Meat Characteristics of Sheep and Goat Breeds Commonly Consumed in U.A.E. 1. Carcass Characteristics.

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ABSTRACT :

This study was conducted at Al-Ain Automatic Slaughter House and the laboratory of Faculty of Agricultural Sciences, U.A.E University during the period from November 15, 1989 through June 15, 1990. The study aims at investigating the influences of breed and age of animal on dressing percentage and physical and chemical composition of some sheep and goat breeds commonly consumed in U.A.E.

Age of animal exerted significant effect (p<.01) on body weight (BW), hot carcass weight (HCW) and dressing percentage (DP) measured on 73 Merino sheep. Least squares means obtained for these traits were 40.5 kg, 20.7 kg and 49.8 %, resp. Corresponding means obtained for 44 Somali goats were 23.3 kg, 10.9 kg and 46.6%, resp. The effect of age, however, was significant only on HCW and DP (p<.01).

Physical dissection of 56 samples representing 9-10-11 ribs cut showed that Turkish lambs had more bone than had Merino ones (p<.05). Age of sheep had significant (p<.01) effect on percentages of lean, fat and bone and on fat thickness over the rib cut. Means obtained for lambs vs. mutton in the four above mentioned traits were 46.3 vs. 38%; 30.6 vs. 45%; 23.1 vs. 16.9% and 2.61 vs. 5.95 mm., in respective order.

Chemical analysis of the 56 Longissiums dorsi muscles of the above mentioned rib cuts showed that Merino lambs had significantly more protein % while Turkish showed

higher % fat (p<.01). The Merino also had greater % of NFE (0.56 vs. 0.17, p<.05). Age showed significant effects on % ether extract and % ash (p<.01) and on % NFE (p<.05). Mutton had markedly greater fat % (4.94 vs. 1.92) while lambs showed relatively higher estimates for NFE and ash percentages.

Simple, within subclass, coefficients of correlation revealed the existence of significant relationships among different physical and chemical parameters used in this study.

Key words : Breed, Carcass characteristics, Goat, Sheep, U.A.E.

INTRODUCTION

United Arab Emirates imports about 80% of population's consumption from red meats. Reliable information on the performance of both imported and local breeds of animals are essential for planning effective programmes to improve domestic meat production.

Australian Merino, Turkish sheep and Somali Goats are major breeds commonly consumed in U.A.E. The objectives of the present study were to assess the meat merits of these breeds by estimating their dressing out percentage and their physical and chemical composition. The study aimed also at analyzing the effects of animals breed and age on the physical and chemical composition of their carcasses. Relationships among different physical and chemical components were also investigated.

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MATERIALS AND METHODS

The study was conducted at Al-Ain slaughter house and at the labs of Animal Production Department, U.A.E. University, Al-Ain, U.A.E. The study started on November 15, 1989 and terminated on June 10,1990.

Dressing Percentage (DP) :

To estimate dressing out percentage (DP), 73 Australian Merino male and 44 male Somali goats were chosen at random from animals imported for slaughter. Body weight (BW) was recorded to the nearest Kg; and after animals were slaughtered and dressed, hot carcass weight (HCW) and total weight of head, hide and four legs was also recorded. Cold carcass weight (CCW) including kidneys was determined after carcasses were chilled for 24 hours. DP was estimated as % CCW from BW. Data were analyzed using SAS General Linear Models procedure, for each genotype (Merino and Somali), separately, using the following model :

$$Y_{ij} = u + a_i + e_{ij}$$

where : Y_{ij} represents BW, HCW or DP; u = overall mean; a = the effect of age, estimated by teething of the i th animal, i = 5 (for Merino) where 1 = < 1.5, 2 = 1.5-<2, 3 = 2-<3, 4 = 3-<4 and 5>4 years while for Somali, i = 3 where 1<2, 2=2-<3 and 3>3 years; and e_{ij} = common random error.

