Comparison of objective external carcass measurements and subjective conformation scores for prediction of lamb carcass quality

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Stanford, K., Woloschuk, C. M., McClelland, L. A., Jones, S. D. M. and Price, M. A. 1997. **Comparison of objective external carcass measurements and subjective conformation scores for prediction of lamb carcass quality**. Can. J. Anim. Sci. **77**: 217–223. Carcass measurements were collected from 1505 lambs over a 2-yr period by a single technician. The lambs (rams, ewes and wethers) were classified as either meat-type or wool-type, with meat-type subdivided by frame size into light, medium or large. Carcass measurements included carcass length (L), length of hind leg (T), depth of hind leg (H) and circumference of hind leg (G). Agriculture and Agri-Food Canada graders measured tissue depth of all lambs at the GR site (11 cm from carcass midline over the 12th rib) and assigned subjective conformation scores for the regions of the leg, loin and shoulder. Sixty-nine lambs across groups were dissected into primal cuts to determine saleable meat yield. Carcass length and T decreased ($P < 0.05$) with increasing conformation score, whereas G and H increased ($P < 0.05$) with increasing conformation score. Wool-breed and light-frame lambs had lower conformation scores ($P < 0.01$) for the regions of the leg and loin than did medium- and large-frame lambs. Comparing the results of carcass dissection, wool-breed lambs had a lower saleable meat yield ($P < 0.05$) than large-frame lambs. Saleable meat yield also tended to be lower for light-frame than for medium- and large-frame lambs, although the numbers of medium- and light-frame lambs dissected were low. The carcass measurements used in this study accurately predicted percentage of the high priced leg cuts ($R^2 = 0.80$, RSD = 0.6%), and were marginally more accurate than subjective conformation scores in predicting saleable yield from dissection ($R^2 = 0.61$, RSD = 1.3%). However the carcass measurements used in this study were not valuable predictors of percentages of shoulder or loin and rack in the primal cuts. These data do not indicate any unjustified bias in the subjective conformation scores currently in use in the Canadian Classification System for lamb, as the breed types and frame sizes assigned lower conformation scores also had lower saleable meat yields.

Key words: Measurement, lamb, carcass, meat yield

Stanford, K., Woloschuk, C. M., McClelland, L. A., Jones, S. D. M. et Price, M. A. 1997. **Comparaison des mensurations objectives externes et des notations de conformation subjectives pour la prédiction de la qualité des carcasses d'agneau**. Can. J. Anim. Sci. **77**: 217–223. Des mesures de carcasse ont été prises pendant deux ans par un même technicien sur un total de 1 505 agneaux. Les agneaux (mâles entiers, mâles castrés, agnelles) étaient classés en type à viande ou type à laine, le premier étant fractionné selon le format en petit, moyen ou grand. Les mensurations comprenaient : la longueur de la carcasse (L) et la longueur (T), la profondeur (H) et la circonférence (G) du gigot. Ce sont les services de classement du ministère de l'Agriculture et de l'Agroalimentaire du Canada qui se chargeaient de mesurer la profondeur des tissus aux sites de classement officiels, soit à 11 cm de la ligne dorsale au niveau de la 12^{e} côte, et d'attribuer des notations de conformation subjectives pour le gigot, la longe et l'épaule. Soixante-neuf agneaux, tous groupes confondus, étaient découpés en grosses pièces pour établir le rendement boucher. La longueur de la carcasse et celle du gigot diminuaient ($P < 0,05$) en fonction de l'accroissement des cotes de conformation, tandis que G et H augmentaient ($P < 0,05$). Les agneaux de race à laine et ceux de petit format obtenaient des cotes de conformation plus basses ($P < 0,01$) pour le gigot et la longe que ceux de races de moyen et de grand formats. A la découpe, le rendement boucher des agneaux de race à laine était inférieur ($P < 0,05$) à celui des agneaux de race de grand format. Il était également relativement plus bas chez les agneaux de petit format que chez ceux de moyenne ou de grande tailles, encore que les carcasses de races de moyen et de petit formats présentées à la découpe étaient peu nombreuses. Les mensurations de carcasses utilisées fournissaient une prédiction exacte de la proportion de gigot, le morceau le plus cher ($R^2 = 0,80$, ETR = 0,6 %). Elles étaient également légèrement plus exactes que les notations subjectives pour prédire le rendement boucher à la découpe ($R^2 = 0,61$, ETR = 0,3 %). En revanche ces mesures de permettaient pas de prédire avec quelque degré d'exactitude que ce soit les proportions d'épaule, de longe et de carré dans les morceaux primaires. Nos observations ne révèlent pas de distorsion injustifiable dans les notations de conformation subjectives actuellement en usage dans le système canadien de classement de l'agneau. En effet, les basses notations attribuées aux carcasses de certains types de race et de format coïncidaient avec un rendement boucher inférieur.

