ECT OF MANAGEMENT SYSTEM IN HISTOLOGICAL CHARACTERISTICS OF TWO LAMB MUSCLES

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mary

n lambs were allotted to four management systems from weaning to slaughter (45 Kg). One
n was weaned while the other nursed the ewe, both were weaned, or neither was weaned.Muscle
er distribution of longissimus thoracis and semimembranosu were evaluated. In both muscles
e red fibers were larger, the percentage of white fibers were higher, while the intermediate
ers showed smaller morphological characteristics in the twin lambs unweaned.

roduction

k production of ewes characteristically increases to a peak of 3 to 5 weeks after parturi
on, after which it declines steadily (Torres-Herandez and Hohenboken, 1980). Normally, ewes
efficiently suckle twin lambs until peak milk productivity is reached. Thereafter, ewes
not provide sufficient nutrition through milk secretion alone to maximize lamb gains becau
of the increased nutrient requirements of the lambs. Geenty (1980) and Benson et al.,(1982)
owed that lambs can be weaned as early as 8 weeks of age without exhibiting any growth de
ression. These results, plus the finding that ewes suckling twin lambs produce only one-third
e milk than those with singles (Poe, 1969), indicate that removal of one member of a twin
er may allow optimum growth of both lambs when compared with weaning both lambs or allowing
h to nurse until the traditional weaning age of 16 weeks. Several researchers including
ther and Whiteman (1961), Ely et al. (1979), Gibb et al. (1981) and Smeaton et al. (1983),
ve developed methods and determined optimum ages for early weaning lambs. However, none of
ese studies compared weaning only one member of a twin pair with weaning both twins. Since
scle is the most abundant carcass tissue and meat is the primary product of animal producti
, it is logical that the quantitative and the qualitative characteristics of the meat would
altered in proportion to the degree alteration of the fibre type profiles. The objectives
this study were to examine muscle fiber characteristics of lambs managed in four systems.

terials and Methods

irty ewes and their 60 twin lambs (half ewes and half wethers) were used in this study. All
ewes were treated alike during gestation. At 66 days, lamb were allotted to the following ma
agement systems: Group 1 - Ewes and lambs were managed in drylot in one group with all lambs
rsing ewes until a slaughter weight of 45 Kg was reached; Group 2 - Lambs were weaned at 8
eks and self-fed a conventional growing-finishing diet until reaching the 45 Kg slaughter
ight; Group 3 - The lambs were managed like group 1 and 2 until they reached 6 weeks of age.
e lamb of each pair remained with the ewe (this group) and was creep-fed the conventional
t like group one; Group 4 - One member of each twin pair in group three was weaned at 8 wee
of age and self-fed the conventional growing-finishing diet like group two, until it reach
the 45 kg slaughter weight. Muscle samples (1 cm^3) from the longissimus thoracis (Kauffman
al. 1990) at the 12th rib location and the semimembranosus (inner portion) were removed
rom the left side of each carcass approximately 2 h post-mortem. The frozen muscle samples
re mounted on spindles before sectioning 14 um thick using a Damon freezing microtome. Se
ial sections mounted on glass microscope slides were treated with a combination staining pro

cedure (Nicastro, 1989), to detect the presence of ATPase and NADH-Tr within a single secti of muscle tissue. Several fields on a each section were photographed at 10x with the bright field setting. Enlarged photomicrographs (12.7 x 17.8 cm) from each section were evaluated fiber type (βR, αR, αW) according to Ashmore and Doerr (1971). In addition to fiber diameter and area, fiber type percentages were determined. Data were analyzed by least squares procedure (SAS, 1985), assuming a mathematical model that include management and sex.

Results and Discussion

Least squares means for longissimus fiber type percentages and diameter are presented in table 1. Lambs allotted in group 1 had larger red fibers ($P < .05$), while no significant differences was noted for intermediate and white fibers. The BR and alpha-White fibers were similar in diameter but both types were larger than alpha-Red fibers. These results, however, are not in agreement with most of the reports in the literature. Gauthier (1970) reported tha red fibers have the smallest and alpha-White the largest diameter. Moody (1980) reported that the βRed fibers were larger than the alpha-Red and alpha-White fiber types. The distribution and diameters of muscle fiber types in the semimembranosus muscle are show in table 2. Percentages of all three fiber type were influenced by management with larger presence of intermediate fibers (55 %; $P < .01$) in lambs from group 3 (one twin remained with the ewe until slaughtered), while it is interesting to note that the presence of Red and White fibers is higher ($P < .05$) in lambs that remained on their mothers (group 1) from birth to slaughter. This variation in fiber type within a specific area adds further evidence that fiber transformation may be influenced by management and nutrition. The males had approximately one percent less βRed and αRed fiber area and about one percent more αW fiber area than their counterpart females. These differences were not significant.