Physical dissection of rib cut :

Rib cut of the 9th, 10th and 11th ribs was physically dissected into lean, fat and bone to predict carcass composition. Sampling included carcasses of 30 Merino lambs, 15 Merino sheep and 11 Turkish lambs. Data were analyzed to investigate the effect of breed of lamb (Merino vs. Turkish) and the effect of age of Merino sheep (lambs vs. mutton) on percentage of lean, fat and bone in rib cut. Carcasses of Somali goats are not easy to get from the market because they are commonly slaughtered by individuals not butchers.

Chemical Composition of Longissimus Dorsi Muscle :

Longissiums dorsi muscle of the above mentioned 56 rib cuts were used to determine its chemical composition according to AOAC (1986). Data were analyzed to investigate the effect of breed of lamb (Merino vs. Turkish) and the effect of age of Merino sheep (lambs vs. mutton) on levels of protein, ether extract (fat), nitrogen free extract (NFE) and ash content.

RESULTS AND DISCUSSION

Dressing percentage (DP) :

Table 1 shows means of body weight (BW), hot carcass weight (HCW) and dressing percentage (DP) of Merino sheep. All traits were significantly affected by age of animal ($p > .01$). BW and HCW increased with advancement of age; DP declined in age group 2 and

Table 1. The effect of age on body weight, hot carcass weight and dressing percentage (DP) of Merino sheep imported for slaughter in U.A.E.

Class	N	Body weight (BW, kg)	Hot carcass (HCW, kg)	DP (%CCW/BW)
Overall	73	40.5±1.06	20.7±0.61	49.8±0.52
Age group :				
1 = < 1.5 yrs	11	29.0±1.91	14.3±1.01	48.3±1.12
2 = 1.5- < 2	10	34.9±2.00	16.9±1.06	46.9±1.18
3 = 2- < 3	16	38.6±1.58	18.9±0.84	47.5±0.93
4 = 3- < 4	7	44.7±2.39	21.9±1.27	49.0±1.40
5 = > 4 yrs	29	46.9±1.18	25.1±0.62	52.8±0.69

Source of Variation :	d.f	Mean	Squares	
		**	**	**
Age	4	781.6	305.8	113.7
Residual	68	40.1	11.3	13.8

** P < .01

increased gradually thenafter to reach the value (52.8%) in group 5. Figure 1 shows the relationship between DP and non-carcass components (head, hide plus the four legs) taken as % of BW. Thonney et al. (1987) and Butterfield (1988) reported that all non-carcass components are early maturing structures decline progressively, as % from BW, as BW increases.

For Somali goats, table 2 shows that age differences in BW were not large enough to catch the level of statistical significance. Means of BW ranged between 22 kg. in age group 1 and 25.1 kg. in group 3. Patti and Restall (1987) found a gradual decline in BW increase of Australian Ferals with advancement of age due to lowered rate of growth. DP averaged 46.6 % which lies within the range defined by Warmington and Kirton (1990) in their review article on DP in goats (35-53%). However, Mtenga and Kitaly (1990) reported only 36.1 % as average DP in Tanzanian grazing goats which is a typical East African goat type. DP increased significantly (p< .01) to 48.5% in group 2 and declined to 45.3 in group 3, partially due to changes in % non-carcass components (Figure 2). Devendra and Owen (1983) and McGregor (1982) indicated that DP increases with increasing BW of goats. The age differences obtained here could be of considerable importance if coupled with information on carcass composition and meat quality characteristics.

Physical composition of rib cut :

Physical dissection of rib cut, fat thickness (FT) over the 9th rib and eye muscle area (EMA) have been widely used for predicting carcass composition

Table 2. The effect of age on body weight, hot carcass weight and dressing percentage (DP) of Somali goats imported for slaughter in U.A.E.

