Influence of Age on Growth Dynamics of Muscle Fibres, their Metabolitic Type and Meat Quality in Sheep.

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There are important cellular based studies on meat quality in sheep/Hammond 1932;Moody 1970,1980; Valin et al.1982; Pinkas et al.1981,1982; Marinova 1983/. They show that both on metabolitic type of muscle fibres and their diameter, a part play the breed, sex, age as well as the live weight of animals. It is in this way that high differences in results obtained by single studies, may be explained.

The objective of the present work is to follow changes occuring in muscle fibres of m.long. dorsi and m.semimembr.with the growth of animals slaughtered successively at 3,45,90,120, 150,180,270 and 365 days of age Ascanian fine-fleeced breed for meat and wool. The fibre type was determined after Ashmore's scheme/1974/. Simultaneously changes of diameter for the three types of fibers were determined. These changes were accompanied by analyses on pH24,; meat colour determined spectrocolorimetrically at 525 nm wave lenght; Water Binding Capacity of meat/WBC/, being determined after a modification by Pinkas/1973/, method of Grau and Hamm/1953/. WBC is expressed in percentage of separated water in 300 mg minced meat. Hempigments were determined after Hornsey's method/1956/. Percentage of lipids was established through extraction with ether.

Results: Type and diameter of muscle fibres. Percentage of the three types of fibres and changes in their diameter both for m.long.dorsi and m.semimemb.are given in table 1. These data show that red fibres of slow contraction/βR / present a small coefficient of changes but in both muscles highest percentage is of βR fibres at 120 and 150 days of age /to

30-31 %/ then falling to 25-26 %. More marked changes occur in intermediaire/αR / fibres reducing from 52 % at 3-day age with a certain variation in single age groups, to 44 % for m.long.dorsi and to 48 % for m.semimemb, at 365 days of age. Smaller percentage of red / βR / and αR / fibres is at expense of white /αW/ fibres, which - excepting 45-day aged group- manifest a graduall increase with the growth of animals. In the studies of Solomon et al./1981/ no similar changes in fibrer type are observed with increasing slaughterweight of sheep. Ashmore et al./1972/ consider the transfert of αR into αW fibres as a normal phenomenon, confirmed by Kiessling /1977/ and Moody et al./1980/, as well as by Ashmore & Robinson /1969/ and Dildey et al./1970/ in both pigs and cattle. In our studies /Pinkas et al./1981/ similar changes in the type of fibres are observed only in populations of well expressed meat abilities, as is the breed, whereof originate animals used in our experiment This conclusion confirms Ashmore's point of view /1974/ that increasing the meat-production in both sheep and cattle is related to increasing of glucolitic type of αW fibres. Question arises about statistically significant reduction / $P < 0.01$/ of αW fibres at 45-day age compared to 3-day age, being manifested in m.semimembranosus also at 90 day of age. Ovbiously the cause is the ratio of single types of fibres in muscles at 3-day age, not being yet completely shaped/Pinkas & Marinova, 1980/.

Data on fibres diameter/table 1/ sohw a logical sequence. Most intense increasing of diameter in both tested muscles is up to 90 days of age, afterwards that intensity reduces gradually, difference between 270 and 365 days of age being practically the same. Diameter of white/αW/ fibres in both muscles is greater than that of βR , this difference being statistically significant in our case. This more intensive growth of glucolitic type of fibres occurs at initial growth period, then this difference for m.semimembranosus disappears at 270 and for m.long.dorsi at 365 days of age. In this respect literature data are rather contradictory. Apparently, breed and age of animals play an essential part in this respect /Moody et al.1980; Pinkas et al.1981/.

Table 2 presents results of chemical and physicochemical analysis in meat of animals slaughtered at various age. pH measured 24 h post mortem shows certain differences within limits of normal values. Apparently, in 270 and 365 days aged animals, pH values reduce compared to the rest of ages. This difference is more marked /$P < 0.05$/ in m.semimembr. Colour of meat expressed in reflectivity percentage/ R /shows a regular decrease of reflectivity with increasing the age. Naturally, meat is lightest in 3-day aged lambs. This is due mainly to hempigments concentration, increasing considerably in the last three age groups.This increase is more intensive in m.semimembr. As for water binding capacity of meat no regularities were observed, some differences having been statistically significant. With growing of animals a natural increase is observed in fat percentage in both muscles.