Mots clés: Mensurations, agneau, carcasse, rendement boucher

Abbreviations: **circ.**, circumference; **G**, circumference of hind leg; **GR**, grade rule, measurement of tissue depth 11 cm from carcass midline over the 12th rib; **H**, depth of hind leg; **L**, carcass length; **RSD**, residual standard deviation; **T**, length of hind leg

Many attempts have been made to find rapid, inexpensive and accurate methods to estimate carcass composition from intact carcasses. Numerous external and internal carcass measurements were investigated to determine their usefulness in predicting lamb carcass composition (Pálsson 1939; Timon and Bichard 1965; Riley and Field 1969). However, these studies were unsuccessful in identifying the single measurement or set of measurements that would classify lamb carcass composition with acceptable precision. More recently, Kempster et al. (1976) and Kirton et al. (1992) determined that subjective scoring of lamb carcasses for fatness was a more precise predictor of carcass composition than were linear carcass measurements, although problems inherent with subjective carcass evaluation, such as difficulty maintaining standards within and between graders, were noted. In contrast, Jones et al. (1992) found that the precision of visual assessment of lamb carcasses for the prediction of lean content was low, as compared to tissue depth measurements between the 12th and 13th ribs.

In Canada, federally inspected lamb carcasses are currently classified on the basis of saleable meat yield by a combination of GR measurement and subjective conformation scores for the region of the leg, loin and shoulder (Jones et al. 1993). The subjective conformation scores are on a five-point scale in which a score of one indicates a severe lack of muscling and a score of five indicates excellent muscling. As the Canadian Classification System for lamb is relatively new, the impact of the system on the marketing of lamb has not yet been determined. Recently, members of the Canadian sheep industry have expressed some concerns about the subjective conformation score system. This study was conducted to address some of these concerns by (1) determining if an unjustified bias against certain sexes or breeds of lambs exists in the subjective conformation score system and (2) comparing the accuracy and precision of objective external carcass measurements with that of subjective conformation scores in determining saleable meat yield.

MATERIALS AND METHODS

All animals were cared for according to standards set by the Canadian Council on Animal Care. Over a period of 2 yr, data were collected on 1397 lambs of known sex and breed types and 108 lambs of unknown sex and breed type slaughtered at Canada West Foods (Alberta) Corp., Innisfail, AB. Rams, ewes and wethers were studied and were classified by type (meat or wool). The meat-type lambs were classified by frame size (light, medium or large) (Table 1). Large-frame lambs included those of Suffolk and Canadian Arcott breeding; medium-frame included Dorset, Katahdin, North Country Cheviot, Polypay, Texel and Rideau Arcott lambs; and light-frame included Romanov and Finn lambs. Wool-type included lambs of Rambouillet and Columbia breeding.

