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Hot Carcass Specific Gravity: Could Be Used Accurately for In-vivo Body Composition Determination

A.E. Fekry and M.K. Shebaita

Nuclear Research Center, Cairo 13759;

and College of Agriculture, El-Fayoum 63514, Egypt

خلاصة

في هذا البحث استخدمت 12 من الجداء البالغة (عمر 4 سنوات) عند متوسط وزن يبلغ 30،5 كجم، ولقد تم تقدير وزن الجسم وحيز الماء المشع وخيز الأنتيبيرين لحساب مكونات الجسم وكذلك تم تقدير حجم الدم والبلازما. وبعد أسبوعين تم ذبح هذه الجداء حيث تم تقدير وزن الجسم الفارغ، ووزن الذبيحة، الكثافة النوعية للذبيحة، المكونات الطبيعية للذبيحة (لحم، دهن، عظم)، المكونات الكيميائية للذبيحة (ماء، بروتين، دهن، رماد)، ولقد تم إجراء الإرتباط المرحلي بين الكثافة النوعية للذبيحة ووزن كل من الجسم والذبيحة (متغيرات مستقلة) ومكونات الجسم (متغيرات تابعة). وبعد حساب معادلات التوقع تم اختبار إمكانية استخدامها لحساب مكونات جسم الماعز بصفة عامة وذلك بإجراء الإرتباط بين مكونات الجسم المحصولة بهذه المعادلات والمكونات المقدرة بالفعل .

ولقد أظهرت النتائج أن الكثافة النوعية للذبيحة لا يمكن أن تستخدم في توقع أي من مكونات الجسم والذبيحة. بينما يمكن استخدام وزن الجسم الحي في توقع وزن الجسم الفارغ وحجم كرات الدم الحمراء، كما يمكن استخدام وزن الجسم الفارغ في حساب كمية الماء في الجسم الفارغ. كذلك يمكن استخدام وزن الذبيحة في توقع وزن الجزء المأكول من الذبيحة .

Abstract

Twelve mature male goats (Bucks) of Egyptian Baladi breed aged 4 years old and body weight of 30.5 kg were used to verify the validation of predicting equations by which carcass specific gravity and body weight can be used to estimate body composition. Live body weight, TOH-space, Blood and plasma volume were determined. Two weeks later, all bucks were slaughtered and each of empty body weight, hot carcass weight, hot

carcass specific gravity, offals, along with separating carcass components (muscle, fat, bone) and chemical components (water, protein, fat, ash) of the whole body, empty body and carcass were determined. Step-wise regression analyses of the relationships among hot carcass specific gravity, body and carcass weight (as independent variables) and body composition parameters were performed. The validation of the obtained predicting equations was examined by calculating the intercept and the slope of the regression of the predicted parameter on the observed parameter. The valid equation should have an insignificant intercept from zero and insignificant slope from one. The data revealed that hot carcass specific gravity has not any valid equation to predict body and carcass composition. Live body weight can be used to predict empty body weight and red blood cells volume. Empty body weight has a valid equation to estimate empty body water. However, hot carcass weight can be used to estimate carcass water, muscle and edible portion.

Introduction

Studies of in-vivo body composition generally have not been based on data from uniformly managed research herds or have the possible differential effects of breed, age, body weight and sex on the various estimates been considered.

The application of carcass specific gravity(10,8,6) and body weight (15,4) as an index of the animal body or carcass composition was demonstrated in sheep. However, regression equations using carcass specific gravity as an index are more accurate at higher levels of fatness (9) while those using body weight may be influenced by the physiological status(7).

There are numerous predicting equations using hot carcass specific gravity and body weight to calculate body composition. It would be preferable to choose predicting equations that are unbiased over biased equations. The ultimate test of the usefulness of any predicting equation to future experimentation is its validation in several independent samples of the intended population of inference (11).

This study was planned to enable researchers who are interested in body composition to rationally and unbiasedly utilize predicting equations of hot crcass specific gravity and body weight.

Experimental Procedure

Twelve mature male goats (Bucks) of Egyptian Baladi breed aged about four years at average body weight of 30.5 kg(1) were used in this study. The bucks were kept in open barn and fed a ration consisted of 2:1 clover (Berseem) hay and pelleted concentrates (28% undecorticated cotton seed cake, 37% wheat bran, 5% cracked corn, 24% rice bran, 2% molasses, 3% lime stone, 1% sodium chloride salt) at a rate of 3% of their body weight. Water was provided three times daily. Live body weight (LBwt), body length (BL), heart girth (HG) and height at withers (HW) were recorded before the determination of tritiated water-space (TOH-space) and antipyrine-space (AP-space) using the equilibration method as described by (6). Plasma volume (PV) was determined using Evan's blue dye (14), and consequently, blood volume (BV) and red blood cells volume (RBCsV) were calculated.