Class	N	Body weight (BW, kg)	Hot carcass (HCW, kg)	DP (%CCW/BW)
Overall	44	23.3±0.62	10.9±0.19	46.6±0.85
Age group :				
1 = < 2 yrs.	11	22.0±1.24	9.8±0.33	43.0±1.57
2 = 2- < 3 yrs.	25	23.2±0.52	11.2±0.22	48.5±1.04
3 = > 3 yrs.	8	25.1±1.45	11.4±0.39	45.3±1.84

Source of Variation :	d.f	Mean	Squares	
		NS	**	**
Age	2	22.65	8.34	125.9
Residual	41	16.86	1.21	27.1

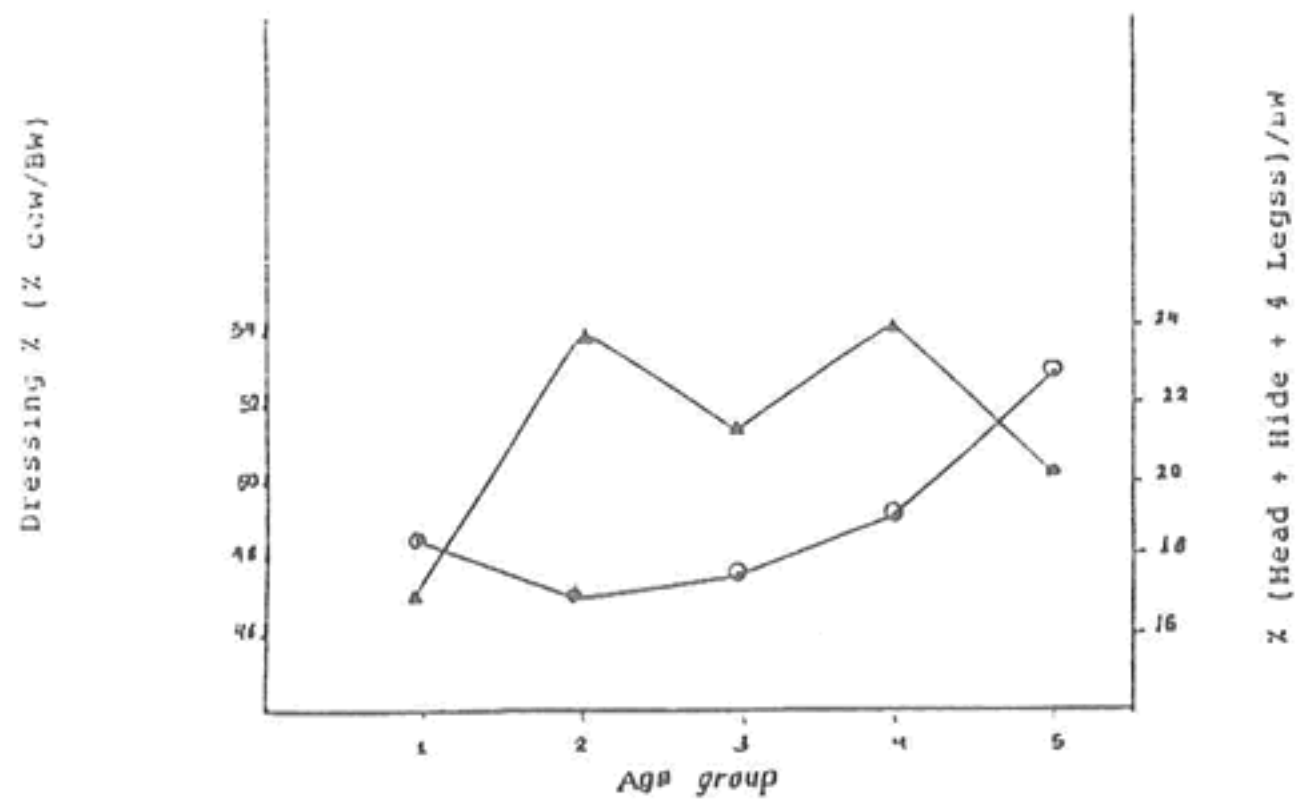NS = Non-significant.   ** P < .01.

