# 5-P23

## Influence Of Ultra-Sounds On Water-Holding Capacity Changes In Meat After Slaughter

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**Keywords**: meat, ultrasound, WHC

### Introduction

The water-holding capacity (WHC) of meat and meat products is one of the most important factors in meat quality, because it affects the weight change during storage, drip loss during thawing, weight loss and shrinkage during cooking, and the juiciness and tenderness of the meat.

Meat tenderness characteristics can be an attribute of two primary components of muscle: the connective tissue fraction and myofibrillar fraction. Many investigators assume the increase of meat tenderness that accompanies post-mortem ageing by the result of breaking, fragmenting or at least weakening of the myofibrillar structure. The water bound into muscle structure is primarily a result of its association with myofibrillar proteins. Changes in WHC are closely related to pH and to variations in muscle proteins.

This study has attempted to analyse the impact of post mortem meat sonication on some of its structural and functional properties (WHC) during the post-mortem cold storage (72 hrs) of beef muscle.

### Material and methods

Muscle *m.semimembranosus* of young slaughter cattle at life weight about 500 kg with no DFD defects was taken directly after the slaughter, divided into three parts from among one was considered as a control (K), the other ones were subjected to ultra-sound operation during 2 mins at 2 hrs after the slaughter. One sample (U1) was treated with ultra-sounds of 25 kHz frequency, the other (U2) – of 45 kHz.

Samples were stored at 6-7°C (Fig.1a), intra-muscular temperature ranged according to dependencies presented on Fig. 5. Dynamics of acidity changes, water-holding capacity rates and ability for maintenance of own water at 2, 24, 48 and 72 hrs after the slaughter was studied. Obtained results presented on figures 1-5 are mean values of 8 repetitions.

*Water-holding capacity (WHC)* [2]. Sample of 50 g grinded meat was homogenised with 50 $cm^3$ distilled water for 1 min in laboratory homogeniser and centrifuged at 700 g. Separated filtrate and suspension was weighed with 0.1 g accuracy (1). Water-holding capacity [%] was calculated using the following equation:

$$WHC = \frac{A-B}{C}100\%$$

where: *A* – added water; *B* – removed water after centrifuging, *C* – sample weight.

*Ability for maintenance of own water (FW)* [[1]. Sample of 2 g meat (grinded or non-grinded, of dimensions 15×10×4 mm) was placed on Whatman No 1 filter paper, covered with glass plate and pressed with 20 N (non-grinded meat was arranged in such a way to ensure muscle fibres being parallel to the force). Ability for maintenance of own water [$cm^2g^{-1}$] was calculated using the following equation:

$$\mathrm{FW} = \frac{\mathrm{AW}-\mathrm{AM}}{\mathrm{M}} \quad [cm^2g^{-1}]$$

where: *AW* – area of smudge of water pressed out of the meat [$cm^2$]; *AM* – area covered with meat [$cm^2$]; *M* – weight of meat sample [g].

*pH value*. Sample of 10 g grinded meat was mixed with 100 cm³ distilled water. After 5 mins, acidity was measured using pH-meter with universal electrode.

### Results and discussion

Study results (Fig. 2) proven that directly after ultra-sound waves operation, meat water-holding capacity was lowered in relation to control (K – 36%, U1 – 15%, U2 – 10%). At 24 hrs after the slaughter, WHC decreased in all samples under study. Sample processed with waves of 25 kHz had the lowest WHC – -8.7%, control sample – -4.8% and that subjected to 45 kHz waves – 0%. In the following day of meat storage, the increase of its WHC is observed. Samples U1 and U2 had higher level of WHC (8% and 10%, respectively) than control (4%). Similar dependencies were after 3-day meat freezing (K – 6%, U1 – 10%, U2 – 15%).

Investigations upon the changes of ability for maintenance of own water (FW) using Grau-Hamm's method showed that grinded meat had the highest FW in all studied samples at 2 hrs after the slaughter (Fig. 3). Differences between ultra-sound-operated and control samples were slight (K – 1, U1 – 2.5, U2 – 3 $cm^2g^{-1}$). In the following days of meat storage, samples were

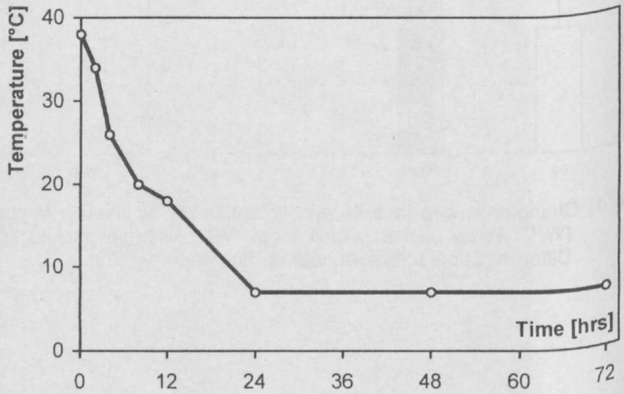


*Fig.1. The temperature of meat during storage*

characterised by lowered ability for maintenance of own water (Fig. 3). At the 3rd and 4th day after the slaughter, ultrasound-operated samples had higher FW than control (after 48 hrs: K – 19, U1 – 16, U2 -18.5 $cm^2g^{-1}$; after 72 hrs: K – 18, U1 – 15, U2 – 14 $cm^2g^{-1}$).

