INFLUENCE OF TYPE (WOOL OR HAIR) AND BREED ON GROWTH AND CARCASS CHARACTERISTICS AND ORGANOLEPTIC PROPERTIES OF LAMB

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INTRODUCTION

Hair type sheep indigenous to the tropical regions of the world have increased parasite resistance, heat endurance and prolificacy when compared to wool breeds (Turner, 1974; Devendra, 1977). These characteristics have attracted the interest of the U. S. sheep industry. The limited information available on growth characteristics of the hair sheep breeds has been summarized by Maule (1977). The purpose of this research was to evaluate the influence of type on carcass characteristics and organoleptic properties of lamb.

EXPERIMENTAL

Forty-six ram lambs including 12 straightbred Barbados Black Belly, 12 straightbred St. Croix (white hair from St. Croix Island, Virgin Islands), 12 Florida Natives and 12 Cross-Breeds were used in this study. Twenty-four of the lambs (Barbados and St. Croix) were hair type, and twenty-two of the lambs (Florida Native and Cross-Breed) were wool type.

The 12 Cross-Breed lams were Suffolk sired from white face wool type breeds. Seven were 1/2 Suffolk, 3/8 Finn and 1/8 Rambouillet. Two were 1/2 Suffolk, 1/4 Targhee, 1/8 Rambouillet and 1/8 Finn. One was 1/2 Suffolk and 1/2 Targhee. The remaining two lambs were 1/2 Suffolk, 1/4 Targhee, 1/4 Finn and 1/2 Suffolk, 1/4 Targhee, 1/8 Dorset and 1/8 Finn.

All lambs were born in housed confinement and were creep fed a high concentrate protein (CP-18%) diet at two weeks of age. Post weaning the high concentrate diet was continued for approximately two months and then changed to a 15% CP diet until the end of the trial (averaged 1 month). Lambs were removed from trial when the live animals appeared to have the same apparent fat finish.

Lambs were transported to The Ohio State University Meat Laboratory and slaughtered in a conventional manner. They were chilled at 3±4°C for 72 hours prior to cutting into retail cuts. All lamb carcasses were graded for marbling, conformation, leg score, quality score and a final grade assigned. Measurements included fat thickness over Longissimus dorsi and Longissimus dorsi area.

The lamb was prepared and cooked as chop and as rolled shoulder, and evaluated for tenderness, color, juiciness, flavor and acceptability. Six chops and one rolled roast from each lamb in each group were used for organoleptic studies. Chops 2.54 cm in thickness were broiled in an electric broiler until they reached 77°C internal temperature. The L. D. was trimmed of external fat and served as 1/2" cubes. Rolled shoulders were roasted at a temperature of 149°C in an electric oven until they reached 80±2°C internal temperature.

Chop and rolled roast samples were served warm on plates to panel members. A six member laboratory panel (experienced with lamb and liked lamb flavor) assessed duplicate samples at each session. The samples were scored for tenderness, internal lean color, juiciness, flavor and acceptability using an 8-point scale.

Chemical analysis of the uncooked chop was determined on the Longissimus dorsi after removal of external fat and grinding and mixing of the tissue. Chemical analysis of the uncooked roast was accomplished on a cross sectional center slice taken from the boned and tied roast which was ground and mixed prior to analysis.

The data was analyzed using the SAS implementation of the Least Squares and Maximum Likelihood General Purpose Program of Walter R. Harvey as a nested design with breeds nested within lamb types (Harvey, 1977).

RESULTS AND DISCUSSION

Number of lambs per birth was significantly (P<.05) higher for the hair type sheep than the wool type sheep (Table 1). Within the hair type, the St. Croix had more (P<.01) lambs per birth than did the Barbados and in the wool type the Cross-bred sheep had more (P<.01) lambs per birth than did the Florida Native sheep.

Table 1 - Live animal and carcass traits for lambs. Values are least square means ± standard error.