Warm carcass weight was determined approximately 35 min after stunning. Carcasses were then chilled for a minimum of 1 h at 5°C prior to collection of carcass measurements. All measurements, performed by a single technician, were made on the right side of the hanging carcass. Carcass length (L), leg circumference (G) and leg length (T) were measured using a vinyl measuring tape. Depth of the leg (H) was determined using metal callipers. All carcass measurements were collected for all lambs in the study with the exception of H, which was measured only in the second year of the study, on a total of 919 carcasses. The carcass measurements recorded and their symbols are essentially those of Pálsson (1939) and Timon and Bichard (1965) and are described in detail in Table 2. Subjective conformation scores for the leg, loin and shoulder region and GR (Kirton et al. 1984) were determined by Agriculture and Agri-Food Canada graders on carcasses chilled for 3 to 6 h at 5°C.

Saleable meat yield was determined by dissecting 69 of the lambs into primal cuts. Additional lambs were chosen, but later proved to be unavailable for carcass dissection due to the marketing demands of the commercial lamb processing plant. The primal cuts included a square (bone-in) shoulder, short cut leg, loin and rack and were trimmed to have no more than 0.64 cm of subcutaneous fat. For other lambs, saleable meat yield (%) was estimated using the equation of Jones et al. (1993):

$$\text{Saleable yield} = 78.92 - 0.51\ \text{GR} + 1.25\ \text{ASM}$$

where ASM is the average of the three subjective conformation scores rounded to the nearest integer. This equation has an R^2 of 0.56 and an RSD of 1.3%. All statistical analyses were performed using the stepwise option of the REG and STEPDISC procedures and the GLM and CATMOD procedures of the SAS Institute, Inc. (1988). Stepwise regression was used to assess the accuracy of carcass measurements in predicting saleable meat yield and carcass characteristics from cut-out. Stepwise discriminant analysis was used to assess the accuracy of carcass measurements in predicting subjective conformation scores. Analysis of variance was used to determine the effects of breed type, frame size and sex on carcass measurements. Analysis of variance for categorical data was used to determine the effects of breed, sex and a breed-by-sex interaction on the assignment of subjective conformation scores. Carcass cut-out measurements were adjusted by cold carcass weight, while conformation scores were expressed for carcases adjusted to the same GR.

RESULTS AND DISCUSSION

The vast majority of lambs classified under the Canadian System are recognized to have conformation scores ranging from two to four (Stanford et al. 1995). In the present study, although carcass measurements were collected on a large number of lambs (n = 1505), the number of lambs with overall conformation scores of one and five were also very low (n = 1 and n = 2, respectively). Therefore, results are reported for conformation scores of two, three and four only. Relationships between subjective conformation scores and objective carcass measurements are shown in Table 3. The results of this study confirm the findings of Kirton and Pickering (1967), Jackson and Mansour (1974) and Lirette et al. (1984), namely that carcasses of good conformation had a more compact trunk and shorter hind limbs than those of poorer conformation. In the present study, carcass length

Table 1. Minimum, maximum and mean carcass weight of lambs by sex and type

			Carcass weight (kg)			
Sex	*n*	Frame	Minimum	Maximum	Mean	SD[z]
Ram	209	Large	16.1	34.1	23.5	2.6
	187	Medium	16.0	29.7	22.5	2.4
	36	Light	19.2	29.9	22.9	2.1
	51	Wool-breed	19.8	26.9	23.0	1.7
Ewe	221	Large	16.2	30.5	23.3	2.4
	136	Medium	16.3	36.2	23.6	2.8
	56	Light	18.7	30.5	23.9	2.0
	76	Wool-breed	19.0	31.2	24.0	2.2
Wether	214	Large	16.1	32.1	23.9	3.0
	131	Medium	17.3	28.9	22.8	2.7
	40	Light	20.7	27.0	23.7	1.6
	40	Wool-breed	18.1	35.1	23.7	2.6
Total	1397[y]					

[z]SD, standard deviation of the mean.
[y]Carcass measurements were collected for an additional 108 lambs of unknown sex and breed type.

