...IFICANCE OF CONSISTENCY OF PORCINE SEMIMEMBRANOSUS MUSCLE IN PROCESSING PROPERTIES

...DA-KOVÁCS

...arian Meat Research Institute, Budapest, Gubacsi ut 6/b, Hungary

...MARY

...urvey of 203 commercial pig carcasses, severe stiffness was observed in the **semimembranosus** muscles at 24 hrs post ...em. The rate of stiffness was found to be higher in the muscles of high ultimate pH. Moreover, 34 **semimembranosus** ...es were selected on the basis of pH_1 (6.1-6.4) and rigorometer measurements (6-14 mm). At 24 hrs post mortem, muscles ...lassified into four groups according to the ultimate pH (normal and slight DFD) and ultimate consistency (rigid and non-... Cooking loss, shear value of uncured and cured meat, visual appearance of cooked-cured sample as well as sarcomere ... were determined. Non-rigid muscles proved to be superior to rigid ones in acceptability for cured-cooked product and ...enerally more tender with longer sarcomere length. Rigid and non-rigid muscles of higher ultimate pH significantly ...ed in shear force, visual appearance of cured product as well as in the sarcomere length.

...ODUCTION

...well known fact, that differences are existing in the consistency of post rigor pork meat belonging to the pale-soft and dark-...ategories. However, variation of pork consistency seems to exceed the limits of these classical quality categories as it was ...ed by VAN DER WAL et al (1988) who did not detect any significant difference between tenderometer measurements ...mal and DFD loins at 24 hrs post mortem and reported a great variation also in sarcomere length. On the contrary, ...G et al (1989) found significantly shorter sarcomere length in DFD pork loins, while HONIKEL (1987) demonstrated ... sarcomere length in pork meat with rapid post mortem pH fall.

...gards the consistency of raw meat, LEPETIT (1989) found characteristic rheological behaviour of raw beef samples of ...e post mortem history including cold shortening. Consistency of raw pork meat has not been extensively studied, ...theless it was found to adversely affect processing properties e.g. brine uptake during multineedle injection (CSAPÓ, 1987). ...present study the percentage of early and ultimate stiffness of porcine **semimembranosus** muscle was surveyed with respect ...e ultimate meat quality. Additionally, cooking and processing properties of cured meat as well as sarcomere length were ...ared of normal and slightly DFD muscles including both rigid and non-rigid subgroups in order to assess the role of pork ... consistency during processing.

...ERIALS AND METHODS

...stablishing the rate of stiff muscles in relation to meat quality, 203 commercial pigs were used which were slaughtered at ...al abattoirs. Pigs were electrically stunned before killing (90-500 V), carcasses were slowly chilled (2-4°C). 34 carcasses ...selected for investigation of cooking and processing properties as well as for sarcomere length in relation to ultimate pH ...onsistency. These carcasses were selected on the basis of pH_1 values (6.1-6.4) and rigor measurement (6-14 mm) taken in ...semimembranosus**, which was removed from carcasses at 24 hrs post mortem when ultimate pH and stiffness were measured ... All examinations were carried out at 24 hrs post mortem.

...as measured directly by probe electrode (PCP 510 Labor & Messgeräte, Giessen) attached to portable pH/°C meter (Type ...INDUNORM, Düsseldorf) at 40 min and 24 hrs post mortem. Rigorometer (SYBESMA, 1966) was used for assessing both ... and ultimate rigidity. The latter was measured on the cross section of the muscle after cutting it perpendicularly to fibre ...tion. Means of 3 measurements was used for statistical analysis. Muscles of ultimate rigorometer values ≥ 13 mm were ...ified into "rigid" category.

...les were grouped into 3 categories according to ultimate pH (pH_{ult} < 5.8 = normal; pH_{ult} 5.8-6.2 = slight DFD; pH_{ult} > 6.2 ...FD). PSE was categorized on the basis of visual signs of PSE (VADA-KOVACS et al, 1985) and ultimate pH (pH_{ult} < 5.8). ...ples of 1 x 1 cm taken at 24 hrs post mortem from the core of muscle were stored at -20°C until preparation of longitudinal ...en sections. Sarcomere length was measured by ocular micrometer on 50 fibers using 900 x magnification. Samples of ...rox. 20 g were taken from the core of muscle with a cylindrical sampling device of 2.54 cm diameter and were put into glass tubes of the same diameter then cooked a 75°C for 45 min. Muscle fibers were parallel with the axis of the cylinder. After cooking and storage for one day, cooking loss and Warner-Bratzler shear force were determined. Mean of 4 shear force measurement was used for statistical analysis.

