QUANTITATIVE AND MORPHOLOGIC STUDIES OF THE ADIPOSE TISSUE OF EARLY WEANED LAMBS FED ON SHEEP MILK REPLACERS

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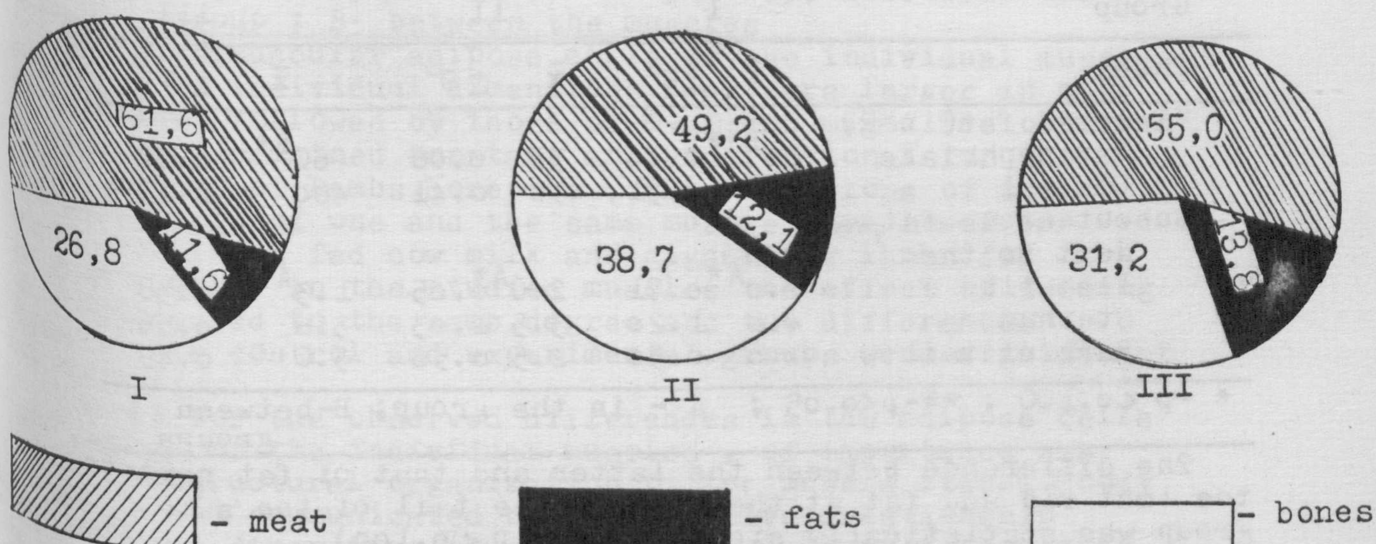
SUMMARY : The srudy was conducted with lambs weaned 48 hours after parturition.The animals were divided in three groups i.e.lambs fed on sheep milk , lambs fed on cow milk and lambs fed on cow milk supplemented with starch to the energetic level of sheep milk.Carcass analysis was carried out at the age of 45 days, prior to the start of the fattening period.Moreover,a study was conducted of the topographic localization of the subcutaneous and visceral fat as well as of dimensions of the adipose cells of the various tissues. The intramuscular and subcutaneous adipose cells of lambs fed on sheep milk were close in dimensions. The dimensions of the intermuscular adipose cells of lambs fed sheep milk were greater than those of lambs fed cow milk and cow milk with added starch. Fat content of the muscles LD,SM and SP was higher in lambs fed sheep milk, followed by the fat content of the same muscles of lambs fed cow milk and cow milk supplemented with starch.

INTRODUCTION : In previous studies we have shown that feeding lambs from the earliest age on sheep milk replacers brought about alterations in the activity of enzymes of the alimentary tract closely linked with food availability and development of the individual tissues(6,7).The most part of the studies concerning fat content of carcass and its topographic location as a componet of meat perfomance and quality of meat were in connection with genotype , age and other exogenous factors(1,2,3,4,5,12). The purpose of the study was to determine quantitatively the reserve fats,and tthe structural organization of the adipose cells of the seperate tissues.