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Fig.1 Relationship between dressing percentage (DP) and %Head+hide+4legs/BW with advance in age of Merino sheep.
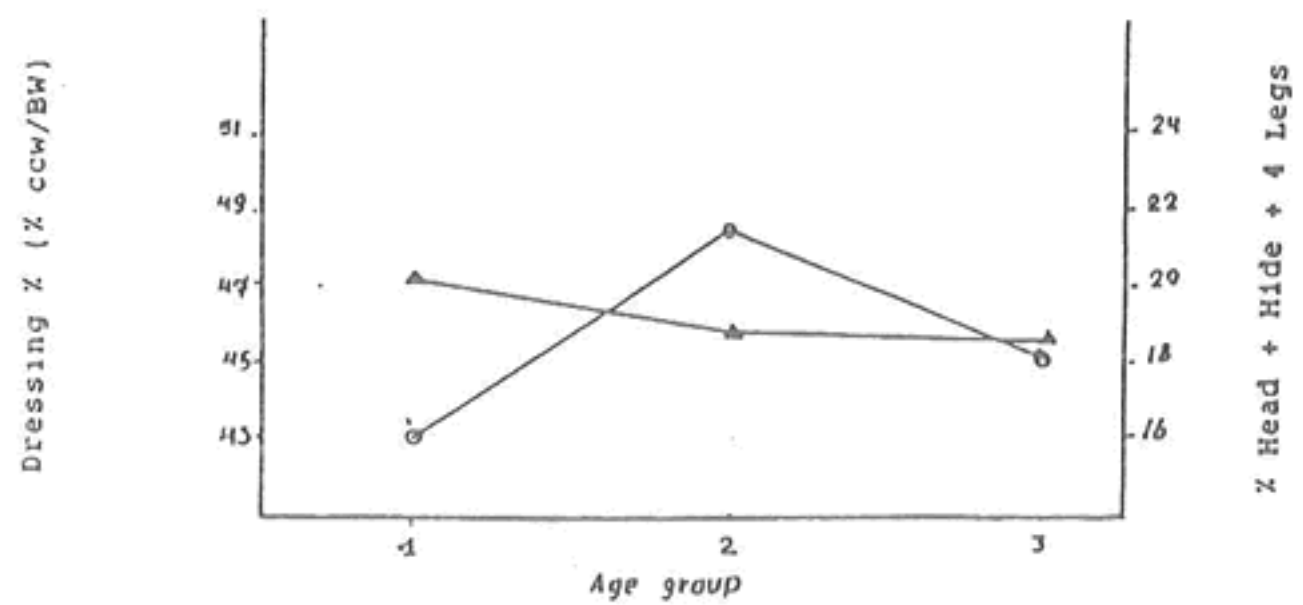

Fig.2 Relationship between dressing percentage (DP) and %Head+hide+4legs/BW with advance in age of Somali goats.

(Berg and Butterfield, 1976). Table 3 shows the effect of breed of lamb (Merino vs. Turkish) on the forementioned physical characteristics. The only significant difference existed in % bone (p<.05). Turkish lambs showed some 20% increase in bone % above the Merino average. The markedly higher % of fat in Merino ribs compared to Turkish breed (30.6 vs. 24.9%) lacks the statistical significance, mainly due to high individual variation.

Age of sheep influenced significantly physical characteristics in Merino (table 4). Lambs had markedly more lean in their rib cuts than had the mutton cuts (46.3 vs. 38%, p<.01). Conversely, mutton had about 14% more fat; 45 vs. 30.5% for mutton and lambs cuts, respectively. This increase represents almost 50% of fat content in lambs cuts. This result is elaborated by the difference observed in FT between the two age groups; 5.95 vs. 2.61 mm (p>.01) for mutton and lambs, respectively. The mutton had some 6% less bone which is expected due to the differential rate of growth of bone, muscle and fat with advancement of age (Berg and Butterfield, 1976).