	Hair type			Wool type		
Variable	Mean for hair type	Barbados	St. Croix	Mean for wool type	Florida N.	Cross-Breed
Type of birth (# of lambs)	2.04±0.11 *	1.75±0.45 **	2.33±0.49	1.63±0.12	1.00±0.00 **	2.25±0.87 **
Av. daily gain (g)	200±9 **	172±41 **	222±27	304±9	259±59 *	349±73
Age off test (days)	166±4 **	158±21 **	173±20	149±5	158±22 **	139±24
Slaughter wt. (Kg)	31.2 ± .9 **	25.2 ±3.8 **	37.1 ±2.5	42.8 ±1.0	38.8 ±5.5 *	46.8 ±5.6
Cold carcass wt. (Kg)	15.3 ± .6 **	12.3 ±1.9 **	18.4 ±1.8	21.7 ± .6	20.5 ±3.7 **	22.9 ±3.6
Untrimmed leg (Kg)	5.0 ± .2 **	4.3 ± .6 **	5.7 ± .5	6.6 ± .2	6.2 ± .9	7.1 ±1.0
Conformation a/	7.0 ±0.2 **	7.7 ±0.7 **	6.3 ±0.8	4.8 ±0.2	4.8 ±1.2	4.8 ±1.1
Leg score a/	6.5 ±0.2 **	6.8 ±0.8 **	6.2 ±0.7	4.5 ±0.2	4.7 ±1.1	4.3 ±1.0
L. D. area (sq. cm.)	8.87±0.3 **	7.80±1.35 **	9.68±1.03	11.16±0.32	10.90±1.68	11.48±1.81
Central fat (cm.)	0.18±0.03 **	0.10±0.05 **	0.25±0.10	0.28±0.03	0.30±0.13	0.28±0.08
Pelvic fat (g)	131.5 ±13.6 **	81.6 ±27.2 **	176.9 ±49.9	213.2 ±13.6	217.7 ±49.9 **	208.6 ±81.6
Kidney fat (g)	435.4 ±54.4 **	258.6 ±86.2 **	612.4 ±217.7	839.1 ±54.4	1011.5 ±444.5	671.3 ±1.99
Marbling b/	21.8 ±0.6 **	25.1 ±3.2 **	18.4 ±2.2	16.7 ±0.6	16.0 ±2.9	17.3 ±2.5
Quality score a/	5.4 ±0.3 **	7.5 ±1.3 **	3.3 ±1.4	2.8 ±0.3	2.8 ±1.8	2.8 ±0.5
Final grade a/	6.5 ±0.2	7.8 ±1.0	5.2 ±0.8	3.7 ±0.2	3.8 ±1.6	3.7 ±0.6

* Significantly different means (P<0.05) for animal type or breed within animal type.
** Significantly different means (P<0.01) for animal type or breed within animal type.
a/ Conformation, leg, quality, final score, 1 = high prime, 2 = Ave. prime, 3 = low prime ... 12 = low utility.
b/ Marbling score, 1 = high abundant, 2 = Ave. abundant, 3 = low abundant ... 30 = low devoid.

When average daily gain was compared, the hair sheep were slower gaining than the wool type. The St. Croix gained at a faster rate than did the Barbados. The Cross-breeds were faster gaining than the Florida Natives. This trend is also reflected in the age off test. The basis for selection for slaughter was visual fat finish, therefore rate of finishing and age off test were inversely related ($r = -.77$). Thus older lambs at slaughter have a slower finishing rate. The Cross-breeds were slaughtered at a significantly ($P<0.05$) younger age than the Florida Natives. The St. Croix lambs were older when slaughtered than the Barbados ($P<0.01$). The types (hair vs wool) were significantly different ($P<0.01$) for average daily gain and age off test. When weights were compared, such as slaughter weight, cold carcass weight, and untrimmed leg weight in all cases the wool type animals were significantly ($P<0.01$) heavier than the hair type animals. The St. Croix breed was significantly ($P<0.01$) heavier than the Barbados breed in the hair type classification while the Cross-bred animals were significantly ($P<0.05$) heavier than the Florida Natives when the wool breeds were compared.

Conformation, leg score and Longissimus dorsi area were completed. In all cases the wool type were significantly better or larger than the hair type and St. Croix was also significantly ($P<0.01$), except for leg score which was not significant ($P>0.05$), larger or better than Barbados. No significant difference ($P>0.05$) was found when comparing the wool breeds.

When degrees of fatness were compared such as central fat, pelvic fat and marbling, in all cases the wool type contains significantly ($P<0.01$) more fat than the hair type and St. Croix was considerably ($P<0.01$) fatter than the Barbados.

Quality score and final grade evaluation showed the wool type being significantly ($P<0.01$) better than the hair type and St. Croix being significantly ($P<0.01$) better than Barbados. There was no significant difference ($P>0.05$) in the wool breeds for these two factors.

The chemical composition of the chop and rolled shoulder samples are shown in Table 2. As would be expected from the carcass data, the wool type was significantly ($P<0.01$) fatter based on both a wet and dry weight basis than the hair type and the St. Croix was significantly ($P<0.01$) fatter than the Barbados. Florida Natives in all cases also had higher fat levels than the Cross-Breed but these levels were not high enough to be significant ($P>0.05$).

Cooking yield data was significantly different for type in the rolled shoulder with the hair sheep having higher ($P<0.01$) yield than the wool sheep. This was probably due to the much higher fat content found in the wool sheep. In the chop area, Barbados was significantly ($P<0.01$) higher than St. Croix; again this was probably influenced by the higher fat level in the St. Croix sheep.

Table 2 - Chemical analysis, and yield of lamb chop and rolled shoulder. Values are least square means ± standard error.

		Chop			Rolled shoulder		
			Fat			Fat	
Type	Breed	% Moisture	% W.B.[a]	Yield[b]	% Moisture	% W.B.[a]	Yield[b]
Hair		75.59±0.18**	2.68±1.18**	61.96±0.87	61.83±1.16**	20.74±1.51**	64.27±0.61*
	Barbados	76.14±0.53**	1.94±0.43**	64.97±2.07**	66.13±5.28**	15.36±6.65**	63.95±2.05
	St. Croix	75.06±0.57	3.42±0.74	58.95±3.43	57.53±5.87	26.12±7.90	64.60±2.65
Wool		74.58±0.19	3.35±0.19	60.68±0.91	45.91±1.22	40.87±1.58	62.43±0.64
	Florida N.	74.22±1.31	3.67±1.21	61.74±7.22	44.99±5.59	41.51±6.80	62.39±3.09
	Cross-Breed	74.94±1.03	3.04±0.97	59.62±3.15	46.84±5.99	40.23±8.41	62.47±3.88

* Significantly different means ($P<0.05$) for animal type (hair or wool) or breed within animal type.

