RELATIONSHIP BETWEEN CARCASS PHYSICAL COMPOSITION AND CARCASS PARTS IN FAT TAIL LAMBS

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SUMMARY: Carcass characteristics were analyzed on 118 fat tail Awassi lambs representing a range of nutritional treatment datasets. Simple and multiple correlation were calculated to derive predication equations. Dissected lean, fat and bone weight in shoulder and leg gave significantly (p<0.01) higher correlations with dissected lean, fat and bone in carcass. cold carcass weight was significantly (p<0.05) correlated with dissected fat and bone carcass, but not significantly (p>0.05) with dissected lean weight. Dissected fat in carcass was significantly correlated with fat tail (p<0.01). Protein and lipid in carcass were significantly (p<0.01) correlated to dissected lean and fat carcass respectively. In conclusion, physical composition of the leg was an accurate estimator of carcass fat, lean and bone.

INTRODUCTION: Accurate assessment of carcass composition in slaughter animals is required since consumers are demanding cuts with higher percent of lean. Several methods have been used to estimate carcass composition including specific gravity (Brown et al., 1951), chemical composition (Kirton et al., 1962) and physical separation (Field, 1963). However, these approaches have disadvantage of being expensive and time consuming. At the present such assessment are not available for fat tail sheep. The objective of this study was to derive predication equations to estimate carcass composition and to examine the reliability of these equations in estimating carcass composition of fat tail lambs. The study utilized four datasets from previous experiments that contained adequate description of experimatal procedures which included physically dissected carcass composition and chemical composition measured on the same animals.

MATERIALS AND METHODS: Dataset 1. This data from an experiment by Hassan et al. (1989). In this experiment, 32 Awassi intact male lambs were grown for 60 days from about 28 kg live weight at four diets containing different levels of dry date pulp. The experiment was terminated by slaughtering the animals and lambs were deprived from food only allowed access to water for 12 hrs then weighed immediately before slaughter to provide a fasted weight. Slaughtering was performed according to local muslim practice in Iraq by seyvering jugular vessels oesophagus and trachea without stunning. The head, skin, feed, testicules and internal organs were weighed separately. The carcasses were chilled for 24 hrs at 4C°, then weighed and cut evenly into left and right sides after removing the fat tail from carcasses. The left half carcass was cut into standarized whole sale cuts acccording to specification of Forrest et al. (1975). The cuts were then weighed separately and dissected into lean, fat and bone. Total carcass lean, fat and bone included only the combined weight of the separable components from the wholesale cuts. Therefore, carcass fat did not include fat tail, kidney fat or omental fat. Fat tail bones were not included in total bone weight of the carcass. Chemical analysis were conducted on the dissected soft tissue after preparation. Dissected lean and fat were pooled minced repeatedly to obtain uniformed samples for chemical analysis for crude protein (Kjeldahl Nx6.25), lipid (ether extract) and dry matter (oven dried) following the AOAC (1975). Dataset 2. The data used were from an experiment by Hassan et al. (1990). Thirty Awassi intact male lambs were grown for 70 days from 24 kg to 32 kg live weight using four diets (two roughage to concentrate ratio 70:30 and 30:70 and two levels of rumen undegradable protein 5 and 10 g/kg dry matter). The lambs were fed 0.478 MJ of metabolizable energy per Kg $BW^{0.75}$. Slaughter procedure, physical dissection and chemical analysis were as for dataset 1. Dataset 3. The data used were from an experiment by Al-Ani et al. (1989). Thirty two Awassi intact male lambs were grown for 9 days from 28 to 40 kg live weight. The lambs were fed to appetitie four concentrate diets containing different levels of barley (0, 30, 60 and 90%). The lambs were slaughter at the end of the experiment. Slaughter procedures, physical dissection were as in dataset 1 and 2. Dataset 4. This data were from the experiment designed to determine lambs responses to different levels of intake (Al Jassim et al. 1990). In this experiment 24 Awassi intact male lambs were grown for 70 days from about 24 live weight at four different feeding levels.

The experiment was terminated by slaughtering the animals and slaughter procedures, physical dissection were as in previous datasets.

DEFINITIONS: It was possible to examine the full range of relationship in all datasets due to traits being recorded and defined similarly. The following definitions were adopted and are used in the tabulation of results: Empty body weight (EBW): Live weight immediately pre slaughter minus gut contents; Cold carcass wight: Carcass excluding head, feed, kidneys, perinephric and retroperitoneal fat.

STATISTICAL ANALYSIS: Simple and multiple correlations were fitted to relationships between (1) physical composition of major cuts and carcass, (2) physical composition of carcass and carcass weight, (3) chemical composition and some independent variables. Relationships were fitted separately for each dataset and within datasets.

RESULTS AND DISCUSSION: Mean of independent variables used in this study are presented in table 1.