Chemical composition of longissiums dorsi muscle :

Chemical composition is considered more reliable in predicting carcass composition than is physical dissection. Berg and Butterfield (1976) showed that fat depot may, under certain circumstances, carry a large proportion of water and low proportion of chemical fat and hence physical weighing would not detect this effect. The major qualitative change in chemical composition of meat

Table 3. Effect of breed of lamb on physical traits of rib cut

Breed	N	Physical composition as %				EMA (cm²)	FT (MM)
		Lean	Fat	Bone			
Merino	30	46.34±1.69	30.56±1.73	23.12±1.25		9.03±0.39	2.61±0.31
Turkish	11	47.03±2.78	24.98±2.86	28.15±2.06		8.47±0.64	3.01±0.52
S.V.	d.f.	Mean	Squares				
		NS	NS	*		NS	NS
Breed	1	3.83	250.01	204.23		2.58	1.28
Within	39	85.22	89.85	46.62		1.49	2.92

NS = Non-significant,   * P < .05

Table 4. Effect of age of Merino sheep on physical traits of rib cut

AGE	N	Physical composition as %			EMA (cm^2)	FT (MM)
		Lean	Fat	Bone		
Lamb	30	46.34±1.41	30.56±2.01	23.12±1.12	9.03±0.39	2.61±0.37
Mutton	15	38.04±2.00	45.03±2.85	16.88±1.58	10.98±0.64	5.95±0.53
S.V.	d.f.	Mean	Squares			
Age	1	690.2**	2095.3**	388.42**	37.74**	111.33**
Within	43	60.1	121.7	37.59	5.21	4.22

** P < .01

always occur in fat content which in turn influences the other components.

Table 5 presents the effect of breed of lamb on chemical composition of L.d. muscle. The most marked genotypic difference existed in fat percent. Turkish had 1% more fat which represents an increment of 52% over the Merino lambs average (1.92%). The increase in fat content reduced the proportion of protein in Turkish where Merino scored 1.7 more, about 9% of the Turkish average. These genotypic differences agree with the findings of Berg and Butterfield (1976) that some breeds are early fatteners and others are late.

The effect of age of Merino sheep (lamb vs. mutton) on chemical composition of their L.d. muscles is shown in table 6. Mutton had more dry matter (DM) compared to lambs (26.8 vs. 24.6%, resp.). The major part of this increment is accounted for by the increase in fat content. Mutton had more than double the fat estimated in lamb muscles (4.94 vs. 1.92%, p<.01). Conversely, lambs had slightly more protein, the difference, however, was statistically non-significant.

Relationships among physical and chemical parameters :

The relationships, calculated as simple coefficients of correlation within subclasses among the physical components of rib cut and the chemical components of L.d. muscle are shown in table 7. Among the physical components of rib cut, highly significant (p<0.001) negative coefficients were obtained between % fat, in one hand, and each of %

Table 5. Effect of breed of lamb on chemical composition of _Longissimus dorsi_ muscle.

Class	N	% Protein	% Ether extract	% NFE	% Ash
Breed group :					
Merino	30	20.9±0.32	1.92±0.19	0.56±0.11	1.23±0.04
Turkish	11	19.2±0.30	2.92±0.37	0.17±0.08	1.15±0.08
Source of Variation :	d.f	Mean **	Squares **	*	NS
Breed	1	23.70	8.00	1.22	0.04
Residual	39	2.53	1.17	0.29	0.05

NS = Non-significant, $* P < .05$ and $** P < .01$

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Table 6. Effect of age of Merino sheep on chemical composition of
Longissimus dorsi muscle

Class	N	% Protein	% Ether extract	% NFE	% Ash
Age :					
Lamb	30	20.9±0.32	1.92±0.19	0.56±0.11	1.23±0.04
Mutton	15	20.7±0.62	4.92±0.32	0.27±0.09	0.85±0.04
Source of Variation :	d.f	Mean Squares			
		NS	**	*	**
Age	1	0.55	118.60	1.13	1.89
Residual	43	4.20	1.27	0.21	0.04

NS = Non-significant, * P < .05 and ** P < .01

Table 7. Simple, within subclass, coefficients of correlation (above) among physical and chemical composition parameters.

