



YOU CAN IMPROVE
THE QUALITY
OF YOUR BEEF!

▶ **HVES**

High Voltage Electrical Stimulation

Scientific research shows the improvements of using HVES technology in meat processing

- **Rapid pH decrease**

Six hours after slaughter, stimulated half carcasses reach about 5.7-5.9 pH which allows the processor to:

- apply fast and ultra fast cooling methods directly after slaughter with no risk of cold shortening,
- sell the carcasses to other meat plants or cool them exactly on the slaughter day.

- **Lower loss of weight while chilling**

Carcasses typically lose weight when hung in the chilling room. The HVES technology:

- makes it possible to use fast and ultra fast chilling methods
- slowing the drip rate (the meat has sponge consistency) which results in gains of 1-1.5% of carcass weight.

- **Reduced time needed for aging**

From 14 days to 24 hours.

- **Improved tenderness by 40%**

24 hours after utilizing HVES technology the stimulated half carcass shows more tenderness than a non-stimulated half carcass after 14 days.



The results of applying HVES technology

- Better brightness in colour by 18-22%

HVES allows better bleeding and deeper oxygen penetration into meat tissue.

- Improved consistency

The stimulated muscle has a desired looser and „spongier” consistency in comparison with non-stimulated meat.

- Easier boning

The muscle contraction during stimulation results in weaker adhesion and less meat sticking to the bone after boning, providing higher processing efficiency.

- Hot boning

Thanks to HVES the hot boning is possible, allowing for faster processing and higher yields, allowing for greater savings.

stimulated



non-stimulated



If pH is higher than 6.2 there is a risk of cold shortening

See greater profits:

- **Additional carcass weight of 1%** (scientists point up to 1.5%)
- Processing 100 cows/day = **250 kg more meat to sell each day!**
- **This translates to 5 500 kg more each month!**

Additional advantages

- Increased water absorption

HVES-stimulated beef can be used for cured meat without using phosphates.

- Allows for hot vacuum packing, extending shelf life up to 60 days

The rapid pH decrease from HVES stimulation reduces pathogenic micro flora growth. This is especially important for processing plants which use hot boning to produce small cooking portions of meat that are vacuum packed and then cooled quickly.

- Shorter chilling process

Due to changed consistency the meat gets chilled faster, reducing energy costs.

- Defrosting lower weight loss

The stimulated meat loses less of its weight while defrosting/thawing.

**See
what
you can
achieve:**

We can win with competition
having better quality

Colour and tenderness are basic when the customer takes decision „where to buy beef”