Table 2. Description of external carcass measurements

	Measurement	Symbol	Definition
a) Linear measurements			
	Carcass length (cm)	L	Point of the shoulder to the distal end of the tarsus
	Length of leg (cm)	T	Tubercule on the proximal end of the tibia to the distal end of the tarsus
b) Caliper measurement			
	Depth of leg (cm)	H	Maximum width between the most caudal point on the median line between the legs to the distal edge of the biceps femoris
c) Circumference measurement			
	Leg circumference (cm)	G	Maximum circumference of a line passing over the distal end of the iliac wings of the pelvis and the most caudal point on the median line between the legs

Table 3. Relationship between subjective conformation scores and objective measurements for lamb carcasses adjusted to the same GR

	Carcass measurement			
Symbol	T leg length (cm)	L carcass length (cm)	G leg circ. (cm)	H leg depth (cm)
Leg score				
2	31.6*a*	107.3*a*	40.6*a*	23.6*a*
3	31.3*a*	106.3*b*	41.4*b*	23.9*b*
4	30.4*b*	104.8*c*	41.8*c*	24.3*c*
SEM[z]	0.2	0.3	0.2	0.1
Loin score				
2	31.9*a*	107.8*a*	41.2	23.9*ab*
3	30.8*b*	105.5*b*	41.3	23.8*a*
4	30.6*b*	105.0*b*	41.3	24.2*b*
SEM	0.2	0.4	0.2	0.1
Shoulder score				
2	31.5*a*	107.0*a*	41.3	23.9
3	31.1*a*	106.2*a*	41.2	23.9
4	30.7*b*	105.2*b*	41.3	24.0
SEM	0.2	0.3	0.2	0.1

[z]SEM, standard error of the mean.
*a–c*Means in the same column followed by different letters differ ($P < 0.05$).

and leg length decreased ($P < 0.05$) with increasing conformation score for the regions of the leg, loin and shoulder. In contrast, leg circumference and leg depth increased ($P < 0.05$) with increasing leg score. The relationship between these measurements and loin and shoulder score, however, was less clear. This study confirms the accuracy of the subjective conformation score system in identifying compact, muscular carcasses. This should be of value, given that consumers tend to prefer cuts of meat from compact "blocky" carcasses with thicker muscles (Jackson and Mansour 1974; Harrington and Kempster 1989).

Not all breed types and frame sizes had the blocky carcasses favoured by the subjective conformation system. The effect of breed type and frame size on external carcass measurements is shown in Table 4. Light-frame lambs had a lower leg circumference and leg depth ($P < 0.05$) than the other lamb types in this study, while having a longer carcass than medium-frame lambs ($P < 0.05$) and a longer leg than both large- and medium-frame lambs ($P < 0.05$). Wool-breed lambs had a longer carcass than large- and medium-frame lambs ($P < 0.05$) and the longest leg of all lambs on the study ($P < 0.05$), although their leg circumference and leg depth tended to be lower than that of large frame lambs. Sex effects on external carcass measurements are shown in Table 4. Sex had less of an effect on carcass conformation than did breed type. Rams had longer carcasses ($P < 0.001$) and a greater leg length ($P < 0.05$) than ewes and wethers, but there were no significant differences between the sexes in leg circumference or leg depth. Rams, with the exception of the light-frame and wool-breed lambs, had a better shoulder conformation score than ewes and wethers ($P < 0.05$), but wethers and ewes with the exception of medium-frame lambs had better loin scores than rams ($P < 0.001$). As overall conformation score is based on the average of the scores for the leg, loin and shoulder rounded to the nearest integer (Jones et al. 1993), the combination of these gender-related

Table 4. Effect of breed type, sex and frame size on external carcass measurements (n = 1397)

	Carcass length (L)		Leg length (T)		Leg circum. (G)		Leg depth[z] (H)	
Frame size/sex	cm	SEM[y]	cm	SEM	cm	SEM	cm	SEM
Large	104.4*a*	0.3	29.6*a*	0.1	41.1*a*	0.2	23.9*a*	0.2
Medium	100.9*b*	0.5	28.7*b*	0.2	40.8*a*	0.3	23.4*a*	0.2
Light	105.0*ac*	0.4	30.4*c*	0.2	39.3*b*	0.2	22.7*b*	0.4
Wool breed	105.8*c*	0.5	31.1*d*	0.2	40.6*a*	0.3	23.4*a*	0.2
Ram	105.1*a*	0.2	30.3*a*	0.1	40.6	0.1	23.9	0.1
Ewe	103.3*b*	0.3	29.8*b*	0.2	40.5	0.2	24.0	0.2
Wether	103.6*b*	0.3	29.9*b*	0.1	40.6	0.1	24.0	0.2

