Untersuchungen über die Wirkung der ionisierenden Strahlen auf die Ultrastruktur und auf die Mikroflora von portioniertem Kalbfleisch.

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Die Autoren untersuchten den Einfluss von niedrigen Dosen ionisierender Strahlen (3000 Gy) auf die Ultrastruktur und auf die Mikroflora von portioniertem Kalbfleisch, das bei einer Temperatur von ± 0 bis +4°C gelagert wurde. Die auftretenden ultrastrukturellen Veränderungen in den Versuchs- und Kontrollproben werden erörtert und diskutiert. Es wurde die Veränderung in der Restmikroflora während der Kühllagerung beobachtet.

A study of the effect of ionizing radiation on the ultrastructure and microflora of portioned veal

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A study was made of the effect of low doses of ionizing radiation (3000 Gy) on the ultrastructure and microflora of portioned veal stored at a temperature of ± 0 to +4°C. The ultrastructural changes in experimental and control samples are discussed. Changes in residual microflora during cold storage are followed.

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Etude de l'action des rayons ionisants sur l'ultrastructure et la microflore de la viande de veau portionnée

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On a étudié l'influence de doses réduites de rayons ionisants (3000 Gy) sur l'ultrastructure et la microflore de la viande de veau portionnée, conservée à une température de ± 0 à ± 4°C. On a analysé les modifications ultrastructurales dans les échantillons témoins et les échantillons expérimentaux. On a poursuivi l'évolution des changements de la microflore résiduelle au cours de la conservation frigorifique.

Исследование действия ионизирующих лучей на ультраструктуру и микрофлору порционированной телятины

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Изучено влияние низких доз ионизирующих лучей (3000 Gy) на ультраструктуру и микрофлору порционированной телятины, хранившейся при температуре ± 0 до +4°C. Рассматриваются и обсуждаются наступившие ультраструктурные изменения в опытных и контрольных образцах. Прослежено изменение остаточной микрофлоры во время холодильного хранения.

A study of the effect of ionizing radiation on the ultrastructure and microflora of portioned veal.

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The problem for lengthening the shelf life of meat utility products by application of low doses ionizing radiation has been discussed by a number of authors (1,2,3,4).The ultrastructural changes appearing after refrigeration storage are also of interest.There are available data for ultrastructural chnages of pork radiated with low doses ionizing radiation (5).

The scope of the present paper is to establish the ultrasyructural chnages and microbiological picture as well as the sensor quality in m.longissimus dorsi from calves following low doses radiation with ionizing radiation (0,3 Mrad) and storage at temperatures of ±0 to + 4°C.

Material and methods.

The studies are made with m.longissimus dorsi from calves 24 hours after slaoughter.The meat was cut and packed under vacuum in Cryovac bags and in double polyethylene bags with the presence of air.The source for radiation was a gamma equipment PX 20 using Co^{60} and a dose of 0,6 Mrad.The radiation was condmcted at room temperature.The samples and the controls were stored under refrigeration (up to +4°C) and periodically analysed (each two weeks).The ultrastructural changes, the microbiological status and sensor values were observed.The following groups of microorganisms were identified: lactic acid bacteria on Rogosa medium, yeasts - on Saburo, micrococcae - on Chapman, enterococci - on Slanetz coliforms - on lactose broth and pepton water,sulphite reducing anaerobes - on ferricyanate agar. The sensoric evaluation was conducted after the 9 score hedonic scale and trained panel.The obtained data were calculated following variational statistical methods.The materials for electron microscopic studies (pieces of muscle fibres 1 x 0,5 x 0,5 mm) were fixed in 5% glutaraldehyde for 2 hours and in 2% Osmium tetraoxyde for another 2 hours.After dehydration and passing through propyleneoxyde, the samples were incorporated in Durcupan. Ultra thin cuts were prepared by ultramicrotom Tesla BS 490A and after staining by uranylacetate and leadcitrate were observed on electron microscope Tesla BS-613.

Results and discussion

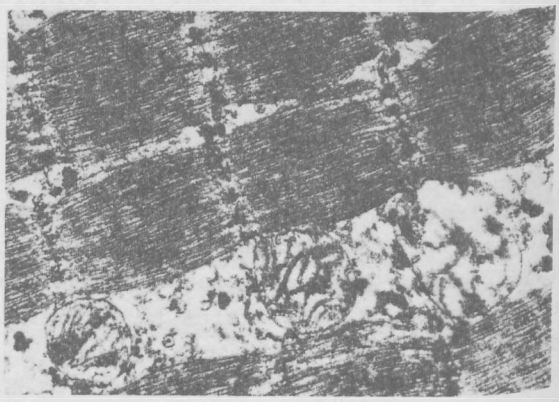
Immediately following the radiation of the meat in the muscle fibres are observed the characteristic for rigor mortis ultrastructural changes.The sarcomers are with smaller dimensions because of the contraction of the myofibriles.The I-discs are shortened, and the light stripes placed sidewise to the Z-lines can no be observed.Some of the mitochondria on places are with a lightened matrix and with destructions in the mitochondrial membranes and crystes.

