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ELECTRICAL CONDUCTIVITY AND OTHER MEAT QUALITY TRAITS AS INDICATORS OF VITAMINE E EFFECTS ON BEEF AND PORK

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Background:
Biological membranes function as important barriers to detoriorative changes that can affect the quality of foods of animal origin (Stanley, 1991). Asghar et al. (1991) and Monahan et al. (1994) suggested that α-tocopherol could preserve the intgrity of muscle cells membranal phospholipids during storage, and this could inhibit the passage of sarcoplasmic fluid through the muscle cell membrane. If cell membrane integrity could be stabilized postmortem, sarcoplasm should be retained in muscle cells and thereby result in less drip loss and more weight retention during storage and display. Oxidative processes may contribute to the loss of membrane integrity. This oxidation leads to a decrease in fluidity and disruption of normal membrane structure and function, and may affect the ability of the membrane to act as a semi-permeable barrier (Stanley, 1991). The beneficial effect of dietary supplementation of vitamine E on some aspects of meat quality in red white meat has been reported by various investigators. The stability of lipid and colour in beef (Arnold et al., 1993) and pork (Monahan et al., 1992) and reduction of drip loss from pork chops following frozen storage (Asghar et al., 1991) could be achieved by dietary supplementation of vitamine E.
Some investigators did not find any differences between drip loss of supplemented and control porcine muscles, whereas the effect of vitamine E supplementation observed by Cheah et al. (1995) depended on the muscle investigated. The effect of vitamine E supplementation on drip loss of bovine muscles seemed to depend on muscle studied (Hertog-Meischke et al., 1997) As was showed (Mitsumoto et al., 1998) appropriate feeding duration and dose of vitamine E and concentrations in muscles must be determined that will be effective in reducing drip losses from fresh beef steaks.

Objectives:
The objective of this study was to determine the effects of dietary vitamine E supplementation on electrical conductivity and other meat quality values of different fresh (M. longissimus, M. psoas major) bovine and fresh (M. longissimus dorsi, M. semimebranosus) pork musles.

Methods:
Total 15 (10 experimental, 5 control) bulls (holstein breeds) with live weight 325 ± 25 kg were used in **experiment 1**. Experimental bulls were supplemented daily with 1000 mg vitamine E (Rovimix E-50 SD, La Roche) for100 days. Longissimus dorsi (LD) and Psoas major (PM) muscles were used.
Total 18 (9 experimental, 9 control) pigs (Large white, Large white x Pietrain, 5 normal and 4 heterozygotes on malignant hyperthermia syndrom in each group) were used in **experiment 2**. Experimental animals were supplemented daily with 200 mg vitamine E (Slovakofarma, Hlohovec) per kg of diet for 60 days before slaughtered (110 kg). Longissimus dorsi and Semimembranosus (SM) muscles were used for measurement.
Electrical conductivity (EC) were measured by instrument Biotech (Nitra) and TEPCRO QUALITY Meter (Germany). Drip loss analysis according to Honikel (1986). Lipid oxidation was mesured as Thiobarbituric Acid Reactive Substances (TBARS) by spectrophotometric method (Salih et al., 1987). pH by combined electrode (Ingold).
Statistical analyses were calculated as mean values and standard deviation and differences were evaluated by t-test (STATGRAPHICS).

Results and Discussion:
Dietary vitamine E supplementation (1000 mg/animal) for 100 days significantly ($P<0.05$) influenced electrical conductivity values and the oxidative stability of lipids in LD and PM muscles of bulls during chill storage (table 1).
In pigs dietary vitamine E supplementation (200 mg/kg diet) for 60 days influenced electrical conductivity and drip loss in LD and in SM muscles of pigs but significant differences ($P<0.05$) were received on conductivity values in SM muscle measured 2 hour post mortem. Drip loss values showed to be lower ($P\leq0.05$) in LD muscle of with vitamin E supplemented pigs.
A possible mechanism for the beneficial effect of vitamin E supplementation on drip loss has been suggested that α-tocopherol could preserve integrity of the muscle cell membrane by preventing oxidation of membranal phospholipids during refrigerated storage (Asghar et al., 1991). This could be consistent also with lowering of conductivity values in animals administered with vitamin E. den Hertog-Meischke et al. (1997) reported that the effect of vitamin E supplementation on drip loss seemed to depend on the muscle studied. Their results suggested that vitamin E supplementation may have both positive and negative effects on drip loss of meat, depending on the muscle studied. Drip loss in supplemented muscles may be decreased when compared with control ones through decreased rate of pH fall post mortem. Cheah et al.,(1995) showed that dietary supplementation of vitamin E (500 mg/kg diet) for 46 days could reduce drip loss in unfrozen longissimus thoracis in heterozygotes and in normal on malignant hyperthermia pigs. Monahan et al. (1994) heve shown that membranal lipid oxidation and drip loss of pork are not directly related. The influence of vitamin E supplementation on conductivity and drip loss of muscles was not always consistent. It is believed that conductivity and drip loss could be affected not only dietary vitamin E supplementation but also another factors such as moisture and fat contents of

the muscle (Mutsimoto et al., 1998) and animal model (occurence of mutation on RYR 1 gene in pigs) in experiment. The effect of vitamin E supplementation on conductivity and drip loss needs further investigation.

Conclusions:

Dietary vitamin E supplementation may have beneficial effects on electrical conductivity and drip loss values, but this depends on the muscle studied and conditions of experiment. In pigs occurence of mutation in ryanodine receptor gene conected with malignant hyperthermia syndrom should be controled. Howeve, this view deserves further investigation.

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Table 1 Changes of meat quality traits of longissimus dorsi and psoas major muscles with supplementation of vitamine E (1000 mg/animal/day) and control bulls

Parameter	Control group (n=5)				Experimental group (n=10)				Significance	
	48 h		7 days		48 h		7 days		48 h	7 days
	x	s	x	s	x	s	x	s		
Longissimus dorsi										
Electrical cond.	5.54	0.751	12.70	1.319	5.81	0.798	9.58	0.802	-	+
TBARS number	0.36	0.029	0.65	0.043	0.32	0.027	0.48	0.034	-	+
Psoas major										
Electrical cond.	7.76	1.641	10.80	0.298	5.21	0.810	8.25	0.746	+	+
TBARS number	0.40	0.042	0.65	0.080	0.28	0.031	0.43	0.053	+	+

(+) $P \leq 0.05$, + $P < 0.05$

Table 2 Changes of meat quality traits of longissimus dorsi and semimebranosus muscles with supplementation of vitamine E (200 mg/kg diet) and control pigs

Parameter		Control group (n=9)		Experimental group (n=9)		Significance
		x	s	x	s	
Longissimus dorsi						
pH	45 min	6.27	0.240	6.34	0.250	-
Conductivity	2 h	4.39	1.040	3.42	1.190	-
	24 h	3.97	1.600	3.01	1.820	-
Drip loss	24 h	4.85	1.380	3.80	0.640	(+)
Semimebranosus						
pH	45 min	6.43	0.180	6.56	0.190	-
Conductivity	2 h	9.11	2.300	5.22	2.900	+
	24 h	8.99	3.560	6.86	2.850	-