (El Hag and Mukhtar, 1978 and Sulieman et al., 1990). The Desert ecotype distributed on the Sudan country and it consists of seven regional sub-ecotypes named Kabashi, Gezira (Ashgar and Abrag), Butana, Bija, Meidob, Watish and North riverine wooled sheep. The Nilotic ecotype distributed on the South Sudan country and it consists of three regional sub-ecotypes named Shilluk, Mongalla and Nuba Mountain.

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Most of the sheep population in the Sudan and South Sudan is raised by Nomads under an extensive system where most of the modern scientific techniques were not practiced. Estimation of the live weight of the animal is very important and necessary in many field operations. It is well known that the amount of feed that satisfied the animal's appetite is a function of live weight. Sheep eat about 4.2 - 5.2% of live weight (El Khidir et al., 1988, Atta and El Khidir, 2010), whereas the camel needs to eat about 2.5% of its live weight (Eltahir et al., 2011). In addition, most of the animal veterinary prescriptions depend mainly on the unit live weight of the animal so there should be a quick and easy way that enables the physician to estimate the live weight of the animal. Body measurements are used widely to estimate the live weight of animals, especially when there is no access to weighing equipment. This method is more common for cows (El Khidir, 1980), to a lesser extent for pigs (Lawrence and Fowler, 2002), sheep (Atta and El Khidir, 2004) and goats (Atta et al., 2011). The relationship between live weight and body measurements represents the details of the growth of the animal body. Growth is a complex process of life caused by the growth rates of the different body tissues. In practice, the external measurements of the body estimate the growth of the skeletal structure alone or with the soft tissue. According to Sulieman et al. (1990) and Atta and El Khidir (2004), body length and height at wither were skeletal measurements those were less variable with live weight change because they measure the growth of bone which is an early maturing tissue while heart girth measures the growth of bone and muscle together, which is most closely associated with the change in live weight. For animals growing over a wide weight range, the relationship between live weight and heart girth has been reported to be curvilinear. Brody (1945) used a nonlinear equation to describe cattle body growth based on heart girth and he found that live weight changed with a cubed heart girth unit. Similarly, Atta and El Khidir, (2004) found that the live weight of Nilotic sheep can be estimated using the equations: $y = 0.0001668x^{2.867}$ for males and $y = 0.0010674x^{2.407}$ for females, where y and x are the live weight and heart girth, respectively.

The objectives of the study are to examine the relationship between live weight and body measurements of Kabashi, Ashgar and Nilotic adult rams. The study also aimed at examining the body measurements as predictors of live animal weight.

Materials and Methods

The experiment was conducted during April and May 2010 at the Small Ruminant Research Unit of the Animal Production Research Center, Khartoum North, Sudan at the latitude $15^{o}\ 36^{'}$ north and the longitude $32^{o}\ 33^{'}$ east. Twenty two adult rams of different ages (1 – 3 years of age) from the sheep flock of the Research Station were grouped according to their type into three groups. The animals' types were Kabashi (8 animals), Ashgar, (5 animals) and Shilluk sub-ecotype of Nilotic sheep (9 animals). Animals of each type were accommodated and fed together. The same concentrate ration, sorghum straws, water and liking salts were always available in front of the animals. Weekly and for a period of 45 days (15 days adaptation period followed by 30 days experimental period) the body measurements of all rams were taken using a measuring tape after animal weighing. The studied body measurements are the scapuloischial length which is the distance between the dorsal tip of scapula and the tip of the ischium, the height at wither which is the height of the highest point on the dorsum of the animal above the scapular vertical to the ground surface at the level of the front feet and the heart girth which is the circumference of the chest just behind the foreleg.

Statistical Analysis

Taking the age of the animal as a covariate, the collected data were tested for the significance of animal type effect using analysis of covariance (StatSoft, 2011). The means of the significantly affected traits were separated by Duncan Multiple Range Test. The correlations of live weight and body measurements of each type were tested. The regression of the live animal weight on the body measurement of the highest correlation coefficient was calculated for the pooled data and for each type separately.

Results and Discussion

The result showed the significant differences between the three sub-ecotypes in live animal weight and body measurements (Table 1). The desert sheep ecotypes (Ashgar and Kabashi) significantly excelled Nilotic rams in all the examined traits. This might be attributed to that observed by Macleroy (1961). He noted that Nilotic ecotype has small frame, short legs and small body size to suit its bushy and forest natural habitat, whereas, the Desert sheep has long legs and narrow trunk to be well adapted to its habitat and to travel long distances in search for water and pasture.

Table (2) showed the correlations coefficients matrix of live animal weight and body measurements for the pooled data of the three types of sheep, whereas Tables (3), (4) and (5) showed the correlation coefficients matrices of live weight and body measurement for the Ashgar, Kabashi and Nilotic rams, respectively. In the four tables, the rams' live weight correlated significantly and positively with most of the body measurements with the highest coefficient of correlation for the heart girth. This finding agreed with the studies of Topal and Macit (2004) and Atta and Khidir (2004). They noted that heart girth has the highest correlation with live weight because it is the most measurement affected by fattening status and animal conditions. Lawrence and Fowler (2002) added that heart girth is a measure for both the muscular and bony tissues whereas the height at wither and body length measurements measure only the skeletal tissue.