Studies upon the ability for maintenance of own water by non-grinded muscle tissue (Fig. 4) showed that meat was characterised by higher level of FW as compared to that by grinded meat. Study results at 2 and 24 hrs after the slaughter showed that operated samples had lower FW than control. At 48 and 72 hrs after the slaughter, samples operated directly after that had higher FW.

Obtained results regarding to pH values (Fig. 5) point that ultra-sound operation did not affected the acidity changes after the slaughter. Meat acidity amounted to: K – 6.60, U1 and U2 – 6.50 at 2 hrs after the slaughter. After 24 hrs, pH value decreased up to about 5.60 in all studied samples. At 48 hrs, pH value decreases again to 5.50 and it was at the same level after 72 hrs after the slaughter.

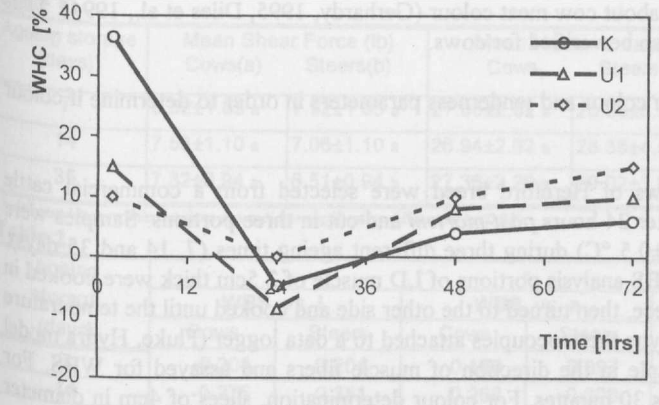

*Fig. 2. WHC of meat after slaughter*

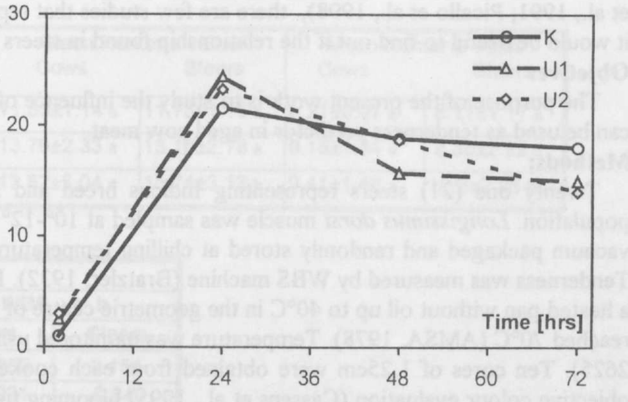

*Fig.3. The maintance of own water (grinded meat)*

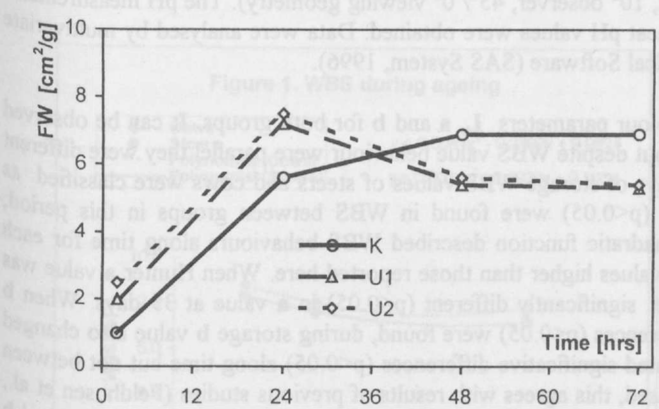

*Fig. 4. The maintance of own water (non-grinded meat)*

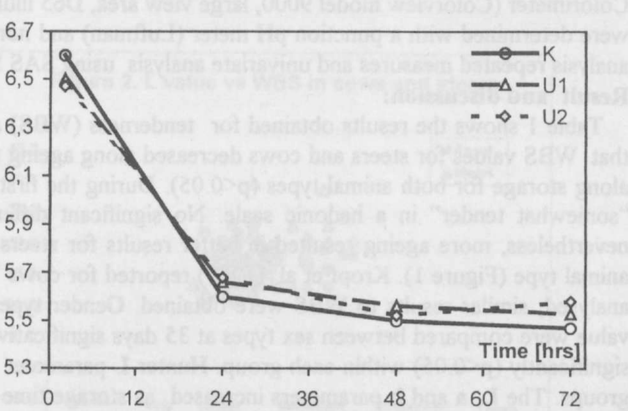

*Fig. 5. pH of meat after slaughter*

## Conclusions

Meat operated with ultra-sound waves of low frequency and middle intensity affected the water-holding capacity and ability for maintenance of own water changes. They depended on ultra-sound wave frequency.

Meat operated with ultra-sound waves of low frequency and middle intensity did not affect the dynamics of acidity changes.

## Bibliography

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