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Comparative hystological studies on muscle

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We mentioned formerly that the morphological and chemical examination of developing muscular tissue gives many data - besides the enlargement of theoretical knowledge - for a better understanding of details about meat chemistry and meat technology, for a more particular knowledge of finer differences between the flesh of different slaughter animals. Presumably there are differences as well in the muscular development of the different species within a breed, as it would be interesting to know the different character and size of muscular development betwen male and female embryos.

Dickerson and Widdowson /1/ compared the prenatal morphological and chemical alterations in the different phases of muscular development between man and pig. Similar examinations were made by others for diverse purposes, but these all disregarded such details as could interest the meat researcher and technologist. In the course of our former examinations we stated the change of water and connective--tissue content in animals for slaughter of different age and quality /2/. Needham /3/ and others observed in the developing muscle the decrease of water-content and of the extracellular sodium and chlorine ions and, on the other hand, the protein and among the intracellular components the increase of potassium and phosphorus. Dickerson and Widdowson /1/ found the increase of non-protein N in the course of foetal development which, however, reaches the

grown-up level soon after birth. Before birth there was no significant alteration to be found as to the quantily of sarcoplasm-protein; there is, however, a rapid increase after birth. The most significant alteration was stated in the fibrillar N fraction, which showed an increase during the whole term of foetal development.

With our cellular and muscular researches, started some years ago, we are now working in this most interesting and for our discipline very important field. In the course of our researches started for the establishment of the morphological and chemical nature of sarcolemma development, it proved necessary to make also comparative morphological examinations as to the developing muscular tissue of diverse breeds. In our opinion finer morphological changes must be examined along with chemical alterations, i.e, meat hystological and chemical development must be examined in parallel. In case of slaughter animals healthy embryo-series are difficult to get, thus we are now still at the beginning of our work. We speak willingly of this theme in order to arouse others' interest for that research matter.

Besides the morphological details we are interested in the nitrogen alteration of non-protein and protein, further, as regards protein N, in the alterations occuring in the course of intra- and extrauterine development of extracellular and intracellular /within the latter the sarcoplasm, the miofibrillar and the stroma/ protein. How great the differences are in that respect: Dickerson's and Widdowson's chemical data are well backed by fig.1. and fig.2. showing the thigh /M.semimembramosus?/

excision of an about 8 weeks old resp. of an about 12-14 weeks old pig-embryo. On the longitudinal cutting of the former, there are in places muscle cells /myotubes/ to be seen now and then together with nuclear rows taking place in the middle of developing cells. On the cross section of the same muscle from a 12-14 weeks old pig--foetus already developed bundles of muscular cells show that, as regards the quantity of fibrillar N, there must be a significant difference in the muscular tissues being in two different phases of development.

The difference between the cell-protein components of animals belonging to diverse breeds is strikingly proved by Bendall's /4/ two data, according to which in the long back muscle of cattle and hare the sarcoplasm N is 25.0, resp. 31.9%, the miofibrillar N is with both breeds 52.00 %, the stroma protein is 10.30 resp. 5.46 %. These data call the attention deservedly to those, obviously also physiologically motivated differences, that exist between the morphological and chemical properties and characteristics in the muscular tissues of animals belonging to diverse breeds.

The examinations on the muscular cell-membrane of cattle and pig started in former years have been extended to the muscles of horse and sheep too. Due to external difficulties our work couldn't progress neither here as planned. From our rich hystological material we show the muscle tissue characteristics of the M.semimembranosus of horse resp. sheep /fig.3 and fig.4/. On the cross section of horse muscle there is well visible the connective -tissue membrane described by us as sarcolemma externa, following the shape, of the cross sections of the cells, which are a little shrunk. In the membrane, there are the

nuclei to be seen. On fig.4 there is the cross section of the M.semimembranosus of sheep, on which the exceedingly altering diametrical differences of muscular cells and, on the other hand, their conspicuous adjustment to spacial circumstances and to each-other can be observed. On the muscle tissue design of sheep the sarcolemma network is distinct here and there, even if not as conspicuous as on the horse's excision. The muscle of pig and cattle is well discernible from these.