%	Fat	Bone	Moisture	Protein	Ether extract	Ash
Lean	-0.779	0.102	0.337	0.239	-0.371	0.382
	(.0001)	(NS)	(0.01)	(NS)	(0.005)	(0.004)
Fat		-0.703	-0.526	0.317	0.492	-0.431
		(.0001)	(.0001)	(0.02)	(.0001)	(.001)
Bone			0.452	-0.231	-0.360	0.251
			(.0005)	(NS)	(0.006)	(NS)
Moisture				-0.409	-0.328	0.419
				(0.0008)	(0.008)	(0.0006)
Protein					0.537	-0.647
					(0.0001)	(0.0001)
Ether extract						-0.543
						(0.0001)

( ) between brackets are levels of significance;
NS = Non-significant.

lean and % bone on the other hand, (r = -0.779 and -0.703, resp. and p<.0001). These results indicate that the increase in fat content occurs on the account of both lean and bone proportions.

Among chemical components of the L.d. muscle, the results indicated that the increase in dry matter content is basically due to increasing fat and to a lesser extent to protein contents. The decline in % ash was accompanied also by an increase in the same two components.

The relationships among physical and chemical parameters are manifested clearly in the cases between : % fat in rib cut and % ether extract in L.d. muscle (r=0.492, p<.0001) and % fat and both of % moisture and % ash (r=-0.526, p<.0001 and r=-.431, p<.001, resp.). Percentage of lean in rib cut showed negative relationship with ether extract (r=-.371, p<.005) and showed also negative and non-significant relationship with, surprisingly, % protein in L.d. muscle. Reid (1972) obtained higher relationship between carcass protein and dissected lean and between carcass ether extract and dissected fat of lambs. However, Berg and Butterfield (1976) pointed the attention out to the great need for more studies determining carcass composition by physical dissection followed by chemical composition of the dissected tissues to establish the true relationship between the two procedures.

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خصائص لحوم سلالات الأغنام والماعز شائعة الإستهلاك في دولة الإمارات العربية المتحدة .

١- خصائص الذبيحة

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الخلاصة :

أجريت هذه الدراسة في المسلخ الآلي بالعين ومختبرات كلية العلوم الزراعية بجامعة الإمارات العربية المتحدة خلال الفترة من ١٥ نوفمبر ١٩٨٩ وحتى ١٥ يونيو ١٩٩٠ . أوضحت النتائج أن عمر الحيوان أثر معنويا (01. > P) على وزن الجسم ووزن الذبيحة الحار ونسبة التصافي في أغنام المرينو (ن = ٧٣ حيوان) . كانت المتوسطات المقدرة بطريقة الحد الأدنى للمربعات للصفات الثلاث ٤٠٫٥ كجم ، ٢٠٫٧ كجم و ٤٩٫٨٪ (على الترتيب) . وكانت المتوسطات المناظرة المقدرة على ٤٤ ماعز صومالي ٢٣٫٣ كجم ، ١٠٫٩ كجم و ٤٦٫٦ ٪ (على الترتيب) وكان تأثير العمر فيها معنوياً على وزن الذبيحة ونسبة التصافي فقط (P<.01) .

أوضح فصل مكونات الأضلاع ٩ ، ١٠ ، ١١ أن ذبائح الحملان التركية بها نسبة عظم أعلى من حملان المرينو (P<.05) ، كما أوضح أن عمر الحيوان له تأثير معنوي (R<.01) على نسب اللحم الأحمر والدهن والعظام وكذلك على سمك طبقة الدهن فوق الضلع التاسع .

ظهر من نتائج التحليل الكيماوي للعضلة العينية أن لحوم المرينو بها نسبة أعلى من البروتين بينما احتوت لحوم الحملان التركية على نسبة أعلى في الدهن (P<.01) . أثر العمر معنوياً على نسبة مستخلص الأثير (E E) ونسبة الرماد (P<.01)وكذلك على نسبة المستخلص خالي النيتروجين (NFE.P<.05) واحتوت لحوم الأغنام الكبيرة نسبة أعلى من الدهن (٤٫٩٤٪) مقارنة بما احتوته لحوم الحملان (١٫٩٢٪) وأظهرت حسابات التلازم – داخل المجاميع- وجود علاقات معنوية بين مقاييس طبيعية وأخرى كيماوية من التي استخدمت في هذه الدراسة .

كلمات مفتاحية : سلالات ، خصائص ، الذبيحة ، ماعز ، أغنام ، دولة الإمارات العربية .