250 g of meat excised from the middle part of the muscle was cut into cubes of appr. 20 g and mixed with 10 % of brine (related to muscle weight). Salt and polyphosphate contents were adjusted to 2,3 and 0.4 %, respectively. After 2 days of curing at 6 - 8°C meat cubes were stuffed into cylindrical cans of 75 cm^3 and cooked at 75°C for 45 min. Duplicate samples were prepared for cooking. Visual appearance, cooking loss and shear force were determined after cooling in refrigerator for one day. The scores for visual appearance were the following: 1 = regular cylindrical shape without cavities; 5 = strongly deformed shape, poor binding of meat pieces. Means of 4 categories were compared by Student's t-test. Significant differences in Fig. 1-4. ($p <$ 0.05) are indicated by different letters.

RESULTS AND DISCUSSION

58.13 % normal, 26.11 % slight DFD, 8.37 % DFD and 7.39 % PSE **semimembranosus** muscle were found in a total of 203 sample units (Table 1). The rate of rigid muscles as related to the ultimate meat quality are in accordance with the generally accepted view that severe rigor early post mortem occurs more frequently in the aberrant meat quality categories. A considerable part of muscles was found to be rigid at 24 hrs post mortem, particularly DFD muscles (39.60 % of slight DFD and 29.40 % of extreme DFD). Out of the 42 rigid muscles observed at 24 hrs post mortem, 21 muscles were qualified as slightly DFD (pHult 5.8 - 6.2) and 15 muscles were of normal pH (pHult < 5.8).

These quality categories were further studied in order to establish the importance of meat consistency in processing properties. 34 **semimembranosus** muscles were selected on the basis of pH$_1$ and early rigor avoiding great variation in pH1 (6.1 - 6.4), while in rigor measurements a great variability was preferred (6-14 mm). Selected muscles were classified into quality groups on the basis of ultimate pH and consistency (Fig. 1). No significant difference was found in the ultimate pH values of rigid and non-rigid muscles within the normal and slight DFD categories, while rigorometer values of post rigor muscles differred significantly between rigid and non-rigid groups regardless to meat quality. Rigid muscles observed at 24 hrs post mortem appeared to be more rigid even at the early post mortem period, particularly slight DFD muscles showed significantly higher rigorometer values as compared to the non-rigid normal group.

Significant difference was found between sarcomere length of non-rigid and rigid slight DFD muscles (Fig. 2). Similar, but non-significant difference was observed in sarcomere length of normal muscles. The shorter sarcomere length of rigid muscles suggests higher rigor shortening which is supported by the early occurrence of rigor at high muscle temperature (Fig. 1). At the same time, non-rigid slight DFD muscles showed remarkably longer sarcomere length compared with other groups. Cooking loss of uncured muscle was generally influenced by ultimate pH (Fig. 3), rigid, normal samples showed significantly higher cooking losses compared to the slight DFD category. However, shear force was related mainly to the consistency of raw meat. Slight DFD, non-rigid muscle samples proved to have significantly lower shear force value.

Higher shear force values of aged beef in the intermediate ultimate pH range were reported by PURCHAS (1990) and JEREMIAH et al (1991). PURCHAS (1990) found shorter sarcomere length in muscles of high ultimate pH. The present findings with porcine **semimembranosus** muscles of higher ultimate pH are in accordance with the above results. The occurrence of non- rigid slightly DFD muscles may be related to slower post mortem metabolism owing to the stress free conditions before and during slaughter or to a better skeletal restrain.

Cooking loss of cured samples was significantly influenced by the pH of raw muscle, while the shear force tended to follow the order of raw meat consistency. Statistically significant difference in shear force was detected between the rigid, slight DFD and the non-rigid, normal samples (Fig. 4). Additionally, cooked cured samples prepared from rigid muscles showed a significantly less acceptable visual appearance e.g. deformed shape, accompanied by insufficient binding of meat pieces. This observation indicates that poor adhesion of meat pieces or improper packaging of cured meat blocks (cavities on the surface and inside) might be related to the rigid consistency of raw meat.

CLUSION

...d consistency of raw porcine **semimembranosus** muscle adversely influenced the shear force of both uncured and cured, ...ed meat, morewover, it caused shape deformation of the cured cooked blocks. Rigid consistency occurred more frequently ...g muscles of higher ultimate pH.

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...ble 1.