MATERIALS AND METHODS : The experiment wa conducted with 15 lambs weaned 48 hours after partutition, divided in three groups and fed under control. $Group_1$ (control) was fed sheep milk, $group_2$(experimental) was fed cow milk , and $group_3$ (experimental) was fed cow milk enriched with starch to the energetic level of sheep milk.Carcass analysis was performed at the age of 45 days, prior to the fattening period. Morphologic studies of the intramuscular adipose cells were conducted on samples of the muscles Longissimus dorsi (LD), Semimembronosus (SM) and Supra spinatus (SP). Determinations of adipose cell dimentions and their distribution in the slices were carried out according to the method of Herring (1967). Three cathagories of intramuscular cell distribution were laid down i.e. associations of up to 10 cells, 11 to 20 cells, and above 20 cells. Subcutaneous fat was sampled at the base of the tail and intramuscular fat from the leg. The chamical analysis of fat was conducted according to the method of Soxlet.

RESULTS AND DISCUSSION : Data on the content of meat, fat and bones of carcass indicated that the kind and composition of feed had a strong impact on muscle tissue development (Fig.1).



The portion of fat was composed of subacutaneous and intermuscular fat. It was observed that a tendency existed towards a higher percentage of the above fats in the groups of lambs fed mother's milk replacers. The quantity of the deposited fat showed that formation of 1 kg muscle tissue was accompanied by formation of o.28 , o.27 and o.25 fat tissue in lambs of $group_1$, $group_2$ and $group_3$ respectively. However , the established ratios between muscle and fat tissue at that age of lambs were not in agreement with the studies of Wasmuth (1974) and Shön (1971), who established a negative correlation between avarage daily gain and deposition of fat. Similar were the results of the quantity of perimephrial fat in animals fed cow milk, but the established differences with the other two groups were significant ($p < 0.05$).

Subcutaneous fat thickness from different topographic parts of carcass of lambs of the three groups was largest in the region of the sternum.

Table 1

Quantity and topographic localization of visceral and subcutaneous fat

Group	1		11		111	
Index	$\bar{x}$	$\pm\sigma$	$\bar{x}$	$\pm\sigma$	$\bar{x}$	$\pm\sigma$
Visceral fat(in g)						
Perinephrial	80^{B**}	0.04	35	0.08	60^{B*}	0.02
Omental	480	0.31	450	0.41	460	0.17
Subcutaneous fat, mm						
Next to the last rib	2.0^{A*}	0.71	2.0^{A*}	0.05	1.3^{A*}	0.38
Sternum	4.8	1.20	3.5	1.03	3.8	0.56
Base of tail	2.8	0.50	2.5	0.56	3.0	0.49

* -$p < 0.100$; **-$p < 0.05$; A - in the group; B-between groups

The difference between the latter and that of fat next to the last rib and fat at the base of the tail of the same group was statistically significant ($p < 0.100$).

The observed deviations and insignificant differences between the groups in deposited subcutaneous fat, showed the strong effect of the system of feeding at that age , on development of muscle tissue.

In another study we found that up to the 90-th day of age feeding lambs on cow milk only to the 50-th day, had also a strong unfavourable effect on development of muscle tissue (4).

Dimensions of intra and intermuscular adipose cells are presented in Table 2. Those data showed that feeding had a significant effect on the dimensions of intermuscular adipose cells of all the three muscles. Compared to the other two groups development was more advanced in lambs fed on mother's milk ($p < 0.05$).