LITERATURE

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Vergleichende Studien über Muskelgewebe.

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Zusammenfassung

Es sind für die Fleischchemie und Fleischmorphologie sehr bedeutende Angaben von den Untersuchungen zu erwarten, welche die Verfasser bezüglich der morphologischen und chemischen Veränderungen der Muskeln, die im Stadium der Entwicklung stehen, begonnen haben. Aus diesen Untersuchungen werden - wegen äusseren hindernden Ursachen - besonders in chemischer Hinsicht, vorläufig über bescheidene Ergebnisse berichtet. Aus den bisherigen histologischen Sammlungen werden zur Veranschaulichung der chemischen Abweichungen aus den M. Long. Dorsi eines 8 wöchigen und eines 12 bis 14 wöchigen Embryos Schnitte gezeigt/Abb.1. und 2./. Aus diesen ist die Tatsache gut ersichtlich, dass im Schweinemuskel das im Entwicklungsstadium steht sich die Menge des fibrilleren Stickstoffes erhöht; im Muskel eines Embryos von 8 Wochen ist nur hie und da ein Muskelrohr zu sehen, dagegen sind in einem Embryo von 12 bis 14 Wochen schon auch die Muskelbündel entwickelt, es besitzt offenbar schon eine grössere Menge an miofibrillen N. Bei den anderen zwei Schnitten,d.h. Querschnitten aus den mittleren M.Longissimus Dorsi eines Schweines und Schafes, wird in Beziehung zu den anderen Schlachttieren die abweichende Sarcolemm und eine feinere Gewebsstruktur demonstriert.

Сравнительные исследования мыщц мяса

д-р Ф. Лёринц, д-р Я. Синак

Резюме

Исследования, проведенные авторами в области морфологических и химических изменений развывающей мыщцы, могут дать существенные результаты. Полученные данные, особенно в области химии, из-за посторонных причин еще скромные. С гистологической коллекции, собранной авторами до сих пор, для демонстрации химических отклонений они ознакомляют с разрезами ткани М. лонгиссимус дорзы, полученных от эмбрионов свиней возрастом 8 и I2-I4 недель (см. рис. I и 2). Образы мыщц ясно показывают, что в развывающей свинрй мыщце увеличивается количество фибриллярного азота; вмыщце эмбриона свиньи возрастом 8 недель, мышечные трубочки обнаруживаются только местами, но у эмбриона свиньи возрастом I2-I4 недель мышечные тяжи уже развиты, вероятно больше в них количество миофибриллярного азота. На остальных двух разрезах ткани, полученных из средней части М. лонгиссимус дорзы лошади и овца, авторы демонстрируют на поперечных их разрезах отклонению сарколеммы и характерную мелькую тканевую структуру, сопоставляя их ответственными тканами других видов убойного скота.

ad Dr. F. Lőrincz and Dr. J. Szinák's paper:
Comparative hystological studies on muscle.

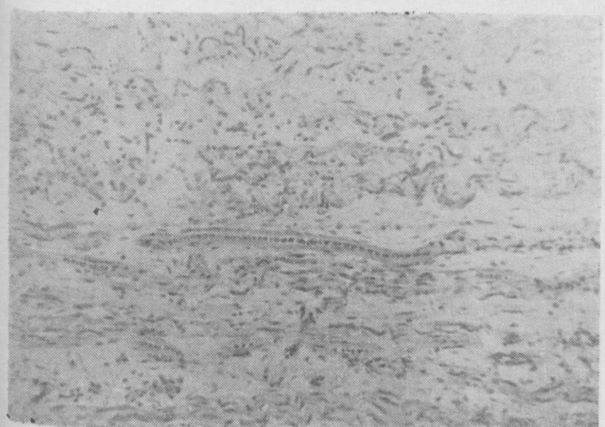

Figure 1: Thigh (M. semimembranosus) longitudinal section of an about 8 weeks old pig-embryo, magnified 130 times. In the relatively big visual field there are in places developing muscle cells (myotubes) to be seen now and then together with nuclear rows taking place characteristically in the middle of the cell.