The regressions of live animal weight on heart girth measurement were always significant (Table 6). These results were in agreement with those of Atta and Elkhidir (2004) who also used heart girth to predict live weight of Nilotic male and female sheep from birth to sexual maturity. However they used a non linear formula based on $y= ax^b$. When this formula was used for the present data lower coefficients of determinations were observed. Consistently, Lawrence and Fowler (2002) stated that when animals are growing over a wide weight range, the relationship between live weight and heart girth is curvilinear but it may be linear if the weight range is narrow. The sensitivity of the present regressions of live weight on heart girth was tested by calculating the percentages of difference between the observed and that calculated according to the prediction formulae (Table 7). The calculated percentages were always below 5% indicating the good precision of live animal weight prediction by these formulae. The results also showed that for the three types of rams the variations in the percentage of differences when using the pooled or the type's formulae were not significant. This indicated that the pooled data formula can be used with a satisfactory precision to predict the live weight of Ashgar, Kabashi and Nilotic adult rams, however, Johanson and Hildman (1954) noted that the error involved in estimating the live weight of cattle from heart girth measurement may be decreased by making an allowance for breed variation.

Table 1: Live weight (kg) and body measurements (cm) of Kabashi, Ashgar and Nilotic adult rams

Breed	No.	HG	HW	SIL	WT
Kabashi	8	80.34[b]	79.67[b]	66.03[b]	44.95[b]
Ashgar	5	91.10[a]	84.75[a]	76.10[a]	61.30[a]
Nilotic	9	78.47[b]	70.36[c]	61.69[c]	40.89[b]
SE		2.367	1.057	1.004	2.617
L.S.		**	**	**	**

In this table and the following: No. = Number of animals; HG = Heart girth, HW = Height at wither, SIL = Scapuloischial length; WT = live weight, SE = Standard error, L.S. = Level of treatment significance; ** = Treatment is significant (P<0.01); a, b and c = means on the same column of different superscripts are significantly different (P<0.05).

Table 2: Correlation coefficients matrix of pooled data of Ashgar, Kabashi and Nilotic rams live weight and body measurements

Variable	HG	HW	SIL	WT
HG	1.00			
HW	0.70*	1.00		
SIL	0.73*	0.77*	1.00	
WT	0.93*	0.78*	0.80*	1.00

Number of observations = 88; * = marked correlations are significant (P<0.05)

Table 3: Correlation coefficients matrix of Ashgar rams live weight and body measurements

Variable	HG	HW	SIL	WT
HG	1.00			
HW	0.77*	1.00		
SIL	0.20	0.11	1.00	
WT	0.77*	0.70*	-0.22	1.00

Number of observations = 20; * = marked correlations are significant (P<0.05)

Table 4: Correlation coefficients matrix of Kabashi rams live weight and body measurements

Variable	HG	HW	SIL	WT
HG	1.00			
HW	0.90*	1.00		
SIL	0.76*	0.73*	1.00	
WT	0.95*	0.90*	0.83*	1.00

Number of observations = 32; * = marked correlations are significant (P<0.05)

Table 5: Correlation coefficients matrix of Nilotic rams live weight and body measurements

Variable	HG	HW	SIL	WT
HG	1.00			
HW	0.46*	1.00		
SIL	0.48*	0.19	1.00	
WT	0.81*	0.40*	0.56*	1.00

Number of observations = 36; * = marked correlations are significant (P<0.05)

Table 6: Regression of live animal weight (y) on heart girth measurement (x) according to the equation: y = a + bx for the pooled data, Ashgar, Kabashi and Nilotic rams

	a	b	R^2	SE of estimate	p	No.
pooled data	-73.247	1.452	0.86	4.470	**	88
Ashgar	-52.829	1.253	0.60	5.873	**	20
Kabashi	-62.684	1.340	0.91	3.930	**	32
Nilotic	-46.252	1.083	0.66	1.844	**	36

R^2 = coefficient of determination; P = probability of error (P<0.01)

Table 7: Percentage of difference between observed and calculated live weights of Ashgar, Kabashi and Nilotic rams

Pooled data formula			Type's data formula			SE	L.S.
Ashgar	Kabashi	Nilotic	Ashgar	Kabashi	Nilotic		
2.84	4.76	-0.33	-1.18	0.48	4.37	5.184	NS

Conclusions

- The rams of the Desert sub-ecotypes always excel the rams of the Nilotic sub-ectype in live weight and body measurements.

- The relationship between animal weight and body measurements of the studied rams was linear.
- The live weight of adult rams of the three type of sheep can be estimated using heart girth measurements with a satisfactory precision by the formula y = 1.452x-73.247, where y is the live weight (kg) and x is the heart girth (cm).

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