...ECTS OF A MAGNESIUM FUMARATE SUPPLEMENTATION ON MEAT QUALITY IN PIGS

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...MMARY

Magnesium is a cofactor in many enzymatic reactions and is supposed to counteract catecholamine effects in stress ...ations. Stress susceptibility is the main reason for the development of poor meat quality, e.g. pale, soft and exudative pork ...E-meat). Thus, we investigated the effects of dietary magnesium fumarate on meat quality characteristics in pigs from ...erent genotypes.

18 animals came from the German Landrace (DL) and 18 animals from the Pietrain breed (PI). In each breed, reactors ... non reactors to the volatile anaesthetic halothane were equally distributed. From the 36 animals three feeding groups with ...plementation of 0 g (control), 10 g and 20 g of magnesium fumarate per kg standard fattening diet were formed. Animals ... fed ad libitum, starting with a body mass of 30 kg until reaching an approximate slaughter weight of 100 kg. After ...ughtering, the following criteria were measured in two muscles (musc. longissimus thoracis and musc. semimembranosus): ...cass composition, pH, conductivity, water binding capacity and color, at 1 and 24 hours post mortem.

In general, meat quality criteria were positively influenced by magnesium fumarate supplementation. Meat color was less ..., pH1 values higher and conductivity values significantly lower in the 10 g supplementation group and partly also in the ... supplementation group, compared to the control group. Magnesium fumarate supplementation did not affect any of the ...cass composition criteria. Significant differences in meat quality criteria and carcass composition were also found between ...otypes.

...TRODUCTION

Magnesium is an important cofactor in enzymatic reactions of the energy and protein metabolism (NIEMACK, 1985; ...MANI, 1990). It is also required for muscle contractures and signal transmission of nerves. As an antagonist to calcium ...GUYEN-DUONG, 1989), magnesium is supposed to counteract catecholamine effects in stress situations (CLASSEN, 1986; ...ENTHER et al., 1985; KAEMMERER et al., 1984; KIETZMANN et al., 1985; SCHMITTEN et al., 1984). Stress suscepti-...ty in swine is accompanied with an abnormal intracellular calcium release in skeletal muscle, hypercatabolism and elevated ...dy temperature. These abnormal metabolic reactions are also the main reason for the development of poor meat quality. Thus, ...was the aim of this study, to investigate the effects of two supplementation regimes of magnesium fumarate on meat quality ...teria of slaughter pigs from different genotypes.

...TERIAL AND METHODS

18 animals of the German Landrace and 18 animals of the Pietrain breed were obtained from different breeding schemes ...nd tested for their sensitivity to halothane (barnyard challenge). Half of each group was halothane positive (h+) and half was ...alothane negative (H-). 23 animals were castrated male and 12 were female. The animals were equally distributed to form three ...eding groups with a supplementation of 20 g, 10 g and 0 g (control) of magnesium fumarate per kg standard fattening diet. ...arting at an approximate body weight of 30 kg the animals were given ad libitum access to their diets until reaching an ...proximate slaughter weight of 100 kg. After slaughtering, the following criteria were measured: pH and conductivity at 1 and ... hours post mortem in two muscles (musculus longissimus thoracis = musc. long. thorac., and musculus semimembranosus = ...usc. semimembr.), and water binding capacity (GRAU et al.,1952) and color (OPTOSTAR, Fa. Matthaeus, Poettmes, ...ermany) in the musc. long. thorac.. Carcass composition was evaluated by measurements of backfat thickness and meatiness

(HENNESSY grading probe). Data were evaluated by ANOVA using the SAS software package for personal computers. The following statistical model was applied: y = μ + breed (B) + halothane genotype (G) + sex (S) + feeding group (F) + slaughter day + B x G + B x S + B x F + G x S + G x F + S x F + b x body weight + e.

RESULTS AND DISCUSSION

In general, supplementation with magnesium fumarate positively influenced meat quality criteria. The color of musc. long. thorac. was significantly less pale and conductivity 24 hours post mortem in the same muscle was significantly lower in the magnesium fumarate supplementation groups compared to the control group (Tab. 1). The 10 g supplementation group showed significantly higher pH and lower conductivity values 1 hour post mortem in the musc. long. thorac. compared to the control group. No significant differences of the carcass composition and fattening performance were found between the feeding groups (Tab. 2). Carcasses of halothane negative animals showed significantly better meat quality compared to carcasses of halothane positive animals (Tab. 3). No significant differences in meat quality were found between breeds. Some carcass composition criteria were influenced by halothane genotype and breed. In general, the carcass composition of the halothane positive animals and of the Pietrain pigs was less fat compared to the halothane negative animals and the German Landrace pigs (Tab. 4). No significant interactions were found between magnesium fumarate supplementation, halothane genotype and breed concerning meat quality and carcass composition.

CONCLUSIONS

We conclude that a supplementation of magnesium fumarate in the diet can improve meat quality criteria. These positive effects were found not only in stress susceptible but also in stress resistant animals. Indeed, magnesium fumarate seems to counteract catecholaminic effects during stress situations. In preslaughter stress situations, a potential reduction of transportation losses may be assumed. In addition, further investigations should be carried out to reveal questions of dose and duration of supplementation more in detail.