Table 1. Mean of independent variables (kg) and std. error

Dataset No.	1	2	3	4	Std.error
Empty body weight	37.8[a]	26.5[b]	36.1[a]	33.8[c]	(3.1)*
Cold carcass weight	21.2[a]	14.3[b]	18.1[c]	18.0[c]	(1.8)**
Tissue weight in carcass					
Lean	10.8[a]	7.4[b]	8.2[b]	7.7[b]	(0.31)*
Fat	3.7[a]	2.0[b]	3.4[a]	3.8[a]	(0.08)*
Bone	3.5[a]	3.0[ab]	3.4[a]	3.7[a]	(0.37)NS
Whole sale cuts					
Shoulder	5.7[a]6	3.3[b]	4.4[a]	4.9[a]	(0.50)*
Lack	2.4[a]	1.3[b]	1.9[a]	1.2[b]	(0.31)*
Loin	2.7[a]	1.4[b]	1.9[b]	1.3[b]	(0.22)*
Leg	5.6	4.3	5.4	5.2	(0.47)NS
Fat tail	3.2[a]	1.9[b]	3.1[a]	2.7[c]	(0.35)**

[a] [b] [c] Mean in the same row with different superscrip differ significantly ($P<0.05$)

All variables, except leg cut were significantly ($p<0.05$) different among datasets. Three criteria were used for selecting the cuts for predicting carcass composition, (1), correlation between the physical composition of the carcass should approach unity, (2), These cuts can be accurately removed from the carcass and (3), they can be easily and accurately separated into lean, fat and bone (Latham, et al 1966). Relationships between carcass lean and lean in cuts are shown in table 2.

Table 2. Relationship between dissected carcass lean weight, kg (Y) and lean in cuts ,kg (X)

	Dataset	r[a]	Estimating equation	Std.error (kg)
Shoulder	1	-0.95	Y=14.92-1.44X	0.43
	2	0.97	Y= 1.15+2.99X	0.41
	3	0.98	Y= 3.33+2.02X	0.33
	4	0.98	Y= 0.40+3.21X	0.30
	Overall	0.94	Y=-1.22+3.98X	0.34
Rack	1	-0.51	Y=12.54-1.29X	0.81
	2	0.97	Y= 1.51+7.94X	0.76
	3	0.34	Y= 6.40+2.51X	0.91
	4	0.68	Y= 0.24+6.86X	0.67
	Overall	0.39	Y= 4.69+3.37X	0.80
Loin	1	0.60	Y=10.62+0.09X	0.77
	2	0.75	Y=-0.45+11.4X	0.70
	3	0.65	Y=-4.15+12.3X	0.76
	4	0.70	Y= 2.28+5.52X	0.73
	Overall	0.70	Y= 3.41+5.39X	0.67
Leg	1	-0.89	Y=11.1-0.103X	0.50
	2	0.98	Y=-1.74+3.21X	0.41
	3	0.93	Y= 0.81+2.48X	0.42
	4	0.97	Y=-2.14+3.97X	0.35
	Overall	0.91	Y=-0.60+3.19X	0.39

[a] Correlation of 35, $p<0.01$ in this table and following tables.

All datasets shon that dissected lean in shoulder and leg gave significantly ($P<0.01$) higher correlations with dissected lean in carcass than did dissected lean in rack or loin. In addition the standard errors of estimate of 0.34 and 0.39 respectively were lower than for rack or loin. Barton and Kirton (1959) reported that percent lean in the leg was the most accurate indicator of carcass lean. In this study the leg was slightly less accurate than the shoulder in estimating weight of lean carcass; however, the leg could be removed more accuraely from the remainder of the carcass. Therefore suggestion can be made that the leg is most satisfactory for estimating carcass lean. This disagree with that reported by Latham et al. (1966) who found that the rib was the best indicator of carcass lean. Relationships between carcass fat and fat in cuts are shown in table 3.

Table 3.Relationships between dissected carcass fat weight,kg (Y) and fat weight in cuts ,kg (X)

	Dataset	r	Estimating equation	Std.error (kg)
Shoulder				
	1	0.87	Y= 1.41+2.82X	0.46
	2	0.89	Y= 0.49+4.74X	0.45
	3	0.87	Y= 1.52+3.24X	0.43
	4	0.90	Y=-0.09+4.68X	0.42
	Overall	0.84	Y= 1.09+3.62X	0.48
Rack				
	1	-0.75	Y= 3.84-0.17X	0.79
	2	0.86	Y= 0.031+7.6X	0.73
	3	0.61	Y= 0.25+9.69X	0.81
	4	0.87	Y= 0.68+3.58X	0.70
	Overall	0.73	Y= 2.32+2.04X	0.78
Loin				
	1	-0.84	Y= 11.2+8.89X	0.57
	2	0.77	Y= 0.01+6.17X	0.69
	3	0.56	Y= 0.93+4.21X	0.85
	4	0.68	Y= 1.76+2.27X	0.75
	Overall	0.57	Y= 1.25+3.19X	0.87
Leg				
	1	0.83	Y= 0.75+2.15X	0.40
	2	0.96	Y= 0.06+2.95X	0.38
	3	0.93	Y= 0.51+4.99X	0.41
	4	0.91	Y= 1.49+3.02X	0.44
	Overall	0.91	Y= 3.11+0.48X	0.41

All datasets shown that dissected fat weight of leg gave the highest correlation (0.91) with carcass fat with a standard error of estimate of 0.41 kg. This was followed by shoulder and rack with a correlation of 0.84 and 0.73 with standard errors of estimate of 0.48 and 0.78 kg respectively. Haminond (1932) suggested that the leg was most satisfactory for estimating carcass fat. Relationships between carcass bone and bone in cuts are presented in table 4.