We can achieve higher income thanks to
better high/low quality proportion

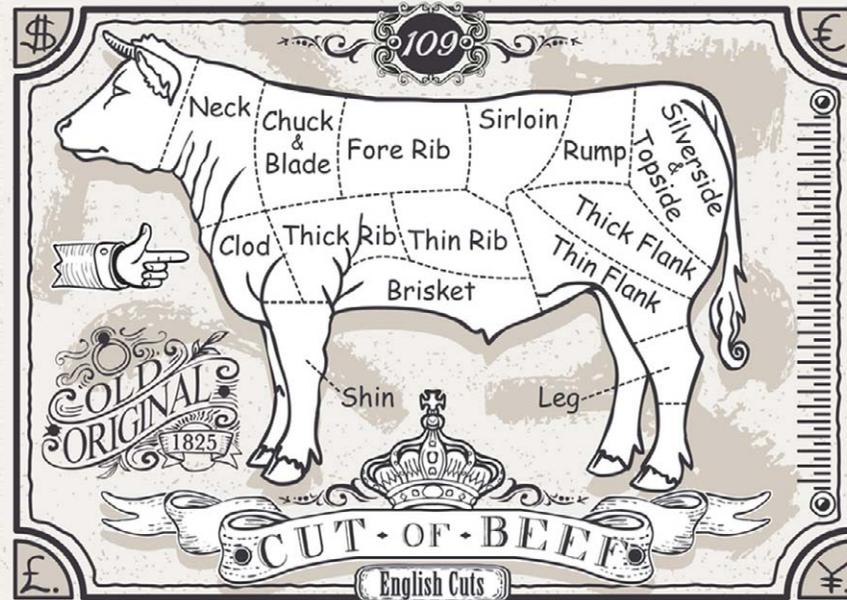
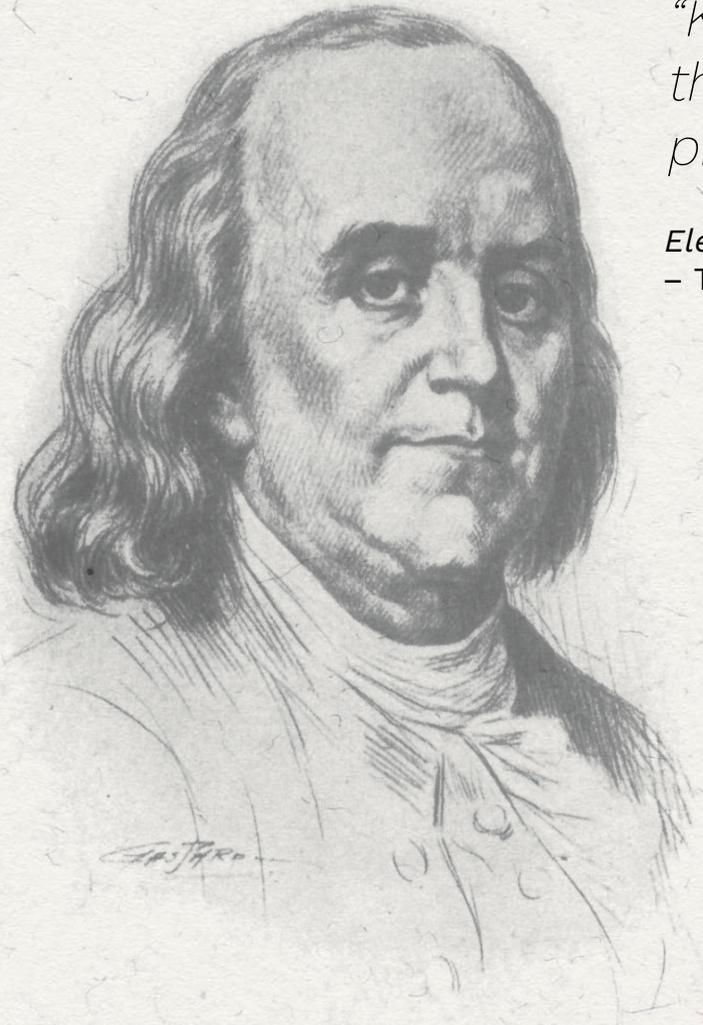
- After HVES the percentage of high quality beef increases: what used to fall in category 2, now rises to category 1, what was in 3, now rises to 2.
- Higher quality meat will dramatically increase your income, the sales of 30% or 50% of meat at prices by 5% or 10% higher **make a big difference.**

History of electrical stimulation

The use of electrical stimulation for increasing meat tenderness is not a new idea. Benjamin Franklin remarked in 1749 that:

“Killing turkeys electrically, with the pleasant side effect that it made them uncommonly tender, was the first practical application that had been found for electricity.”

Electrical Stimulation Purpose, Application and Results
– Texas Agricultural Experiment Station



HVES - BASIC RULES:

What is HVES?

HVES is a short flow of electrical current, similar to nerve impulses, through a carcass conducted within one hour after stunning. It implies dramatic drop in pH of muscle (glycogen, the muscle sugar, converts into lactic acid), which prevents cold shortening.



When?	20 to 50 minutes after slaughter
Best place?	Just before splitting
Duration?	From 1.5 to 2 min
Current?	Around 300 V

HVES - BASIC RULES:

How it works

Three-fold process of accelerated aging.



The enzymes are freed
(due to meat structure destruction)



The enzymes act faster
(as a result of a lower pH-positive environment)



The enzymes start intensive action
when the carcass is still warm

As the result the aging takes 24 h instead of 14 days.

