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Meat Characteristics of Sheep and Goat Breeds Commonly Consumed in U.A.E. 2. Use of Body Dimensions for Predicting Body and Carcass Weights.

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ABSTRACT :

Eight body dimensions were measured on 73 Australian Merino males (AM) and 44 Somali Goat males (SG) to predict body weight (BW), hot and cold carcass weight (HCW&CCW, resp.). Heart girth (HG) was the best single predictor and accounted alone, for 77% of the variation in BW of AM. Entry of chest depth (CD) followed by circumference of rear flank (RF) into the multiple regression prediction equation increased R^2 to 84%. In SG, HG was the single significant variable and R^2 was only 45% .

Heart girth was, also, the most significant variable for predicting HCW and CCW of AM, R^2 was 72.8 and 72.2%, respectively. Entry of CD increased R^2 to 79.7 and 79.5%, resp. In SG, HG was replaced by HAW (height at withers) which was responsible for 56.6 and 51.8% of the variation in HCW and CCW, resp. For HCW, entry of round circumference (RC) improved R^2 to 65.4%, successively increased by incorporating CD to 73.4% . However, for CCw, entry of CD in the 2nd step increased R^2 to 62.5 while addition of RC improved the prediction determination to 70.8%.

Differences between AM and SG are attributable to genotypic variations, differences in numbers of experimental animals and to magnitude of variability in predicted traits.

Key words : Sheep, Goat, Body dimensions, Body weight, Prediction.

INTRODUCTION

Practical methods of assessing yield of meat in live animals should be rapid, inexpensive and reasonably accurate. Reports on the use of live body dimensions to predict meat merit of the animal are markedly contradicting. (Galal et al., 1965; Fahmy and Galal., 1968; Berg and Butterfield, 1976; Abdallah and Rashad, 1981;Al-Jalili and Aziz, 1990 and Mc Gregor, 1990). Most of these studies indicated that live weight is the best single predictor of carcass merit. However, under some situations, especially under field conditions of developing countries, where body weight itself may not be easy to measure, body dimensions could be the most practical and feasible means to predict animal meatness.

The objective of the present study was to determine the significance of live body dimensions for predicting body and carcass weights of Merino sheep and Somali goats imported for slaughter in U.A.E.

MATERIALS AND METHODS

The present study was conducted at Al-Ain Slaughter House during the period from November, 1989 to June 1990. Data were

collected on 73 Australian Merino and 44 male Somali goats chosen randomly from sheep and goats imported for slaughter in Al-Ain abattoir.

Animals were weighed and their body dimensions were measured just prior to slaughter after fasting for 18 h. Body dimensions recorded were : Heart Girth (HG): circumference of the body just behind the fore legs; Chest Depth (CD): vertical distance from the withers to the chest floor; Height at Withers (HAW): vertical distance from the withers to the floor; circumference of Rear Flank (RF): circumference of the body just before the hind legs; Round Circumference (RC): circumference of the round just under the body floor; Pelvis Width (PW): distance between the two hooks; Chest Width (CW): width of the body at the withers; and Body Length (BL): bone. All dimensions were measured to the nearest cm., HG, RF and RC were measured with tape while the others were measured using a standard steel calliper.

Hot carcass weight (HCW) was recorded including kidneys while cold carcass weight (CCW) was determined after chilling for 24 h at 4^0C. Data were analysed and prediction equations were developed using SAS General Linear Models Procedure (1982). Independent variable was included into the step-wise multiple regression equation only if its inclusion added significantly ($P < .05$) to the accuracy (R^2) of the equation.

RESULTS AND DISCUSSION

Table 1 shows means, standard deviation, minimum values of the various body dimensions measured on Australian Merino (AM). Variability estimates among individuals in different body dimensions, expressed as C.V., were relatively low, C.V. ranged

Table 1. Mean, standard deviation, minimum and maximum values of live body dimensions of Merino sheep at slaughter.

Variable	Mean	Standard deviation	Minimum	Maximum
Heart girth (HG, cm.)	91.9	9.21	71	112
Chest depth (CD, cm.)	30.4	3.38	23	39
Height at withers (HAW, cm.)	67.7	6.59	46	79
Rear flank (RF, cm.)	91.6	11.70	63	128
Round circumference (RC, cm.)	44.4	6.29	22	56
Pelvis width (PW, cm.)	19.7	3.68	13	29
Chest width (CW, cm.)	22.3	2.99	16	29
Body length (BL, cm.)	47.2	4.74	37	58

from 9-12% with the exception of PW (C.V. = 18.7 %) and RC (C.V. = 14%). Larger variability estimates, however, were observed for body and carcass weights, C.V. ranged from 21-25%. Live body weight of AM averaged 40.4±1.0 kg and ranged from 24 to 65 kg. Hot carcass weight (HCW) averaged 20.5±0.6 Kg and ranged from 10.7 to 33.5 kg while cold carcass weight (CCW) averaged 20.1±0.6 kg and ranged from 10.5 to 33.1 kg.