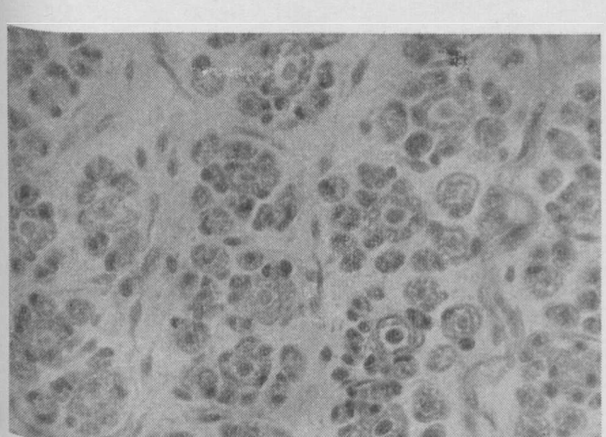

Figure 2: Thigh (M. semimembranosus) cross section of an about 12—14 weeks old pig-embryo (magnified 400 times). The characteristic bundles of muscular cells are already well visible in the endomysium network. The cells are immature yet, the nucleus takes place in the middle, the peripheric part of the plasm is occupied by the well visible cross sections of the miofibrils.

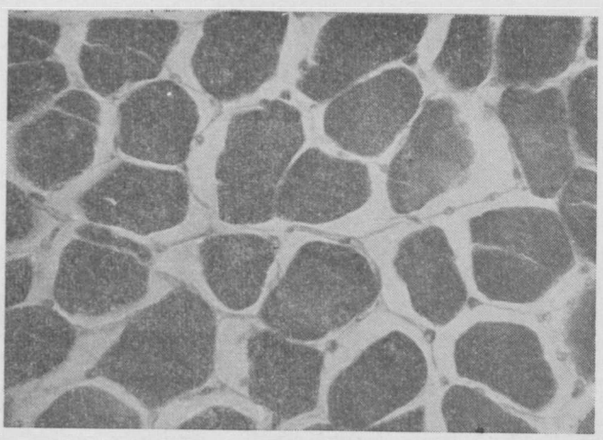

Figure 3: M. semimembranosus cross section of horse (magnified 400 times). There is conspicuously visible the endomysium taking place around the slightly retrahent muscular bodies (sarcoplasm) and following the shape of these latter. Part of the endomysium is the sarcolemma externa.

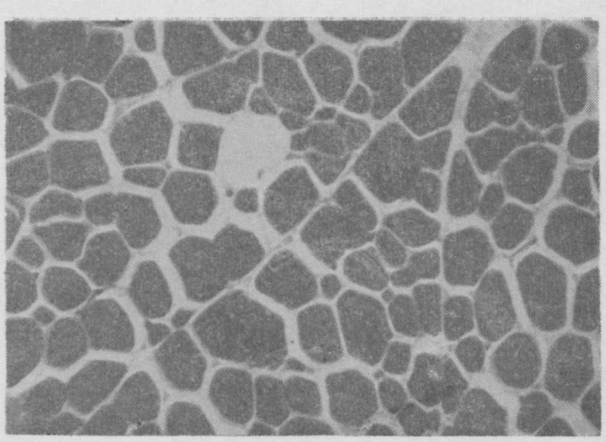

Figure 4: M. semimembranosus cross section of sheep (magnified 400 times). Due to the adjustement of the muscular cells to each-other, resp. to space, the picture is characterized by its exceedingly varied shape. The fine fibres of the endomysium are also here discernible, these are, however, by far finer than in case of horse or beef muscle. The muscular tissue design of sheep resembles in many respects to that of pig, however, it is well discernible from the latter.