See the difference:

Comparison of meat colour and consistency between stimulated and non-stimulated half carcasses of the same cow:

meat from stimulated
half carcass



meat from non-stimulated
half carcass



Colour

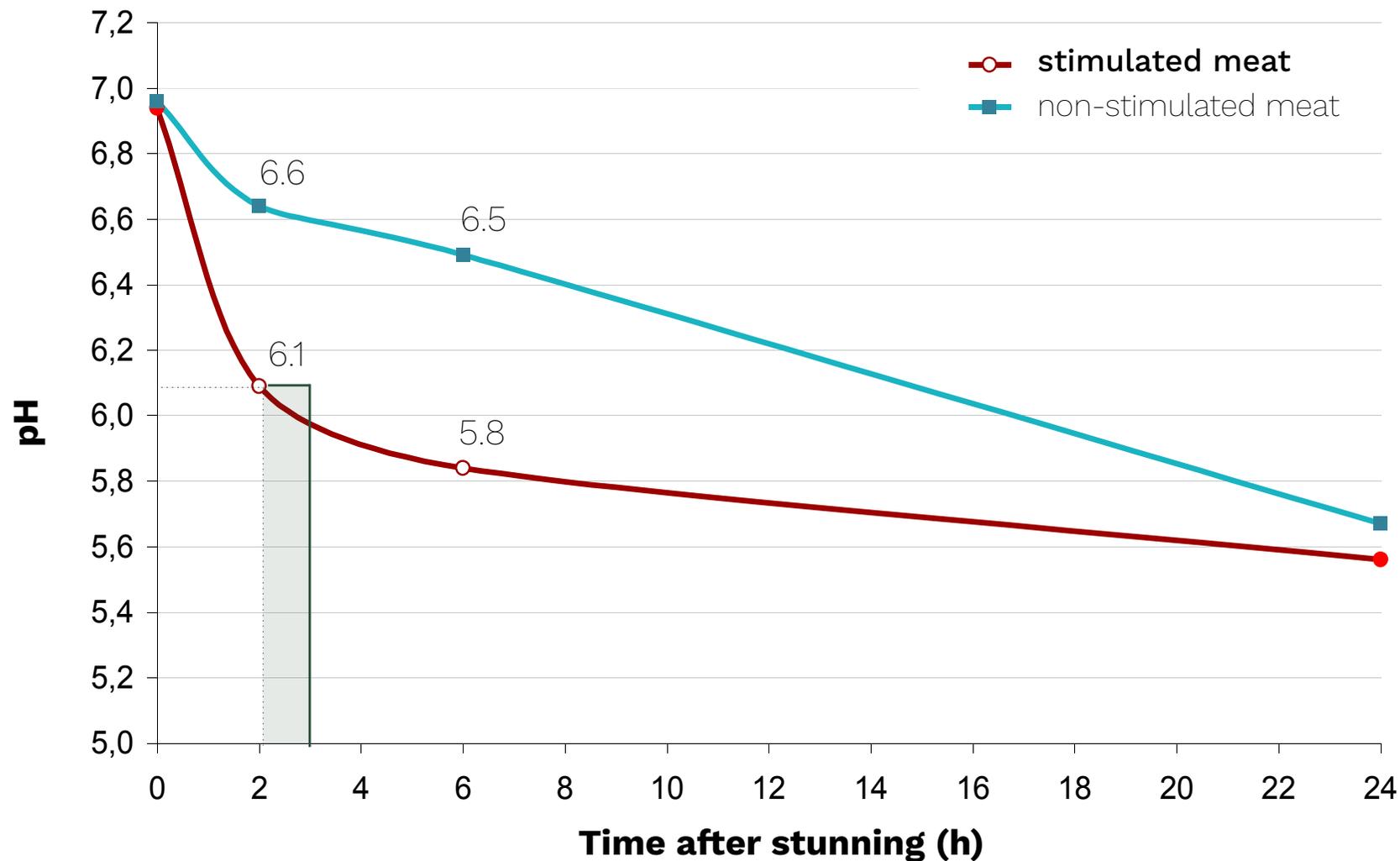
A big difference in colour between stimulated and non-stimulated meat can be seen with the naked eye in just six hours. This advantage for stimulated meat covers all breeds, although is less visible in young bulls.

Consistency

The muscle is loose and spongier – highly desirable – compared to non-stimulated.