[z]Data collected in year 2 of study only (n = 919). Leg depth data do not include medium- or light-frame wethers.
[y]SEM, standard error of the mean.
*a–d*Means in the same column (across frame size or across sex) followed by different letters differ ($P < 0.05$), with the exception of carcass length within sex which differ ($P < 0.001$).

Table 5. Effect of breed type and sex on subjective conformation score from categorical analysis of variance

Sex	Leg score	SEM[z]	Loin score	SEM	Shoulder score	SEM
			Large frame			
Ram	3.19	0.04	3.14*a*	0.04	3.22	0.05
Ewe	3.26	0.03	3.19*ab*	0.03	3.14	0.03
Wether	3.26	0.03	3.28*b*	0.04	3.13	0.03
			Medium frame			
Ram	3.20	0.04	3.22	0.04	3.35*a*	0.05
Ewe	3.21	0.04	3.22	0.04	3.19*b*	0.04
Wether	3.22	0.05	3.21	0.04	3.17*b*	0.04
			Light frame			
Ram	2.76*a*	0.08	2.76*a*	0.08	2.86*a*	0.10
Ewe	3.00*b*	0.05	3.23*b*	0.06	3.04*ab*	0.05
Wether	2.98*b*	0.08	3.15*b*	0.07	3.13*b*	0.07
			Wool breed			
Ram	2.94	0.07	2.94	0.07	3.00	0.08
Ewe	2.94	0.06	3.11	0.06	3.05	0.06
Wether	2.94	0.04	3.11	0.03	3.04	0.04

[z]SEM, standard error of the mean.
*a, b*Means in the same column within the same frame size followed by different letters differ ($P < 0.001$ for loin score and $P < 0.05$ for other scores).

traits resulted in similar overall conformation scores for both sexes. In contrast, Notter et al. (1991) found that wethers had better leg and overall conformation than ewes, while no differences were found in conformation or carcass quality between rams and wethers, other than a leaner carcass for rams. In the present study, lambs ranged in age from 3 to 11 mo and were of wide-ranging breed type/frame size. Notter et al. (1991) compared lambs of less than 6 mo of age, which would account for the lack of difference in conformation between wethers and rams.

Comparing the subjective conformation scores from Table 5 against frame size revealed that wool-breeds and light-frame lambs had lower scores for the leg and loin than did medium- and large-frame lambs ($P < 0.01$), in accordance with the work of Crouse et al. (1981). Those researchers found Rambouillet-sired lambs to have inferior leg conformation scores compared to Suffolk-sired lambs. Medium-frame lambs in the present study had higher shoulder scores than large-frame lambs which in turn had higher shoulder scores than light-frame and wool-breed lambs ($P < 0.05$). Light-frame rams in this study as in that by Lirette et al. (1984), were found to have the lowest conformation scores of all breed types and frame sizes ($P < 0.05$). Producers of light-frame lambs should therefore consider castration of their male lambs in order to improve carcass conformation and marketability.

The usefulness of subjective conformation scores in the prediction of saleable or lean meat yield in lambs has been controversial. Horgan et al. (1995), Wolf et al. (1981) and Kempster et al. (1981) found subjective conformation to be of limited value in predicting saleable and/or lean meat yield, in direct contrast to the work of Kirton et al. (1992) and Jones et al. (1993). An explanation for this discrepancy may be found in the populations of lambs evaluated in these studies: the more variance in lamb breed types and sizes used, the greater the value of subjective conformation score in predicting lean and/or saleable meat yield. Consistent with that trend, subjective conformation scores were useful in predicting saleable meat yield in the present study which involved lambs of widely ranging breed types and carcass