The electronmicroscopic picture of samples from the cpntrols,packed under vacuum,after 42 days of storage reveals the following peculiarities: a very strong fragmentation of the Z-lines is observed,which have totaly desapeared on some places.Diminished or totaly absent is the contour of the M-lines.The hydrolitic processes have affected to a more or less degree the protofibriles of the separate sarcomers,following which is revealed different by measure destruction.Electrongram 1.

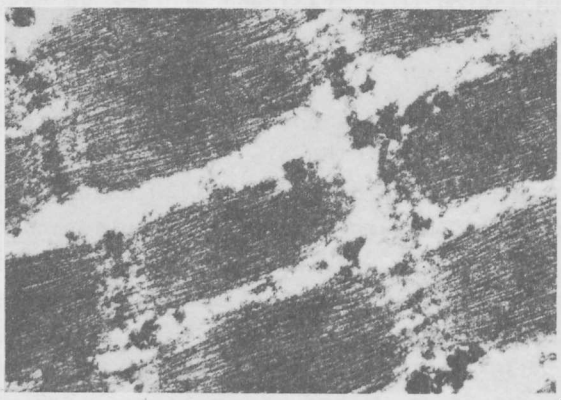
The corresponding samples from irradiated samples,packed under vacuum are characterized by weaker fragmentation of the Z-lines and better preserved protofibriles.In the mitochondria are observed different by degree oedemic and destructive changes.Electronogram 2.

The ultrastructural changes appearing in samples submitted to radiation,packed without any vacuum, after 85 days of storage,are illustrated on electronogram 3.Clearly is seen strong fragmentation to total destruction of the Z-lines,a picture closely related to the described one in electronogram 1. The samples from the radiated,packed under vacuum and

Electronogram 1.Magn.14000x

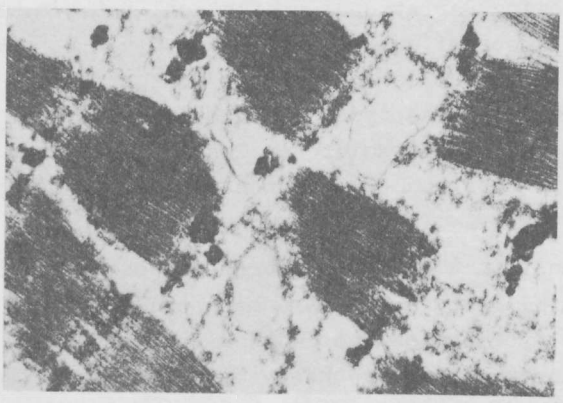


Elecronogram 2 .Magn 19000x



Electronogram 3 .Magn 19000x

Electronogram 4 .Magn.19000x



Electronogram 5 .Magn.14000x

Electronogram 6 .Magn.10000x

stored for 85 days,show a lesser fragmentation of the Z-lines and better preserved ultrastructure of the myofibriles.Electronogram 4.

The electron microscopic picture of irradiated and vacuum packed samples after 98 days of storage shows a strong advance in the hydrolytic processes,and because of them the destructive changes envolve bigger or smaller spots from the separate sarcomers (electronogram 5). However,on some places could be seen a relatively better preserved ultrastructure of the muscle fibres,characterized by weaker fragmentation of the Z-lines,well exibited I-discs and A-discs (electronogram 6).

The results from the sensoric studies of thermally treated (grilled) samples,are presented on figures 1,2,3,4,and 5.

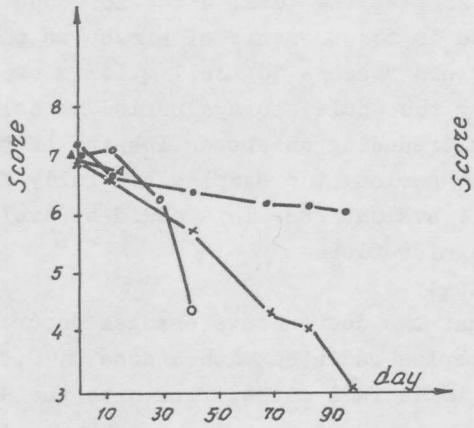


Fig 1 Odour

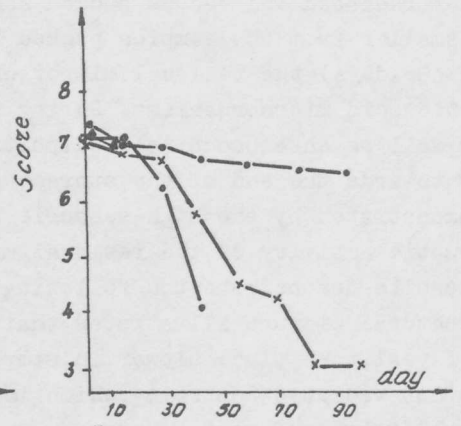


Fig 2 Taste

•-0,3 Mrad in vacuum ; x-0,3 Mrad no vacuum ; o-Kontrole in vacuum; Δ- Kontrole no vacuum;