** Significantly different means ($P<0.01$) for animal type (hair or wool) or breed within animal type.

a/ W.B. = Wet basis

b/ $\text{Yield} = \frac{\text{Drained wt. after cooking}}{\text{Uncooked wt.}} \times 100$

Organoleptic comparison of the chop and rolled shoulder from the four breeds of sheep are shown in Table 3. This comparison showed the wool type rolled shoulder significantly ($P<0.05$) more tender than the hair type rolled shoulder and that within the hair breed, St. Croix was more ($P<0.05$) tender then Barbados. In each case the product that was the most tender was also highest in fat content. In color, the only significant difference found was in the comparison of hair and wool types with the hair types being darker ($P<0.01$) when chops were compared. In roast products, the hair type was also darker than the wool type but this difference was not large enough to be significant ($P>0.05$). Chops from the St. Croix breed was juicier ($P<0.01$) than the Barbados and the Florida Natives were juicier ($P<0.05$) than the Cross-Breed. The same relationship was found in roast with the exception that the Florida breed-Cross-Breed difference was not large enough to be significant ($P>0.05$). The scores as would be expected are in the same direction as the fat levels for these products. Flavor was compared and the wool type was rated significantly higher ($P<0.05$) than the hair sheep in the roast product. The same relationship was noticed in the chop product but the difference was not large enough to be significant. It should be pointed out that the mean flavor was not objectionable for any breed. There were a few notations for specific hair type samples from a few specific panel members that objected to the flavor of an individual sample. In overall acceptability of the roast product, the wool breeds

were scored significantly (P<0.01) higher than the hair breeds and in the chop products, St. Croix was significantly (P<0.05) higher than Barbados. But as with flavor, all average scores were acceptable.

Table 3 - Organoleptic evaluation of lamb chops and rolled roasts.
Values are least square means ± standard error.

	CHOP					ROLLED SHOULDER				
Type Breed	Tenderness[a]	Color[b]	Juiciness[c]	Flavor[d]	Acceptability[e]	Tenderness[a]	Color[b]	Juiciness[c]	Flavor[d]	Acceptability[e]
Hair	5.3±.2	5.0±.1**	4.8±.1	5.2±.1	5.8±.1	6.4±.1*	4.2±.1	5.6±.1	5.4±.1*	6.2±.1**
Barbados	4.8±.9**	4.9±.3	4.6±.3**	5.2±.3	5.5±.6*	6.2±.4*	4.2±.3	5.4±.4*	5.4±.2	6.2±.4
St. Croix	5.8±.7	5.1±.3	5.1±.5	5.2±.4	6.1±.5	6.6±.4	4.1±.2	5.7±.4	5.4±.5	6.3±.4
Wool	5.2±.2	4.8±.1	4.7±.1	5.3±.1	5.7±.1	6.7±.1	4.1±.1	5.7±.1	5.6±.1	6.6±.1
Florida N.	5.4±.6	4.8±.3	4.9±.4*	5.4±.4	5.9±.4	6.6±.4	4.2±.3	5.8±.4	5.7±.3	6.5±.2
Cross-Breed	5.1±.6	4.7±.4	4.5±.4	5.3±.3	5.6±.6	6.7±.3	4.0±.3	5.7±.4	5.6±.4	6.6±.3

*Significantly different means (P<0.05) for animal type (hair or wool) or breed within animal type.
**Significantly different means (P<0.01) for animal type (hair or wool) or breed within animal type.
a/1 = Extremely tough, 2 = Very tough, 3 = Moderately tough, 4 = Slightly tough, 5 = Slightly tender, 6 = Moderately tender, 7 = Very tender, 8 = Extremely tender.
b/1 = Extremely pale, 2 = Very pale, 3 = Moderately pale, 4 = Slightly pale, 5 = Slightly dark, 6 = Moderately dark, 7 = Very dark, 8 = Extremely dark.
c/1 = Extremely dry, 2 = Very dry, 3 = Moderately dry, 4 = Slightly dry, 5 = Slightly juicy, 6 = Moderately juicy, 7 = Very juicy, 8 = Extremely juicy.
d/1 = Extremely mutton flavor, 2 = Very mutton flavor, 3 = Moderately mutton flavor, 4 = Slightly mutton flavor, 5 = Slightly lamb flavor, 6 = Moderately lamb flavor, 7 = Very lamb flavor, 8 = Extremely lamb flavor.
e/1 = Extremely unacceptable, 2 = Very unacceptable, 3 = Moderately unacceptable, 4 = Slightly unacceptable, 5 = Slightly acceptable, 6 = Moderately acceptable, 7 = Very acceptable, 8 = Extremely acceptable.

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