# E STUDY OF MICROSTRUCTURE OF SLAUGHTER ANIMALS MEAT UNDER CONDITIONS OF ECOLOGICAL BALANCE

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MARY

ological disbalance influences significantly quality of raw material. For this reason conducted complex and microstructural research of beef and pork on early stages of ing using qualitative and quantitative histological and cytological analysis. According pH-value of meat and to its colour characteristics raw material was divided into three oups: normal, PSE and DFD meat.

fering from normal meat, dark and firm meat (DFD) was characterized by longer ageing d by increased water-holding ability. Pale, soft and exudative meat (PSE) was characte-ed by more active ageing and by greater amount of destructive changes in muscle fibers. ter-holding ability of this meat was lower.

## RODUCTION

anges in conditions of meat animals growing due to intensification of this process and to olution of biosphere have put these animals into tough ecological conditions negatively fluencing their vital activity.

rodynamia and increased frequency of stress situations become apparent in beef and pork ality. This tendency is clearly revealed through methods of morphological analysis, com- for world practice and being criterion of meat quality assessment. Data, obtained in is country and abroad evidence about increase in PSE and DFD quality deviations and dec- ease in the amount of meat with normal pH and normal course of ageing.

BLE 1 Sizes of muscle fibers ( cross-section)

| | DFD | | PSE | | NOR | |
|---|---|---|---|---|---|---|
| | beef | pork | beef | pork | beef | pork |
| ean diameter of uscle fiber( $\mu m$) | 57.3±0.01 | 47.6±0.01 | 39.1±0.01 | 41.9±0.01 | 44.4±0.01 | 46.0±0.01 |
| nge of mean values r cross-section area muscle fibers ($\mu m^2$) | 500-1825 | | 350-1600 | | 375-1700 | |

## TERIALS AND METHODS

.longissimus dorsi of steers and pigs, grown by intensive technologies at different agri- ltural enterprises served as object of research. Meat samples for hystological and mic- structural research were taken at different ageing times (to 48 hrs post mortem) and, cording to pH-value, were divided into 3 groups: NOR, PSE, DFD.

eat samples were fixed in a 20% neutral formalin solution (for hystological research) and

pieces, excised therefrom, were spatially orientedfor obtaining of lengthwise and cross wise cuts. After placing samples in celloidin, the obtained hystological cuts were dyed hematoxylin-eosine. Cuts were examined by light microscope "Laboval", microghraphs were so taken. Picture analysis and morphometric studies were conducted on "Magiscan -2A-MD",

Fig.1 Correlation of sizes of muscle fibers (cross-section) between different quality groups (DFD, PSE,NOR).