Two weeks later, all bucks were slaughtered and each of empty body weight (EBwt), hot carcass weight (HCwt), hot carcass specific gravity (HCSG) and the weights of offal (Kidney; heart; spleen; respiratory system, RS; reproductive system, RPS; liver; empty GI tract, EmGI; GI fill, GIFil; blood; hide; and head plus limbs, Hd&Lm) were recorded and the separating carcass components (edible, edibl; muscle, muscl; physical Fat, fat; bone; fore quarter of the carcass, FQ; and back quarter of the carcass, BQ) were determined. The chemical composition (water, W; protein, P; fat,F; and ash, A) of total body (TBW, TBP, TBF, TBA); empty body (EBW, EBP, EBF, EBA); and carcass (CW, CP, CF, CA) were performed according to A.O.A.C. (1975)(2).

Step-wise regression analysis of the relationships among hot carcass specific gravity, body and carcass weight (as independent variables) and body composition parameters (Table 1) was performed using Microstat (1984)(12).

The intercept and the slope of the regression of the predicted parameter (body components using the obtained predicting equations) on the observed parameter was calculated. According to MacNeil (1983)(11), the regression of predicted Y on observed Y should have an intercept not significantly different from zero and a slope not significantly different from one, otherwise predicting equations may be biased.

Results and Discussion

Step-wise regression analysis indicated that hot carcass specific gravity may be used to determine empty GI tract and height at withers. However, its predicting equations are not valid to predict both of empty

Table (1) : Independent and dependent variables.

Independent variables (X)			**Dependent variables (Y)**		
Item	**Mean**	**SE**	**Item (kg)**	**Mean**	**SE**
LBwt, kg	30.5	1.41	TOH-space(TOH)	20.6	1.08
EBwt, kg	26.2	1.20	AP-space (AP)	18.3	1.06
HCwt, kg	13.3	0.64	RBCsV	0.5	0.03
HCSG	1.016	0.004	LBwt	30.5	1.41
BV, kg	1.8	0.07	TBW	19.4	0.99
PV, kg	1.2	0.04	TBP	5.1	0.26
BL, cm	86.2	2.32	TBF	1.3	0.08
HG, cm	74.6	1.38	TBA	4.7	0.29
			EBwt	26.2	1.20
			EBW	16.0	0.76
			EBP	5.0	0.26
			EBF	1.2	0.08
			EBA	4.0	0.26
			HCwt	13.3	0.64
			CW	7.9	0.42
			CP	2.8	0.17
			CF	1.0	0.08
			CA	1.6	0.11
			HCSG	1.016	0.004
			Edibl	9.7	0.52
			Muscl	8.6	0.89
			Fat	1.1	0.10
			Bone	3.6	0.19
			FQ	6.8	0.40
			BQ	6.5	0.35
			Offal	17.3	0.84
			Kidny	0.1	0.01
			Heart	0.1	0.01
			Splen	0.04	0.003
			RS	0.4	0.02
			RPS	0.3	0.02
			Liver	0.5	0.02
			EmGI	2.7	0.14
			GIFI	4.3	0.29
			Blood	1.4	0.07
			Hide	2.7	0.32
			Hd&Lm	4.7	0.25
			HW, cm	69.4	1.81

Table (2) : Relationships between hot carcass specific gravity (X1) and some dependent variables (Y).

Y	Choice No	X2	X3	X4	Predicting equation	R2	sy.x	Validity
EmGI	1	--	--	--	Y= -20.68+ 22.96X1	0.45	0.38	Not Valid
HW	1	--	--	--	Y=-265.01+329.16X1	0.55	4.43	Not Valid
	2	HG	--	--	Y=-258.87+274.37X1+0.66X2	0.79	3.20	Not Valid
	3	HG	BL	--	Y=-251.74+265.10X1+1.04X2-0.30X3	0.86	2.79	Not Valid

carcass specific gravity as a predictor had a limited importance in the prediction of body composition at least in Baladi goats. Riley (1969) (13) demonstrated that regression equations using specific gravity as an index are likely to be more accurate at higher levels of fatness, mainly because the higher proportion of fat results in lower specific gravity values. Generally, goats are characterized with low fat% in their body(5). Hedrick (1983)(9) stated that other factors that influence carcass specific gravity include variations in temperature of water and of the carcass, amount of hydration or dehydration of the carcass, and especially entrapped air in the carcass.