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LE 1: Effects of different magnesium fumarate supplementations on meat quality criteria in two muscles of swine (least square mean values ± standard error)

	magnesium fumarate supplementation			
	0 g	10 g	20 g	
	a	b	c	
	n = 12	n = 12	n = 11	Signif.
water binding capacity (m.l.t.)	0.39 ± 0.02	0.41 ± 0.02	0.43 ± 0.02	n.s.
meat color (m.l.t.)	52.0 ± 2.4	59.8 ± 2.4	60.7 ± 2.8	a:b *, a:c *
	n = 9	n = 9	n = 8	
pH 1h post mortem (m.l.t.)	5.68 ± 0.14	6.23 ± 0.12	6.08 ± 0.19	a:b *
pH 1h post mortem (m.sm.)	5.86 ± 0.12	6.12 ± 0.11	6.16 ± 0.17	n.s.
pH 24h post mortem (m.l.t.)	5.30 ± 0.04	5.29 ± 0.03	5.33 ± 0.05	n.s.
pH 24h post mortem (m.sm.)	5.40 ± 0.05	5.36 ± 0.04	5.48 ± 0.07	n.s.
conductivity 1h p.m. (m.l.t.) mS	10.3 ± 1.2	5.3 ± 1.0	9.5 ± 1.6	a:b *
conductivity 1h p.m. (m.sm.) mS	4.5 ± 0.3	3.7 ± 0.3	4.8 ± 0.5	n.s.
conductivity 24h p.m. (m.l.t.) mS	9.6 ± 0.5	5.9 ± 0.5	6.9 ± 0.7	a:b**, a:c *
conductivity 24h p.m. (m.sm.) mS	9.0 ± 1.0	7.1 ± 0.9	6.1 ± 1.4	n.s.

m.l.t. = musculus longissimus thoracis, m.sm. = musculus semimembranosus, p.m. = post mortem, mS = milli Siemens, * = significant difference ($p < 0.05$), ** = ($p < 0.01$), *** = ($p < 0.001$)
n.s. = no significant difference between all possible group comparisons

LE 2: Effects of different magnesium fumarate supplementations on carcass composition and fattening performance criteria of pigs (least square mean values ± standard error)

	magnesium fumarate supplementation			
	0 g	10 g	20 g	
	a	b	c	
	n = 12	n = 12	n = 11	Signif.
carcass weight (kg)	78.6 ± 1.1	78.3 ± 1.1	76.9 ± 1.1	n.s.
carcass lenght (cm)	91.7 ± 0.9	92.6 ± 0.8	92.7 ± 0.9	n.s.
lean meat content (%)	57.8 ± 1.0	57.2 ± 1.0	57.7 ± 1.0	n.s.
lean meat to fat ratio (1 : ..) m.l.t.	0.34 ± 0.01	0.32 ± 0.01	0.34 ± 0.01	n.s.
backfat thickness (cm)	2.1 ± 0.1	2.2 ± 0.1	2.0 ± 0.1	n.s.
daily gain (g)	698 ± 26	695 ± 26	726 ± 27	n.s.

m.l.t. = musculus longissimus thoracis,
n.s. = no significant difference between all possible group comparisons

TABLE 3: Differences between meat quality criteria from two halothane genotypes of swine (least square mean values ± standard error)

	halothane genotype		
	H-	h+	
	a	b	
	n=18	n=17	Signif.
water binding capacity (m.l.t.)	0.46 ± 0.01	0.36 ± 0.02	a:b ***
meat color (m.l.t.)	63.1 ± 1.9	52.0 ± 2.5	a:b **
	n=13	n=13	
pH 1h post mortem (m.l.t.)	6.32 ± 0.12	5.68 ± 0.14	a:b **
pH 1h post mortem (m.sm.)	6.40 ± 0.11	5.70 ± 0.12	a:b **
conductivity 1h p.m. (m.l.t.) mS	3.57 ± 1.01	13.17 ± 1.17	a:b ***
conductivity 1h p.m. (m.sm.) mS	3.57 ± 0.29	5.09 ± 0.34	a:b **
conductivity 24h p.m. (m.l.t.) mS	4.82 ± 0.45	10.12 ± 0.52	a:b ***
conductivity 24h p.m. (m.sm.) mS	5.59 ± 0.84	9.25 ± 0.97	a:b *

H- = halothane negative, h+ = halothane positive,
m.l.t. = musculus longissimus thoracis, m.sm. = musculus semimembranosus, p.m. = post mortem,
mS = milli Siemens, * = significant difference ($p < 0.05$), ** = ($p < 0.01$), *** = ($p < 0.001$)

TABLE 4: Pig carcass composition of different halothane genotypes and breeds of swine (least square mean values ± standard error)

	breed			halothane genotype		
	DL	PI		H-	h+	
	n = 17	n = 18	Sign.	n = 18	n = 17	Sign.
carcass length (cm)	94.42 ± 0.81	90.21 ± 0.88	**	94.49 ± 0.69	91.14 ± 0.78	*
lean meat content (%)	52.52 ± 0.95	62.60 ± 1.01	***	54.91 ± 0.84	60.22 ± 0.90	**
lean meat to fat ratio (1 : ..)	0.41 ± 0.01	0.26 ± 0.01	***	0.37 ± 0.01	0.30 ± 0.01	***
backfat thickness (cm)	2.25 ± 0.08	1.94 ± 0.09	*	2.31 ± 0.08	1.88 ± 0.11	*

significant difference:
* = $p < 0.05$
** = $p < 0.01$
*** = $p < 0.001$

PI = Pietrain
DL = German Landrace
h^+ = halothane positive
H^- = halothane negative