Table 4. Relationships betwen dissected carcass bone weight ,kg (Y) and bone weight in cuts ,kg (X)

	Dataset	r	Estimating equation	Std.error (kg)
Shoulder	1	0.87	Y=3.04+0.33X	0.35
	2	0.91	Y=-2.29+5.6X	0.39
	3	0.98	Y=1.77+1.21X	0.30
	4	0.87	Y=2.19+0.79X	0.36
	Overall	0.93	Y=0.84+2.08X	0.36
Rack	1	-0.77	Y=4.68-1.68X	0.51
	2	0.45	Y=1.01+4.69X	0.62
	3	0.86	Y=1.42+4.48X	0.49
	4	0.60	Y=2.35+1.29X	0.69
	Overall	0.71	Y=2.11+1.58X	0.58
Loin	1	-0.50	Y=4.25-1.66X	0.65
	2	0.39	Y=0.33+9.38X	0.70
	3	0.79	Y=2.19+2.56X	0.69
	4	-0.59	Y=3.58-1.30X	0.62
	Overall	0.53	Y=1.65+3.44X	0.61
Leg	1	0.80	Y=1.27+2.62X	0.39
	2	0.79	Y=1.29+1.57X	0.41
	3	0.91	Y=1.08+2.15X	0.37
	4	0.87	Y=2.90+0.17X	0.38
	Overall	0.83	Y=1.64+1.62X	0.42

Bone weight in the carcass was estimated most accurately by bone weight in shoulder or leg. Correlation coefficients were 0.93 and 0.83, and estimating equations had standard errors of estimate of 0.36 and 0.42 kg respectively for these two cuts. Latham et al. (1966) reported that the leg was a satisfactory estimator of carcass bone. These relationships also indicate that the loin has less correlation coefficient (0.53) and estimating equations had higher standard errors of estimate of

0.63 kg. Relationships between dissected carcass composition and some carcass characteristics.

Table 5. Relationships betwen physicald carcass composition and cold carcass weight (kg)

Relationship	Dataset	r	Estimating equation	Std.error (kg)
Total lean(Y)	1	0.31	Y= 9.6+0.570X	0.60
with cold	2	0.40	Y= 1.47+0.38X	0.56
carcass weight	3	0.18	Y= 3.17+0.31X	0.70
(X)	4	0.27	Y= 0.77+0.38X	0.67
	Overall	0.23	Y= 3.75+0.41X	0.61
Total fat (Y)	1	0.91	Y= -6.7+0.49X	0.41
with cold	2	0.80	Y=-0.10+0.23X	0.40
carcass weight	3	0.88	Y=-2.67+0.35X	0.47
(X)	4	0.79	Y=-1.22+0.29X	0.52
	Overall	0.75	Y=-2.07+0.34X	0.55
Total bone (Y)	1	0.54	Y= 0.85+0.12X	0.65
with cold	2	0.67	Y=0.641+0.14X	0.61
carcass weigth	3	0.85	Y=1.95+0.059X	0.52
(X)	4	0.79	Y=2.22+0.046X	0.58
	Overall	0.71	Y=1.42+0.092X	0.60

Cold carcass weight was significantly ($p<0.01$) correlated with dissected fat and bone weight only ($p<0.01$). These differences have been due to the different initial weight started with and experimental treatments imposed. The range of initial and slaughter weight were considerably greater in dataset 1 and 3 than in dataset 2 and 4. The lambs in dataset 1 and 3 were given food to appetite while other animals (in dataset 2 and some lambs in dataset 4) had their food intake being restricted. Relationships between chemical and physical carcass composition estimated in dataset 1 and 2 only, indicated that protein and lipid were significantly ($p<0.01$) correlated to dissected lean an fat respectively with a correlation of 0.91 and 0.93 and standard errors of estimate of 0.41 and 0.36 kg respectively. However, these data used in this relationship were not sufficient for firm conclusions. This suggested that similar studies in the future should include detailed of chemical analysis of the individual tissues.

CONCLUSIONS: Physical composition of the leg was an accurate estimator of carcass fat, lean and bone. Differences between datasets recommended a single set of relationships for general se and users should thus select relationships from datasets most appropriate to their particular circumstances.

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