Table 2 presents estimates of the simple correlation coefficients among BW, HCW, CCW and the various body dimensions in AM. All correlations were highly significant except for that between pelvis width (PW) and height at witheres (HAW), (r = 0.13 and P<.25). Heart girth (HG) and chest depth (CD) had the highest correlations with each of BW, HCW, and CCW; r ranged from 0.84 to 0.88.

Table 3 presents the multiple regression equations developed to predict BW, HCW and CCW of AM with corresponding standard error (S) and coefficients of determination (R^2). When used as a single predictor, HG alone accounted for 77% of the variation in BW. Entry of CD, in the 2nd step, added 6.34% to the R^2 which increased to 83.3%. In the 3rd step, the inclusion of rear flank circumference (RF) made a further but small increase of only 0.87. Thus, the equation including HG, CD and RF could predict BW of Australian Merino with an accuracy of 84.2, which could be of practical importance in situation where it is not possible to weigh animals.

Similarly, heart girth alone contributed most of the variation in both HCW and CCW of AM. When used alone, HG accounted for 72.8 of the variation in HCW. Numerous studies previously indicated that HG is the best body dimension used for predicting body and carcas weights of meat animals (Brown et al., 1974;

Table 2. Simple correlation coefficients[a] among body weight, carcass weight and certain body dimensions in Merino sheep.

Variables	BW	HAW	CD	CW	PW	BL	HG	RF	RC*
Body weight (BW)	1.00	0.68	0.84	0.66	0.41	0.70	0.88	0.83	0.65
Hot carcass weight (HCW)	0.95	0.70	0.84	0.62	0.31	0.70	0.85	0.75	0.63
Cold carcass weight (CCW)	0.94	0.69	0.84	0.61	0.30	0.69	0.85	0.74	0.62
Height at withers (HAW)			0.72	0.34	0.13	0.68	0.63	0.63	0.61
Chest depth (CD)				0.60	0.29	0.67	0.79	0.73	0.57
Chest width (CW)					0.72	0.46	0.74	0.76	0.58
Pelvis width (PW)						0.31	0.52	0.60	0.41
Body length (BL)							0.71	0.66	0.59
Heart girth (HG)								0.89	0.79
Rear flank circumf. (RF)									0.73

* Round circumference

a $P < 0.0001$ except for those of PW with BW, HCW, CCW, HAW, CD, BL and RC where $P < 0.0002$, 0.005, 0.007, 0.25, 0.009, 0.006 and 0.0002, in respective order.

Table 3. Multiple regression prediction equations for body weight, hot carcass weight and cold carcass weight with standard errors of estimate (S) and Coefficient of determination (R^2) in Merino sheep.

Prediction equations	S	R2
Body weight, Kg :		
1. Y = - 36.8 + 0.847 (HG, cm.)	4.83	0.7695
2. Y = - 41.0 + 0.530 (HG, cm.) + 1.089 (CD, cm.)	4.23	0.8329
3. Y = - 39.2 + 0.369 (HG, cm.) + 1.045 (CD, cm.) + 0.154 (RF, cm.)	4.22	0.8416
Hot carcass weight, Kg :		
1. Y = - 23.0 + 0.478 (HG, cm.)	3.05	0.7280
2. Y = - 25.6 + 0.286 (HG, cm.) + 0.661 (CD, cm.)	2.69	0.7974
Cold carcass weight, Kg :		
1. Y = - 23.1 + 0.475 (HG, cm.)	3.07	0.7223
2. Y = - 25.7 + 0.278 (HG, cm.) + 0.676 (CD, cm.)	2.70	0.7952
3. Y = - 25.4 + 0.334 (HG, cm.) + 0.612 (CD, cm.) - 0.178 (PW, cm.)	2.65	0.8064

Abdallah and Rashad, 1981; Nicholson and Sayers, 1988 and Sabry, 1991). However, in the 2nd step, the entry of CD added a considerable contribution of 7% to increase R^2 of the model to 79.7%. No other body dimensions contributed significantly to the equation. Since the main objective of the present investigation was to test the predictive capacity of body dimensions not body weight, the latter was primarily excluded from the model. However, Al-Jalili and Aziz (1990) predicted HCW of Awassi lambs using BW, PW , and HAW with R^2 value of 96%.