Table 2

Dimensions of Adipose Cells, μ

Group	I		II		III	
Index	$\bar{x}$	$\pm\sigma$	$\bar{x}$	$\pm\sigma$	$\bar{x}$	$\pm\sigma$
Intramuscular fats in:						
LD	26.47	4.82	24.01	3.44	25.04	5.8
SM	25.34	1.44	22.86	3.38	22.91	3.04
SP	27.65 B*	5.06	24.85 B*	2.14	25.95 B*	5.45
Intermuscular fats in:						
Leg	44.70 A**	5.37	34.63	2.25	42.75 A*	1.19
Subcutaneous fat at the base of tail	44.02 A***	3.77	31.80	4.94	37.24 A**	2.13

* - $p<0.100$; ** - $p<0.050$; *** - $p<0.025$; A-between the group ; B- between the muscles

The intermuscular adipose cells of the individual muscles differed in individual dimentions.They were larger in m.SP ($p<0.100$) followed by those of m.LD and m.SM. The observed differences remained constant and undirectional for the three groups of lambs.Moreover , the dimensions of the adipose cells of one and the same muscle were lower in value for lambs fed cow milk and higher for lambs fed mother's milk. In the studied muscles the effect of feeding was manifested to the same degree and the differences between the control and experimental groups were significant at $p<0.100$.

Except for the observed differences in the adipose cells dimensions of the individual muscles , of importance was also the structural organization of the muscle itself.Moody et al.(1960) communicated on the positive relationship between the dimensions of adipose cells and their count in a definite area.The differences in the morphologic pattern of the different groups referred to the distribution and dimensions of the adipose cells.In the control lambs, fed on sheep milk,prevailed associations of 11 to 20 and above 20 cells. Lambs of group $_2$ were represented mostly by the category of up to 10 cells , and group $_3$ occupied a medial position in respect to cell association. With the increase of the adipose cell count in the associations increased also their dimensions in all the variants of this study.

The comparative studies of adipose cell dimensions Blumer et al.(1962) found that the intramuscular cells were of lesser size and suggested that this was due to the pressure excersized by the connective tissue, while the size of subcutaneous adipose cells was larger.

In this study was shown that the intramuscular and subcuteneous cells were close in dimension in lambs of group 1. However, in the other two groups the intermuscular adipose cells exceeded the subcutaneous cells in dimensions. It was inferred that this occurrence was due to their development at a more advance age. Feeding had a significant effect on those two traits($p < 0.05$) and ($p < 0.025$). Data on intramuscular adipose cells indicated a trend towards higher dimensions in lambs of the control group fed mother's milk for all the studied muscles.

In studies of the relation between dimensions of adipose cells and extracted fat content numerous authors communicated on the exsistance of a highly positive correlation (9). Some other authors found that its magnitude was directly proportional to the cathegory of the adipose cell association (8, 10). On Table 3 are presented the results of the chemical analysis of the fat content of the three muscles. It was found that its quantity was greater in muscles having adipose cells of a higher dimension and higher cell association. In respect to this trait the muscle could be arranged in a descending line as follows: SP, LD, SM.

A tendency was observed towards a higher content of extracted fat in lambs of the group fed on sheep milk.

Table 3

Extracted Fat Content (in %)

Group	1		11		111	
Muscles	$\bar{x}$	$\pm\sigma$	$\bar{x}$	$\pm\sigma$	$\bar{x}$	$\pm\sigma$
LD	1.97	o.4o	1.5o	o.16	1.79	o.54
SM	1.86	o.27	1.52	o.35	1.62	o.3o
SP	2.35	o.56	1.77	o.66	2.o1	o.54

CONCLUSIONS : Intramuscular and subcutaneous adipose cells in lambs fed sheep milk were close in dimensions. In lambs fed cow milk and cow milk supplemented with starch to the energetic level of sheep milk the intermuscular adipose cells had higher dimensions. The dimensions of the intermuscular adipose cells in lambs fed sheep milk were higner than those of lambs fed on sheep milk replacers. Fat content of the muscles SP, LD and SM was higher in lambs fed on cow milk supplemened with starch, and on cow milk alone.

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