Distribution of meat quality and percentage of rigid muscles observed at 40 min and 24 hrs post mortem in the different meat quality categories of porcine m. **semimembranosus.**

...eat quality	**Normal**	**Slight DFD**	**DFD**	**PSE**	**Total**
n	118	53	17	15	203
%	58.13	26.11	88.37	7.39	100.00
...id ...sistency					
... min pm %	1.70	28.30	41.17	33.33	14.28
... hrs pm %	12.70	39.60	29.40	6.70	20.69

Fig. 1. Post mortem changes in pH and consistency of selected **semimembranosus** muscle

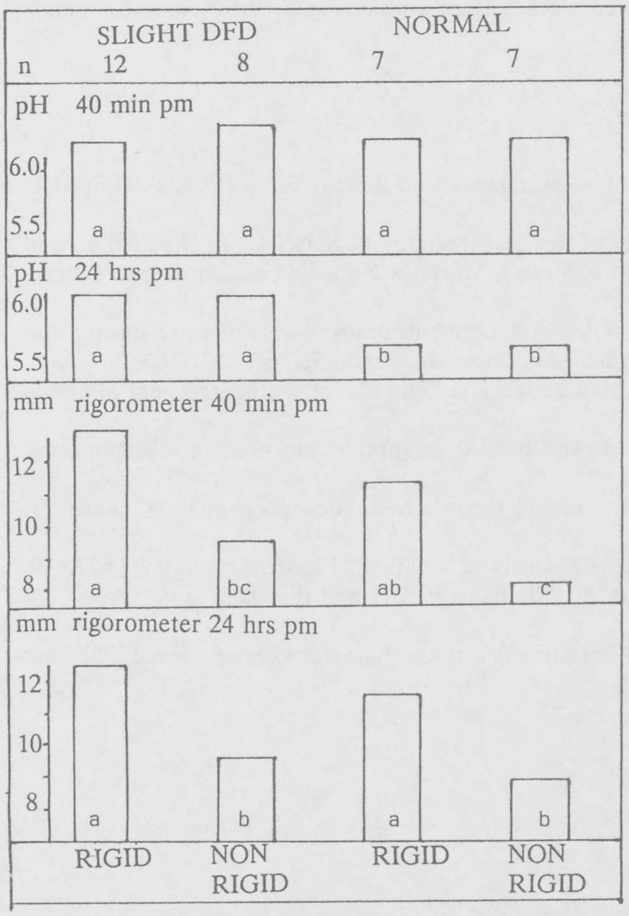

Fig. 2. Sarcomere length in **semimembranosus** muscles of different ultimate pH and consistency

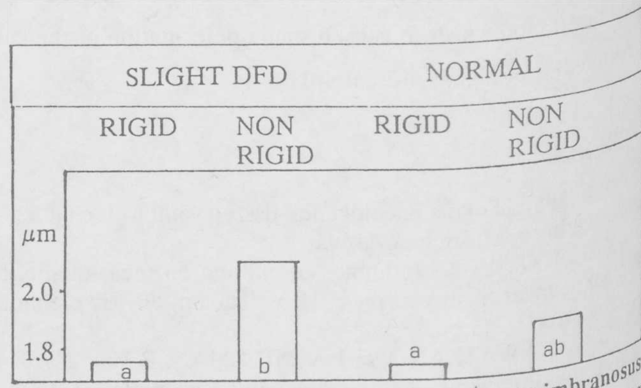

Fig. 3. Cooking loss and shear force in **semimbranosus** muscles of different ultimate pH and consistency.

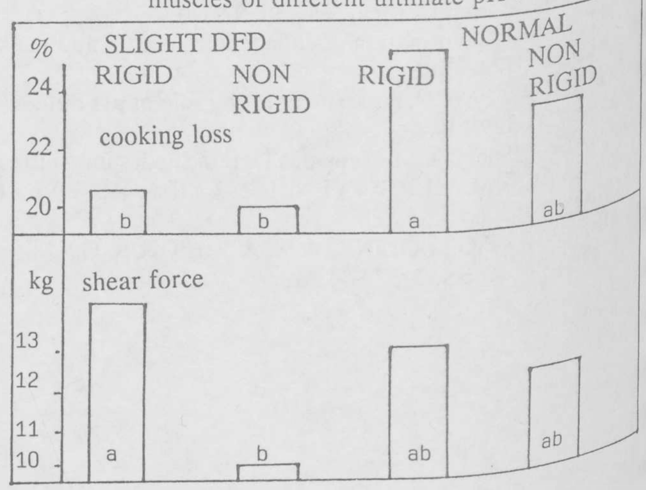

Fig. 4. Cooking loss, shear force and scores for visual appearence of cured-cooked samples prepared from **semimembranosus** muscles of different ultimate pH and consistency.