Table 6. Effect of breed type and frame size on carcass cut-out data adjusted to equal carcass weight

		Primal cuts							
		Saleable		Leg		Loin		Shoulder	
Frame size/type	*n*	Yield (%)	SEM[z]	Weight (kg)	SEM	Weight (kg)	SEM	Weight (kg)	SEM
Large	23	78.78*a*	0.01	5.51*a*	0.05	5.63*a*	0.07	6.29*a*	0.08
Medium	2	77.66*ac*	0.02	5.19*abc*	0.19	5.94*a*	0.23	5.51*b*	0.26
Light	5	76.94*ac*	0.01	4.82*b*	0.04	5.07*b*	0.15	5.57*b*	0.16
Wool breed	39	76.99*bc*	0.01	5.29*c*	0.12	5.67*a*	0.05	6.14*a*	0.06

[z]SEM, standard error of the mean.
a–*c*Means in the same column followed by different letters differ ($P < 0.05$).

Table 7. Relationships between subjective conformation scores and carcass measurements by lamb frame size and breed type from stepwise discriminant analysis

	Classification variable[z]											
	Leg conformation breed type				Loin conformation breed type				Shoulder conformation breed type			
	Large	Medium	Light	Wool breed	Large	Medium	Light	Wool breed	Large	Medium	Light	Wool breed
GR	NS	NS	NS	NS	0.16	NS	0.11	0.07	0.02	NS	NS	0.05
Carcass weight	NS	0.03	0.14	NS	0.02	NS	NS	NS	0.11	0.17	0.22	NS
Leg circumference (G)	NS	0.02	NS	0.04	0.03	NS	NS	NS	NS	NS	NS	0.11
Carcass length (L)	NS	0.05	NS	NS	0.06	NS	NS	NS	0.09	0.19	0.23	0.15
Leg length (T)	NS	0.03	NS	NS	0.03	NS	NS	NS	NS	NS	NS	NS
Leg depth (H)	NS	0.08	NS	NS	0.02	NS	NS	NS	NS	NS	NS	NS
L / H	NS	NS	NS	0.21	0.07	0.18	NS	0.28	NS	NS	NS	NS
T / H	0.27	0.09	NS	NS	NS	NS	NS	0.03	0.02	NS	NS	NS
L / G	NS	0.03	0.38	NS	0.03	NS	NS	0.04	NS	NS	NS	NS
T / G	NS	0.16	NS	NS	0.01	NS	0.30	NS	NS	NS	NS	NS

[z]partial R^2.
NS, not significant ($P > 0.15$).

weights. Lambs of poorer conformation were generally found to have a reduced saleable meat yield. Saleable meat yield as determined by carcass dissection was lower from wool-breeds than from large-frame lambs ($P < 0.05$) of the same carcass weight and tended to be lower from light-frame than from medium- or large-frame lambs (Table 6), although number of medium- and light-frame lambs dissected was low. A trend toward reduced meat yield from Rambouillet-sired as compared with Suffolk-sired lambs was also reported by Crouse et al. (1981). Because light frame and wool-breed carcasses lack the compact blocky conformation desired by consumers, the meat from these lambs might be better directed toward end uses such as cubed or ground lamb which are not influenced by conformation.

A number of researchers (Kirton and Pickering 1967; Jackson and Mansour 1974; Kempster et al. 1981) have concluded that lamb carcasses with good conformation tend to be fatter than those with poor conformation. In an earlier study (Stanford et al. 1995) we also showed a trend toward increasing GR measurement with increasing conformation score under the Canadian Classification System. However, any tendency to reward carcass fatness through subjective conformation score is, in practice, balanced by penalties for excessive GR measurement. The most desirable carcasses have a high conformation score and a low GR measurement.