A question of interest is the dependance existing between metabolitic type of fibres and single traits characterizing the meat quality. Obtained cofficients of correlation for all the 36 animals, separately for both muscles tested, are given in table 3.

Table 3. - Correlation coefficients/ R / between metabolitic type of fibres and traits characterizing meat quality of m.long.dorsi and m.semimembr.

Type of muscle fibres	m.long.dorsi pH24	colour % R	WBC %	Hempigments mg/g	m.semimembr. pH24	colour % R	WBC %	Hempigments mg/g
βR	0.13	-0.23	0.29	0.18	0.42^{++}	0.26	0.25	0.23
αW	- 0.32	0.49^{++}	0.18	-0.48	- 0.35^{+}	- 0.31	0.03	- 0.46^{++}

+ - $P < 0.05$; ++ - $P < 0.01$

Results obtained show that metabolitic type of muscle fibres in sheep correlatte in some cases quite highly with some traits characterizing meat quality, coinciding with other our studies on sheep's meat /Pinkas et al.1981/.

Conclusions: Data obtained by us provide information about the changes of metabolitic type of muscle fibres and their diameter during growing process of lambs and hoggets, as well as data on changes in traits characterizing meat quality of animals aged from 3 to 365 days.

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Table 1

Ratio of metabolitic type of fibres in /%/ and their diameter in /mμ/ in m.longissimus dorsi and m.semimembranosu in sheep during growing process*

Traits \ Age	3 days	45 days	90 days	120 days	150 days	270 days	365 days
			m.longissimus dorsi				
Muscle fibres							
βR	29.67	28.05	26.84	31.21	30.03	25.56	25.36
αR	52.48	58.40	55.04	44.33	45.67	48.64	44.72
αW	17.85	13.54	18.11	24.45	24.25	25.79	29.91
Diameter							
βR	16.66	24.10	35.10	40.38	49.31	53.32	57.46
αW	17.73	26.69	37.24	42,68	51.48	57.48	55.77
			m.semimembranosus				
Muscle fibres							
βR	27,01	30.75	26,14	31.63	31.21	27.03	26.01
αR	52.89	54.82	58.17	50.94	44.65	52.16	48.56
αW	20.11	14.44	15.69	17.42	24.11	20.80	25.42
Diameter							
βR	18.29	25.96	36.97	43.20	52.81	56.27	55.01
αW	19.66	28.66	37.40	40.59	55.21	56.22	55.51

*/ Significance was determined only between age-adjacent groups. Differences between two adjecent groups are marked with the same letter

Table 2

Traits characterizing meat quality in m.longissimus dorsi and m.semimembranosus in sheep during growing process[*]

Traits \ Age	3 days	45 days	90 days	120 days	150 days	270 days	365 days
				m.longissimus dorsi			
$pH_{24\ h}$	5.73	5.65	5.63	5.62	5.74	5.62	5.50
Colour /R /525 nm	23.79	22.15	22.44	22.03	19.41	20.79	16.95
Hempigments mg/g	1.71	2.01	1.89	1.72	2.30	3.84	4.79
WBC %	33.37	36.31	38.49	37.05	39.37	35.26	35.71
Fats %	1.64	2.04	2.41	3.01	3.24	3.77	3.91
				m.semimembranosus			
$pH_{24\ h}$	5.73	5.69	5.72	5.71	5.82	5.65	5.42
Colour /R / 525 nm	23.77	21.07	21.65	20.07	19.08	20.23	15.12
Hempigments mg/g	1.48	1.86	2.23	1.71	2.67	4.38	5.66
WBC %	34.85	35.69	39.37	35.86	40.53	36.78	33.69
Fats %	2.07	1.60	2.01	1.97	2.26	2.43	3.72

[*] Significance was determined only between age-adjacent groups. Significant differences between two adjacent groups are marked with the same letter.