How to measure the HVES results?

pH drop of stimulated and non-stimulated meat, just after slaughter:



Scientific papers:

... The model was tested over a wide range of carcass types and for three cooking methods (grill, roast and thin slice) with over 1600 consumers tasting over 1100 samples... HVES samples tended to score higher than non-stimulated samples ...

**Allen P., *Predicting Beef Eating Quality*,
Teagasc Food Research Centre,
Dublin, 2013**

Electrical stimulation does not merely accelerate rigor mortis but it also has other advantages such as an increase in tenderness and a reduction in tenderness variability compared to what is normally achieved for unstimulated meat. For unstimulated meat, elevated pre-rigor temperatures do not always allow the meat to reach its tenderness potential after a reasonable ageing duration – with stimulation this is not an issue.

**Devine C., *Letter to the editor*,
Meat Science 83 (2009) 584–585**

LVES vs. HVES vs. no stimulation

Comparison of the force needed to cut a piece of meat after Low Voltage Electrical Stimulation (LVES) vs. High Voltage Electrical Stimulation (HVES) and no stimulation (No ES):

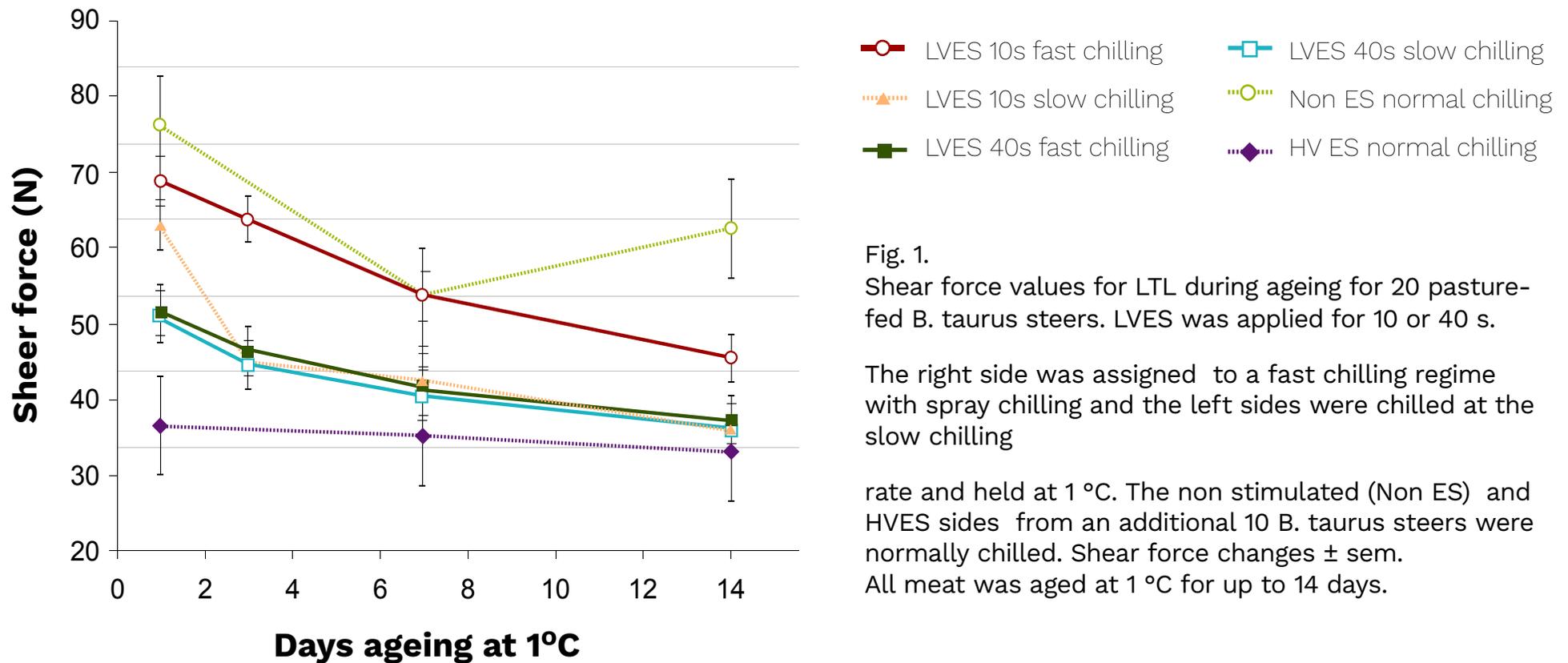


Fig. 1. Shear force values for LTL during ageing for 20 pasture-fed B. taurus steers. LVES was applied for 10 or 40 s.