Table 3 shows for longissimus and semimembranosus muscles percentage area of red, intermediate or white fibers. There was a greater ($P < .01$) fiber area occupied by the βRed fibers of the longissimus in group 1 compared to group 3.Likewise, group 1 had a larger ($P < .05$) βRed fiber area than group 4 but no difference was noted in βRed fiber area of group 2 compared to the other groups. Group 4, however, had a greater area ($P < .01$) of alpha-Red fibers relative to group 1. There was also a larger area of these fibers (intermediate) in group 4 compared to group 2. The αW fiber area not differ among groups. Less difference were observed in semimembranosus fiber type areas among the four groups than in the longissimus. Group 2 had a larger percentage of Red fiber area than group 1 whereas there was no difference in percentage area among the other groups. Moreover, there was no significant difference in βRed or αW fiber. Sex of lamb apparently had no significant effect on fiber area among groups.

Conclusion

These results suggest that histochemical characteristics of longissimus and semimembranosus muscles appear to relate to management system. In fact lambs that remained on their mothers have better morphological characteristics of red and white fibers in both muscles, while intermediate fibers have different trend.

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Table 1 - Least squares means (± S. E.) for fiber type percentages and diameters of ßR (Red), ∝ R (Intermediate) and ∝ W (White) in longissimus thoracis muscle fibers for each management type and sex.

Item	Fiber type %			Fiber diameter, µm		
Management Systems	Red	Interm.	White	Red	Interm.	White
Group 1	13.8±1.4	48.0±2.5	38.1±2.0	39.2±1.7a	33.6±1.0	39.4±1.2
Group 2	11.5±1.3	49.6±2.4	38.9±1.9	37.0±1.6	32.9± .9	38.0±1.2
Group 3	13.9±1.4	49.3±2.5	36.7±2.0	34.8±1.7	33.4±1.0	39.4±1.2
Group 4	10.7±1.4	52.6±2.5	36.6±2.0	34.0±1.7b	33.4±1.0	37.1±1.2
Sex						
Males	12.7±1.0	50.3±1.7	36.9±1.4	36.4±1.2	32.6± .7	38.1± .8
Females	12.3±1.0	49.5±1.7	38.2±1.4	36.0±1.2	34.0± .7	38.9± .9

a, b Means in the same column bearing different superscripts differ significantly ($P < .05$).

Table 2 - Least squares means (± S. E.) for fiber type percentages and diameter of βR (Red), αR (Intermediate) and αW (White) in semimembranosus muscle fibers for each management type and sex.

Item	Fiber type, %			Fiber diameter, μm		
Management Systems	Red	Interm.	White	Red	Interm.	White
group 1	18.2±1.8a	42.5±3.2A	39.2±3.2a	39.0±1.5	35.4±1.4	44.6±1.7
group 2	15.0±1.7	48.6±3.1	36.3±3.0	37.1±1.5	36.3±1.3	41.3±1.6
group 3	13.8±1.8b	55.0±3.2B	31.1±3.2b	38.5±1.5	35.8±1.4	44.0±1.7
group 4	17.0±1.8	50.0±3.2	32.9±3.2	36.9±1.5	35.3±1.4	40.9±1.7
Sex						
Males	15.6±1.2	48.7±2.3	35.6±2.2	37.5±1.1	34.9± .9	42.7±1.2
Females	16.4±1.2	49.4±2.3	34.2±2.2	38.3±1.1	36.5±1.0	42.8±1.2

a,b Means in the same column bearing different superscripts differ significantly ($P<.05$).

A, B Means " " " " " " " " " ($P<.01$).

Table 3 - Least squares means (± S. E.) for percentage areas of βR (red), αR (Intermediate) and αW (White) fibers in longissimus and semimembranosus muscles for each management system.

Muscle	Longissimus			Semimembranosus		
	Fiber area, %			Fiber area, %		
Management system	Red	Interm.	White	Red	Interm.	White
group 1	36.1±1.5Aa	27.0± .9B	36.9±1.3	32.0±1.1	26.5±1.2a	41.5±1.2
group 2	34.7±1.4	27.8± .9b	37.5±1.3	31.3±1.1	30.0±1.1b	38.8±1.1
group 3	31.2±1.5B	28.8± .9	40.0±1.3	31.5±1.1	27.4±1.2	41.1±1.2
group 4	31.7±1.5b	30.5± .9Aa	37.8±1.3	31.8±1.1	29.1±1.2	39.1±1.2
Sex						
Males	34.3±1.0	27.8± .6	37.9± .9	31.6± .8	27.4± .8	41.0± .8
Females	32.6±1.1	29.2± .7	38.2±1.0	31.7± .8	29.0± .8	39.3± .8

a, b Means in the same column bearing different superscripts differ significantly ($P<.05$).

A, B Means " " " " " " " " " ($P<.01$).