With regard to CCW, HG contributed 72.2% of the total variation. Again, CD came second and scored a partial determination of 7.3% increasing the model's R^2 to 79.5. Thses figures are very comparable with those mentioned above for HCW, however, in the 3rd step, PW made a further but small improvement of only 1%, $R^2 = 80.6\%$. That is to say dressing percentage of the Merinos could be accurately estimated ($R^2 = 79.5$), simply by measuring HG and CD of the animal.

Table 4 shows mean, standard deviation, minimum and maximum values for the various body dimensions in Somali goats (SG). Body weight of experimental animals averaged 22.8 $\pm$ 0.4 Kg and ranged from 18 to 34 kg. The range obtained for BW in SG, 16 Kg, is almost one third of that found for AM (41 Kg). HCW of SG averaged 10.9 $\pm$ 0.2 Kg and ranged from 8.4 to 13.8 Kg, while CCW averaged 10.5 $\pm$ 0.2 Kg and ranged from 7.9 to 12.6 Kg. The range of HCW in SG is less than one fourth that of AM and that of CCW is only one fifth the range observed for CCW of AM. Also, coefficients of variations (C.V.) of BW, HCW and CCW of SG is almost half those calculated for AM. These comparisons indicate that the magnitude of variation in each of BW, HCW and CCW is much less than its corresponding amount in AM.

Table 4. Mean, standard deviation, minimum and maximum values of live body dimensions of Somali goats at slaughter.

Variable	Mean	Standard deviation	Minimum	Maximum
Heart girth (HG, cm.)	67.9	3.05	62	75
Chest depth (CD, cm.)	25.3	1.45	23	29
Height at withers (HAW, cm.)	63.5	3.89	54	73
Rear flank (RF, cm.)	69.4	4.67	60	87
Round circumference (RC, cm.)	32.8	3.78	24	41
Pelvis width (PW, cm.)	13.0	1.96	10	18
Chest width (CW, cm.)	14.7	2.36	11	23
Body length (BL, cm.)	37.1	2.50	34	49

Table 5 presents estimates of the simple correlation coefficcients among each of BW, HCW and CCW and the various body dimensions in SG. In general, values of correlation are much less than their corresponding values estimated for AM. HG and CD were highly correlated with BW ($r = 0.67$ and 0.59, resp. and $P < .0001$). With both HCW and CCW, HAW was the highest correlated body dimension ($r = 0.75$ and 0.72, resp and $P < .0001$). Corresponidng correlations of RC amounted 0.68 and 0.66, $P < .0001$. CD also showed comparable and significant values, however, HG showed smaller values, $r = 0.52$, $P < .0003$ and 0.51, $P < .0005$ with hot and cold carcass weight, respectively.

Table 6 shows multiple regression equations developed to predict BW, HCW and CCW of SG. HG was the only significant variable contributed to the variation in BW of SG. R^2 was only 45% , much less than that obtained for the same variable in AM, 0.77%. Body dimensions showed more predictive capacity in estimating carcass weight of SG. HAW was the most significant variable scoring alone R^2 of 56.6% in estimating HCW. R^2 improved to 65.4% by incorporating RC into the prediction equation. In the 3rd step, the entry of CD added a partial R^2 of 7.3 to improve R^2 of the equation to 73.4% .

Minor changes in ranking of the body dimensions could be observed in predicting CCW of SG, R^2 obtained from using HAW alone was 51. 8, improved to 62.5 by incorporating CD and then to 70.8% by the entry of RC.

Differences mentioned earlier between AM and SG could be attributed to various factors; genetic differences (Abraham et al., 1968) Which are probably reflected in different anatomic characteristics. As a tropical goat breed, SG are characterized with relatively long

Table 5. Simple correlation coefficients[a] among body weight, carcass weight and certain body dimensions in Somali goats.

Variables	BW	HAW	CD	CW	PW	BL	HG	RF	RC*
Body weight (Bw)	1.00	0.35	0.59	0.17	0.11	0.25	0.67	0.43	0.32
Hot carcass weight (HCW)	0.50	0.75	0.64	-.22	-.30	0.18	0.52	0.04	0.68
Cold carcass weight (CCW)	0.49	0.72	0.65	-.21	-.29	0.21	0.51	0.01	0.66
Height at withers (HAW)			0.52	-.21	-.41	0.22	0.49	0.004	0.59
Chest depth (CD)				0.08	-.13	0.45	0.68	0.31	0.31
Chest width (CW)					0.42	0.02	0.24	0.26	-.37
Pelvis width (PW)						-.05	0.20	0.39	-.57
Body length (BL)							0.43	0.20	0.11
Heart girth (HG)								0.63	0.20
Rear flank circumf. (RF)									-.14

* Round circumference.

[a] Correlation of 0.28, $P < .05$; 0.37, $P < .01$.