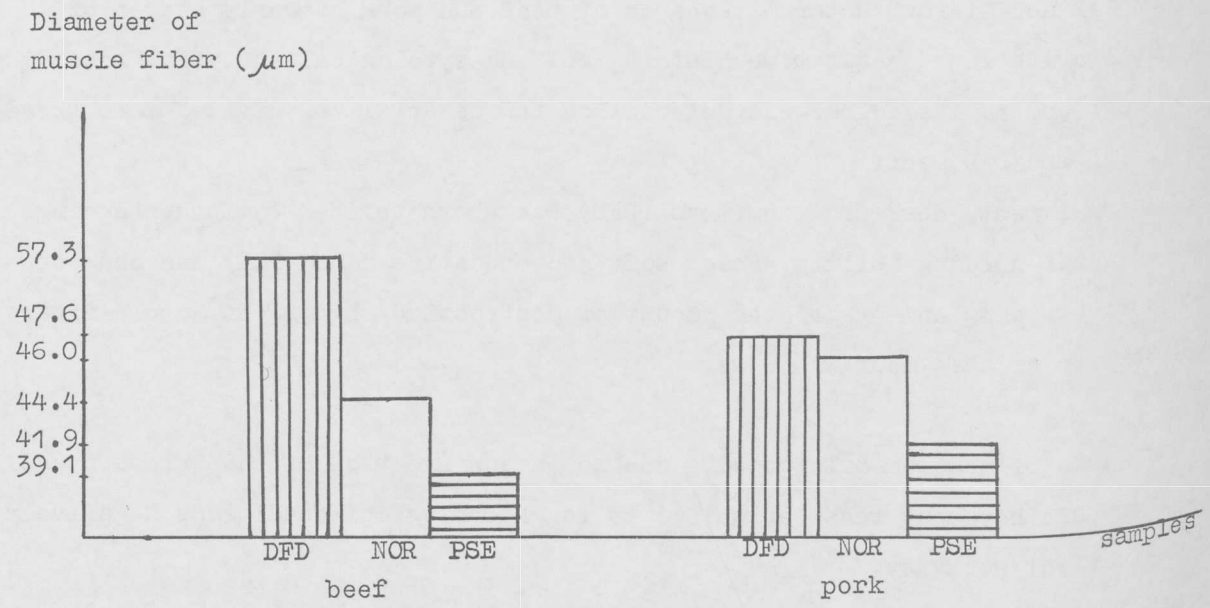
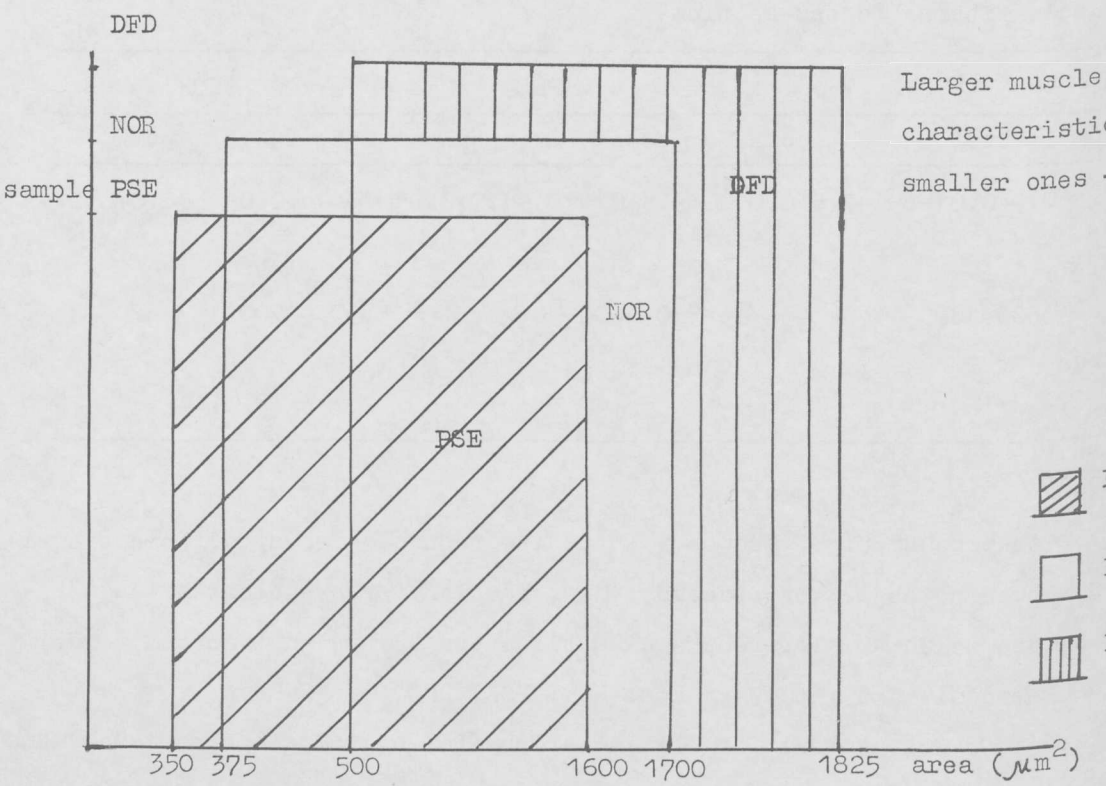



Fig. 2 Characteristics of samples of beef muscle tissue
Range of mean values for cross-section areas of muscle fibers for samples of DFD, PSE and normal meat



ultrastructural research samples were first fixed in 2.5% glutaraldehyde solution, then 0.1% solution of osmium quadroxide. After that samples were dehydrated and immersed into ture of resins: epon-araldit. Pieces of muscle samples were cut lengthwise and crosswise studies.

erfine cuts were made on ultratome "LKB-3", dyed by plumbum citrate and uranilacetate then studied under electronic transmission microscope BS-613 "TESLA", then electrono- ms were made.