Live body weight has valid equations to predict empty body weight and red blood cells volume (Table 3). However, body composition of sheep over a wide range of body condition can be predicted from single relationship with body weight(15).

It has been found that empty body weight plus blood volume have a valid equation to predict empty body water (Table 4).

Table (3) : Relationships between live body weight (X1) and some dependent variables (Y).

Y	Choice No	X2	X3	X4	Predicting equation	R2	sy.x	Validity
RBCsV	1	--	--	--	Y= 0.01+0.02X1	0.95	0.02	Valid
	2	BV	--	--	Y=-0.06+0.01X1+0.16X2	1.00	0.00	Not Valid
	3	BV	PV	--	Y=-0.01+0.01X1+1.00X2-1.00X3	1.00	0.00	Valid
TBP	1	--	--	--	Y= 0.08+0.17X1	0.78	0.45	Not Valid
TBA	1	--	--	--	Y=-0.96+0.18X1	0.76	0.51	Not Valid
	2	HCSG	--	--	Y=17.92+0.17X1-18.47X2	0.83	0.46	Not Valid
EBwt	1	--	--	--	Y= 0.52+0.84X1	0.98	0.66	Valid
Bone	1	--	--	--	Y= 0.08+0.11X1	0.73	0.36	Not Valid
	2	EBwt	--	--	Y= 0.24+0.37X1-0.31X2	0.82	0.31	Not Valid
	3	EBwt	HCwt	--	Y= 0.28+0.52X1-0.64X2+0.32X3	0.87	0.28	Not Valid
	4	EBwt	HCwt	BV	Y=-0.41+0.47X1-0.75X2+0.44X3+1.92X4	0.92	0.23	Not Valid
Offal	1	--	--	--	Y=-0.27+0.57X1	0.92	0.85	Not Valid
Heart	1	--	--	--	Y=-0.01+0.01X1	0.84	0.01	Not Valid
Blood	1	--	--	--	Y= 0.03+0.05X1	0.92	0.07	Not Valid

Table (4) : Relationships between empty body weight (X1) and some dependent variables (Y).

Y	Choice No	X2	X3	X4	Predicting equation	R2	sy.x	Validity
EBW	1	--	--	--	Y=-0.49+0.63X1	0.98	0.36	Not Valid
	2	BV	--	--	Y=-1.40+0.51X1+2.27X2	0.99	0.30	Not Valid
TBP	1	--	--	--	Y= 0.11+0.19X1	0.76	0.46	Not Valid
EBA	1	--	--	--	Y=-1.13+0.19X1	0.79	0.43	Not Valid
HCwt	1	--	--	--	Y=-0.32+0.52X1	0.93	0.61	Not Valid

Hot carcass weight has valid equations to predict carcass water, muscle and edible portion with/ or without live body weight, empty body weight and blood volume (Table 5). Barton and Kirton (1958) (3) found that carcass composition in terms of chemical fat or dissectible fatty tissue and muscular tissue can be predicted from carcass weight avoiding the extra work and cost involved in obtaining the dressing %, carcass specific gravity, chemical and/ or physical analyses.

Table (5) : Relationships between hot carcass weight (X1) and some dependent variables (Y.

Y	Choice No	.X2	X3	X4	Predicting equation	R2	sy.x	Validity
CW	1	--	--	--	Y=-0.64+0.64X1	0.96	0.32	Valid
CP	1	--	--	--	Y=-0.48+0.24X1	0.84	0.25	Not Valid
	2	EBwt	--	--	Y=-0.17+0.48X1-0.13X2	0.90	0.21	Not Valid
Edibl	1	--	--	--	Y=-0.62+0.78X1	0.94	0.45	Valid
	2	LBwt	--	--	Y=-0.10+1.09X1-0.15X2	0.97	0.37	Valid
	3	LBwt	EBwt	--	Y=-0.32+0.68X1-0.52X2+0.64X3	0.98	0.28	Valid
	4	LBwt	EBwt	BV	Y= 0.41+0.56X1-0.47X2+0.75X3-1.92X4	0.99	0.23	Valid
Muscl	1	--	--	--	Y=-2.53+0.84X1	0.37	2.57	Valid
FQ	1	--	--	--	Y=-0.42+0.55X1	0.78	0.67	Not Valid
BQ	1	--	--	--	Y= 0.42+0.45X1	0.72	0.67	Not Valid

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