The figures demonstrate that the sensory evaluations of the irradiated and vacuum packed samples are valid after a storage of 98 days. The same packing in the presence of air hold good for abour two months, while the samples not exposed to radiation on the 28th days are already unfit for human consumption.

For this period of storage the microbiological picture is as follows: immediately after radiation, no microflora is encountered, for the samples packed under vacuum and normally packed, while in the controls the total anaerob ic count is 10^2. After 14 days of storage at $+4^{o}C$ the residual microflora is 10^2, in the controls the total aerobic count is 10^7 maintained to the 28th day. After the storage oeriod of 14 days the residual microflora gradualy inc-

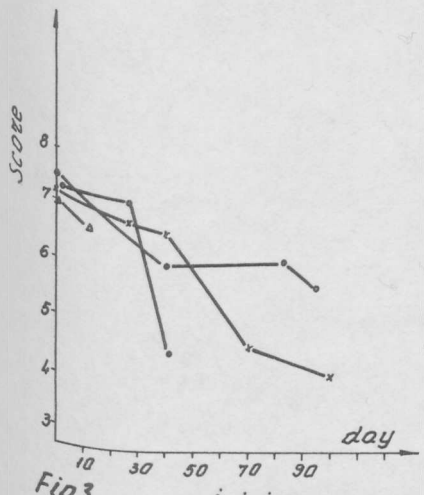


Fig3 juiciness

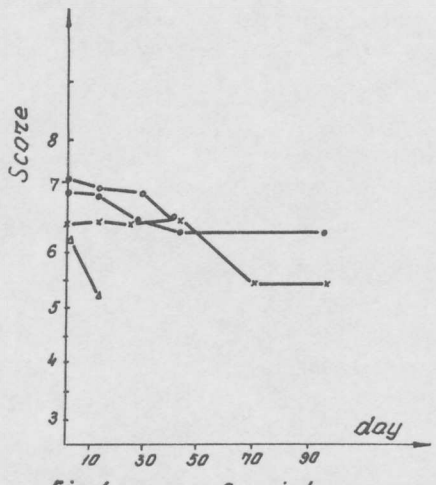


Fig.4 Consistency

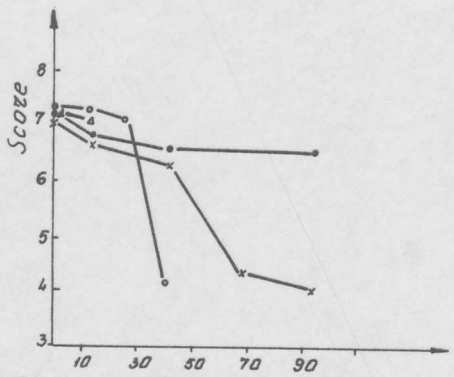


Fig.5 Totale score

•-0,3 Mrad in vacuum ; x-0,3 Mrad no vacuum ; o-Kontrole in vacuum ; Δ- Kontrole no vacuum ;

•-0,3 Mrad in vacuum; x-0,3 Mrad no vacuum; o-Kontrole in vacuum; Δ- Kontrole no vacuum;

reases,while for radiated and vacuum packed samples the total aerob ic count is with 1 logarythmic cycle smaller from the samples packed in the presence of air.Up to the end of the storage period (96 days) the residual microflora reaches 10^8 cell/g.It is exclusively of yeasts and lactic acid microorganisms. During the whole storage period no coliforms were encountered,as well as enterococci and sulphitreducing anaerobes.Inspite of the high total aerobic count towards the end of the storage period, the samples are fully fit for human consumption demonstrated by the high sensoric evaluations. This could be explained with the decreasee enzymatic activity of the residual microflora.

The obtained results demonstrate the following:

1.The ultrastructural picture illustrates that the destructive changes occuring during the cold storage of veal,take place slower in samples radiated with a dose of 0,3 Mrad in comparison to the not radiated controls, which is in full correlation with the sensoric evaluations of thermally treated meat.

2.Inspite of the observed high microbial count of the residual microflora at the end of the storage period, the evaluations of the sensory indices of cooked meat, show a good quality.

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