ULTS AND DISCUSSION

obtained results of structural research show significant differences in structural pro- rties and in ageing processes in normal, DFD and PSE meat, this being indicative of acute essity of meat grading for further technological processing. Selective use of meat can ure manufacturing of meat products of relatively high quality.

scle tissue of pigs and steers with normal pH at the moment of rigor accomplishment sho- signs of asynchronism of this process. Micro- and ultrastructural data obtained for M. ssimus dorsi of steers and pigs (by 48 hrs post) agreed with earlier research data alinsky E.I. and Belousov A.A., 1977; Finger, 1986), these data being characterized relaxation of the most part of muscle fibers, by the presence of separate contracted ers, by integrity of fibrillar and lamellar structures, by relaxation of structures of omyosin complex, by swelling of a-discs.

e exudative beef and pork meat with low pH showed greater porosity (table 1, fig.1) due excessive hydration of intercellular spaces. Besides, PSE-meat was characterized by des- ctive changes of various degree and locality. Earlier data (Skalinsky, Belousov 1977; der Wal, 1988) confirm that in 60% of cases these changes are observed in PSE meat. ages of muscle fibers structure were as follows: microcracks along with preservation of colemma intergrity; cracks with sarcolemma destruction; total breakage of fibers with vergence of end scraps. Using electron microscope different changes were revealed: change the structure of lamellar organellae and atypic position (as compared to normal meat) mitochondriae, as well as destruction of lipid-containing structures and protein fibril- formations. These changes evidence about speeding up of the ageing processes taking ace with atypic permeability of cellular membranes and with deviations in cellular meta- olism (already existing in the organism of a live animal). At early stages of ageing, moi- ins releases from muscle tissue and accumulates between muscle fibers, reduced in volume, ds leading to lower water-holding ability of PSE meat.

k and sticky DFD meat was characterized by swollen muscle fibers and by pronounced de- y in the processes of meat ageing. Swelling of fibers led to increase of their diameter fer to table 1, fig. 1 and 2), spaces between them narrowed and connective tissue layer endomisium became firmer. All this resulted in lower porosity of DFD muscle tissue ples and in firmer structures of muscle bundles.

ntractile myofibrillar elements of muscle fiber are in the state of partial relaxation, aits of ageing were weakly distinguishable, while ultrastructural study (as compared to

optic methods) revealed traits of destruction process in which actin fibrils and complex Z-line proteins were involved. Destruction of membranous cellular organellae, i.e. of mitochondriae, sarcoplasmatic reticulum etc. is also obvious. Differing from PSE muscle tissue characterized by destruction of muscle fibers and membranes and by blocking of permeability in DFD meat destructive processes take place first in lamellar structures. As a result, swelling of muscle fibers and hydration of myofibrillar proteins in DFD meat induce increase of its water-holding ability.

Having analyzed results and having compared them with earlier scientific data, we made the following conclusions:

- breakdown of structure of molecular components of cellular organellae, that is of proteins, comprised in the composition of cellular membranes, leads to the change in susceptibility of muscle tissue (and the organism as a whole) to external effects;
- in its turn it may be caused by ecological changes in vital activity of slaughter animals by high speed of muscle growing, by changes in feeding rations, by indoor maintenance of cattle, by stress during delivery.

As a result, live organism already possesses pathological traits and pre-requisites for PSE and DFD syndroms of meat.

After slaughter there is possibility to trace all atypical and pathological processes of live activity, accumulated in the organism of the animal which influence profoundly quality characteristics of meat raw material.

CONCLUSIONS

Thus, ecological disbalance during growing and keeping of meat animals causes change in quality characteristics of raw material, and the increase of the amount of PSE and DFD meat with deviations in muscle tissue structure and course of meat ageing. Consequently, early prediction of raw material quality is required as well as further adjustment of technological regimes of its processing for manufacturing of high-quality meat products.

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