The right side was assigned to a fast chilling regime with spray chilling and the left sides were chilled at the slow chilling

rate and held at 1 °C. The non stimulated (Non ES) and HVES sides from an additional 10 B. taurus steers were normally chilled. Shear force changes \pm sem. All meat was aged at 1 °C for up to 14 days.

Gursansky B., O'Halloran J.M., Egan A., Devine C.E.,
Tenderness enhancement of beef from Bos indicus and Bos taurus cattle following electrical stimulation,
Meat Science 86 (2010) 635–641

Scientific papers cont.:

*...stimulation... is used for all sheep processed for export from New Zealand...
The main processing advantages of stimulation still stand: the avoidance of cold shortening in fast chilling conditions and the early commencement of ageing allowing for short residence times in holding chillers.*

Devine C., Wells R., Cook C., Payne S.,

Does high voltage electrical stimulation of sheep affect rate of tenderisation?

New Zealand Journal of Agricultural Research, 2001, Vol. 44: 53-58

Taste panel evaluation and ...shear values indicated that longissimus muscle samples from electrically stimulated sides of all three species were significantly more tender than samples from the untreated sides. Flavor ratings for samples from electrically stimulated sides were significantly higher for beef.

J. W. Savell, G. C. Smith, T. R. Dutson, Z. L. Carpenter, D. A. Suter,
Effect of electrical stimulation on palatability of beef, lamb and goat meat,
Journal of Food Science 2006

Scientific papers cont.:

We conclude that HVES caused significant tenderization

L. Uytterhaegen, E. Claeys, D. Demeyer,
The effect of electrical stimulation on beef tenderness, protease activity and myofibrillar protein fragmentation,
Research Center for Nutrition, Animal Production and Meat Technology,
State University of Ghent, 1992, Melle, Belgium

*...electrical stimulation influences water-holding capacity through
its effect on the denaturation of myofibrillar proteins
due to a low pH at a high carcass temperature*

Offer, G., Knight, P., Jeacocke, R., Almond, R., Cousins, T., Elsey, J., Parsons, N., Sharp, A., Starr, R., & Purslow, P. (1989).
The structural basis of the water-holding, appearance and toughness of meat and meat products,
Food Microstructure, 8, 151-170.

*ES can therefore be implemented to improve meat tenderness in zilpaterol
supplemented steers, although steers without zilpaterol will still have an
advantage in final tenderness.*

Hope-Jones M., Strydom P.E., Frylinck L., Webb E.C.,
The efficiency of electrical stimulation to counteract the negative effects of β -agonists on meat tenderness of feedlot cattle,
Meat Science, 86 (2010) 699–705

Scientific papers cont.:

The study showed that all electrical stimulation treatments increased meat tenderness and juiciness scores relative to unstimulated control sides

Duration after min	HVES 40 pH	NOS pH
20	5.89	6.68
120	5.68	6.46
180	5.58	6.29
ultimate	5.4	5.53

HVES40:

High Voltage
Electrical Stimulation
40 minutes after
stunning

NOS:

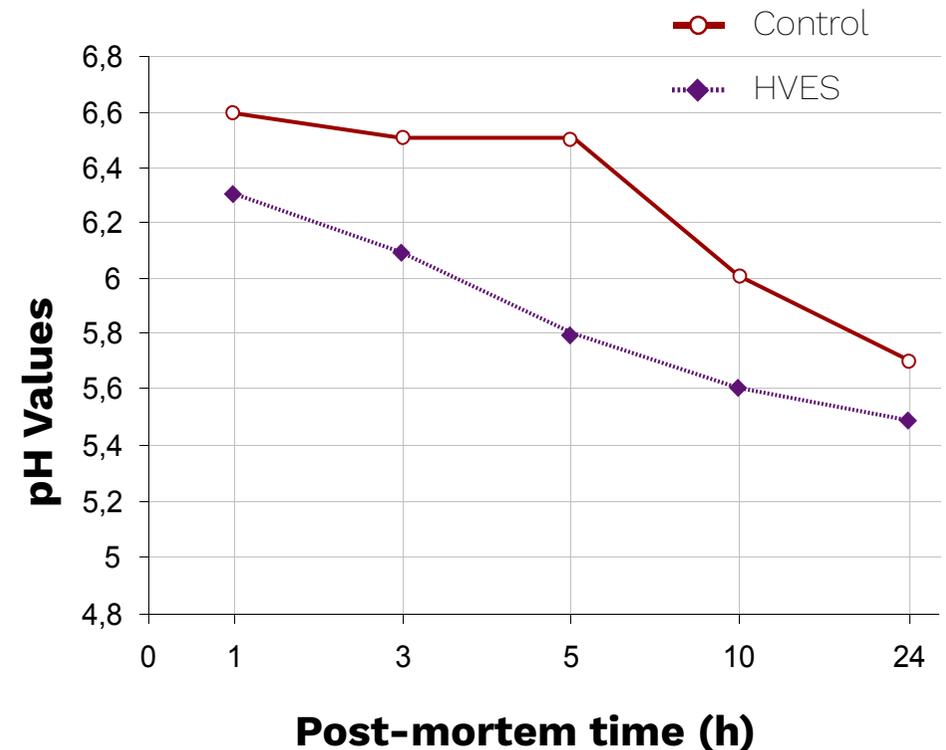
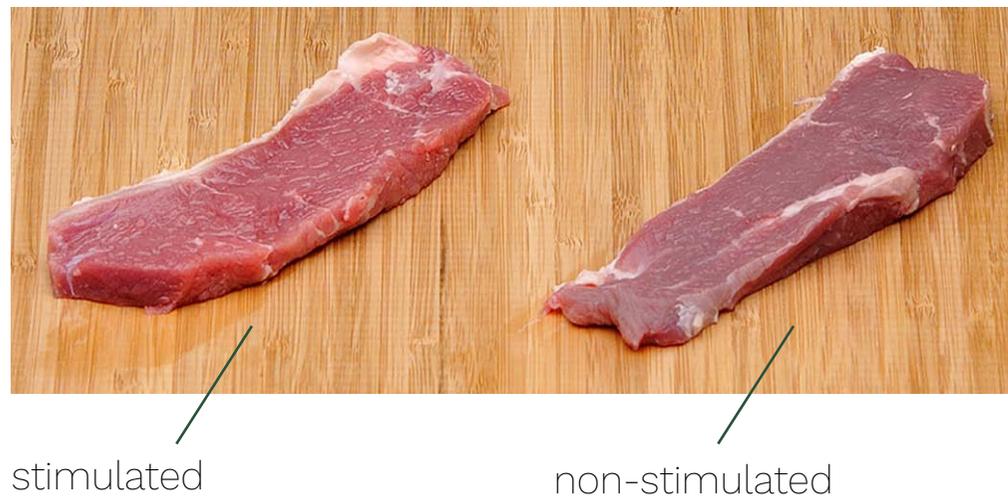
no stimulation

Hwang I.H., Thompson J.M.,
The effect of time and type of electrical stimulation on the calpain system and meat tenderness in beef longissimus dorsi muscle,
Meat Science 58 (2001) 135-144



Scientific papers cont.:

In this study, HVES-applied carcasses were tenderer and characterized by greater stability in colour than the control group 7 days post-mortem. ... Meat in the HVES group on the 7th day was a better red colour than in the control group.



Mombeni E.G. (Veterinary Medicine, Shahid Chamran University of Ahvaz, Iran), Mombeini M.G., Figueiredo L.C., Siqueira L.S.J, Dias D.T., Mombeini A.G.,
Effects of high voltage electrical stimulation on the rate of pH decline, meat quality and colour stability in chilled beef carcasses,
The Bangladesh Veterinarian (2013) 30(1) : 33 – 38

Fig.1. pH decline of beef carcasses within two groups.

For any enquiries
please call us on

+48 501 708 910

or email

IGOR.GIELNIAK@HVES.EU