The results of this study demonstrate that the subjective conformation system lacks an inherent unfair bias against breed types or frame sizes. Light-frame and wool-breeds lamb carcasses are assigned lower conformation scores than large- or medium-frame carcasses, but these lower scores are justified by their reduced saleable meat yields determined by dissection as well as a poorer conformation determined by objective measurements (lower leg circumference and increased carcass length). An earlier study (Stanford et al. 1995) showed that ultrasound measurements could not accurately predict subjective conformation scores. The relationships between objective carcass measurements and subjective conformation scores are shown in Table 7. Although the predictive value of carcass measurements is superior to that of ultrasound (Stanford et al. 1995), less than 50% of the variation in conformation scores could be explained by carcass measurements. Certain trends, though, are evident. Shoulder conformation score was most accurately predicted by carcass weight and carcass length. Loin conformation score was best predicted by GR measurement and by the ratio between carcass length and leg depth, other than for light-frame lambs, for which loin conformation score was best predicted by GR and a ratio of leg length and leg circumference. In contrast, the best predictors of leg conformation score varied according to lamb breed type and frame size. These results are in accordance with those of Kempster et al. (1976), who found prediction equations for the shoulder to be stable across lamb breed type while those for the leg were highly influenced by lamb breed type, perhaps due to variations between breed types in fat distribution in the hind leg.

Equations for calculating carcass characteristics from carcass measurements are shown in Table 8. The carcass mea-

Table 8. Equations for calculating carcass characteristics from carcass measurements

	Predicted variable			
			Primal cuts[z]	
Regression coefficients	Saleable meat yield (%)[y]	Saleable meat yield (%)[x]	Leg (%)[x]	Shoulder (%)[x]
Intercept	34.94	32.90	–27.12	27.11
GR	NI	–0.21	NS	–0.17
Carcass length (L)	–0.03	NS	NS	NS
Leg length (T)	NS	NS	NS	NS
Leg circumference (G)	0.45	7.89	4.68	NS
Leg depth (H)	NS	NS	NS	NS
T / H	–4.92	NS	NS	NS
T / G	16.94	NS	0.51	NS
L / carcass weight[w]	3.49	3.69	3.17	NS
R^2	0.45	0.61	0.80	0.36
RSD	1.6	1.3	0.6	1.2

[z]No significant predictors for loin (%) (P >0.15)
[y]Determined from equation (Jones et al. 1993).
[x]Determined from carcass cut-out (n = 69) and expressed as a percentage of cold carcass weight.
[w]Warm carcass weight.
NI, not included in analysis.
NS, not significant (P > 0.15).

surements used in this study had a reduced accuracy (R^2 = 0.45, RSD = 1.6%) compared with subjective conformation scores (R^2 = 0.56, RSD = 1.3%; Jones et al. 1993) when used to predict saleable meat yield as currently measured in the Canadian Classification System for lamb. However, prediction of saleable meat yields (from carcass dissection) by carcass measurements was slightly improved (R^2 = 0.61, RSD = 1.3%) from that by subjective conformation scores. For the primal cuts, carcass measurements were highly accurate in predicting percentage of the leg (R^2 = 0.80, RSD = 0.6%). For the other primal cuts, GR measurement was the only significant predictor (P < 0.15) of percentage of shoulder, and there were no significant predictors (P > 0.15) for percentage of loin. In the present study, the majority of the carcass measurements focused on the leg, but other carcass dimension measurements would permit more accurate prediction of the percentage of the carcass in the loin and shoulder primals. The results of this study demonstrate that objective carcass measurements would have a marginally superior accuracy for predicting saleable meat yield than the subjective conformation scores currently in use in the Canadian Classification System for Lamb. The objective measurements used in this study, however, required 3 min per carcass. By comparison, the assignment of subjective conformation scores required less than 20 s per carcass by a trained Agriculture and Agri-Food Canada grader (T. Coupland, pers. commun., 1995). The carcass measurements used in this study are slow and labour intensive, which prevents their practical application in commercial lamb processing facilities. However, a new technology, video image analysis, offers objective, rapid, automated measurement of numerous regions of the carcass. Studies are currently in progress to assess the use of video image analysis for classification of Canadian lamb carcasses.

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