Table 6. Multiple regression prediction equations for body weight, hot carcass weight and cold carcass weight with standard errors of estimate (S) and coefficient of determination (R^2) in Somali goats.

Prediction equations	S	R2
Body weight, Kg :		
1. Y = - 19.1 + 0.616 (HG, cm.)	7.14	0.4507
Hot carcass weight, Kg :		
1. Y = - 4.90 + 0.248 (HAW, cm.)	2.14	0.5661
2. Y = - 4.45 + 0.177 (HAW, cm.) + 0.124 (RC, cm.)	1.94	0.6536
3. Y = - 8.23 + 0.121 (HAW, cm.) + 0.123 (RC, cm.) + 0.293 (CD, cm.)	2.03	0.7344
Cold carcass weight, Kg :		
1. Y = - 4.63 + 0.238 (HAW, cm.)	2.26	0.5180
2. Y = - 8.99 + 0.172 (HAW, cm.) + 0.338 (CD, cm.)	2.18	0.6249
3. Y = - 8.51 + 0.103 (HAW, cm.) + 0.335 (CD, cm.) + 0.21 (RC, cm.)	2.13	0.7079

legs which gives a body height close to that of AM, despite the marked difference in live body weight. The finding that HG is the most reliable predictor of BW in both species and for HCW and CCW in AM where HAW is the most reliable predictor for HCW and CCW in SG may indicate differences in the distribution of various body components among the two types of animals. Different numbers of animals, 73 AM vs. 44 SG and differences in magnitude of variation in the traits considered, all contributed to the differences detected between AM and SG.

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مجلة الإمارات للعلوم الزراعية (١٩٩٥) . ٧ : ٣٩ - ٥٤

خصائص لحوم سلالات الاغنام والماعز شائعه الاستهلاك فى دولة الامارات العربية المتحدة . ٢- استخدام مقاييس الجسم فى التنبؤ بوزن الجسم ووزن الذبيحة .

على عطيه نجم ، عمر محمد عبد الله ، محمد بدرالدين ابوالعلا ، حسين محمد كامل ومصطفى عادل احمد

كلية العلوم الزراعية - جامعة الامارات العربية المتحدة -ص ب ١٧٥٥٥ العين- دولة الامارات العربية المتحدة

ملخص

استخدم ٨ مقاييس لجسم ٧٣ ذكر مرينو استرالى و ٤٤ ذكر ماعز صومالى للتنبؤ بوزن الجسم الحى ، وزن الذبيحة الساخن ووزن الذبيحة البارد . فى اغنام المرينو كان محيط الصدر أفضل مقياس جسمى تنبؤاً واعطى بمفرده دقة قدرها ٧٧٪ عند التنبؤ بوزن الجسم وعندما أضيف له عمق الصدر ومحيط الخاصرة الخلفية ارتفعت دقة معادلة الانحدار المتعدد فى التنبؤ الى ٨٤٪ . فى الماعز الصومالى كان محيط الصدر هو المتغير المعنوي الوحيد للتنبؤ بوزن الجسم وكانت دقة التنبؤ ٤٥٪ فقط.

كان محيط الصدر أيضاً اكثر المقاييس معنوية فى التنبؤ بوزن الذبيحة الساخن ووزن الذبيحة البارد فى المرينو الاسترالى وكانت دقة التنبؤ ٨ . ٧٢ ٢ . ٧٢٪ (على الترتيب) ، وبإدخال عمق الصدر فى معادلة التنبؤ زادت دقتها الى ٧ . ٧٩ و ٥ . ٧٩ (على الترتيب) . وفى الماعز الصومالى كان ارتفاع الكتف هو أهم مقياس وبلغت دقته بمفرده ٦ . ٥٦ و ٨ . ٥١٪ عند

التنبؤ بوزني الذبيحة الساخن والبارد (على الترتيب) ؛ بادخال محيط الفخذ زادت دقة التنبؤ بوزن الذبيحة الساخن الى ٤ . ٦٥٪ ثم زادت الى ٤ . ٧٣٪ بإضافة عمق الصدر الى معادلة التنبؤ ، وبالنسبة للتنبؤ بوزن الذبيحة البارد أدي إدخال عمق الصدر الى زيادة دقة التنبؤ الى ٥ . ٦٢٪ ثم زادت الى ٨ . ٧٠٪ بإضافة محيط الفخذ.

عزيت الفروق التي لوحظت بين المرينو الاسترالى والماعز الصومالى الى الاختلافات الوراثية والاختلافات فى عدد الحيوانات المستخدمة فى البحث وكذلك الى حجم التباينات فى الصفات المراد التنبؤ بها .

كلمات مفتاحية : اغنام ، ماعز ، مقاييس الجسم ، وزن الجسم ، تنبؤ .