Effect of supplementation with natural tranquilizers -magnesium and tryptophan- in pig diets on animal behaviour and welfare

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Introduction

Animal Welfare

Transport

Preslaughter handling

ANIMAL WELFARE

Treaty of Amsterdam (1997): Animals

"Protocol on the Protection and Welfare of animals"

X agricultural products

X sentient beings

New Community Legislation

Introduction

Factors affecting meat quality

1. **Genotype**
2. **Sex (castrated males, entire males or females)**
3. ***Ante mortem* treatment**
4. **Others (age, nutrition, post-mortem treatment...)**

Introduction

Factors affecting meat quality

1. **Genotype:** Porcine Stress Syndrome. Halothane gene

STRESS	RESISTANT	SENSITIVE	
HALOTHANE	NEGATIVE(HN)	POSITIVE (HP)	(Eikelenboom & Minkema 1974)
Genotype	NN	Nn	nn (Fuji *et al*, 1991) (DNA test)

- **Inherited autosomal recessive disease (monogenic autosomal recessive gene)**
- **Origin: Mutation in the RYR1 gene, which codifies the calcium release channel of the sarcoplasmic reticulum by the skeletal muscle**

↑ Ca^{2+} cytosolic levels

↑ Rate of muscle metabolism

↑ Lactic acid accumulation

⇓ (Acceleration) muscle pH fall

Introduction

Factors affecting meat quality

1. **Genotype** — RYR1 gene: F(n)= **32 %** in Spain (Gispert et al., 2000)
2. **Sex (castrated males, entire males or females)**
3. **Ante mortem treatment** — Poor animal welfare — Poor pork quality

Directive 93/119/EC of 22 December 1993 on the **protection of animals at the time of slaughter or killing**

'Pigs brought into slaughterhouses for slaughter **shall be stunned before slaughter** or killed instantaneously'

'The **concentration** of carbon dioxide for stunning pigs must be **at least 70 %** by volume'

Introduction

Factors affecting meat quality

1. **Genotype**
2. **Sex (castrated males, entire males or females)**
3. ***Ante mortem* treatment**

To reduce effects of an acute pre-slaughter stress

Magnesium carbonate

- **Counteracts catecholamine effects in stress situations** (Kietzman & Jablonski, 1985)
- **Controls intracellular calcium** (Laver et al, 1997)
- **Delays the initiation of glycolysis** (Moesgaard et al., 1993)

L-Tryptophan

- **Increases plasma and brain Trp, and brain serotonin** (Fernstrom & Wurtman, 1971)

Objective

The aim of this study was to assess the effect of dietary supplementation with magnesium and tryptophan on animal behaviour and welfare in pigs with different sensitivity to stress

Experimental design

61 entire male pigs; Commercial body weight (102.6 ± 12.6 kg)

Housed in 6 pens

Stress Sensitivity		Diet supplementation (5 days before slaughter)		
HAL– (HN) (NN)	HAL+ (HP) (nn)	Control	$MgCO_3$	L-Trp
Landrace Large White	Pietrain	Standard	1.7 g Mg/kg (0.38 %)	4.1 g Trp/kg (0.61 %)
n=34	n=27	n=20	n=19	n=22

Diet: *ad libitum*

***Ante mortem* treatment (minimal stress):**
- **transport and lairage without mixing groups**
- **transport time: 15 min**
- **lairage time: 1-3 h**

Performed analysis

1. In the farm:
- Feed intake

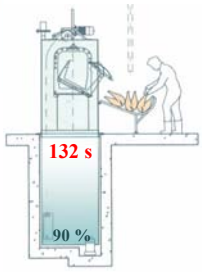
2. In the raceway (to the CO_2 stunning system):
- Time to cross the raceway
- Voluntary movement

If after **1 minute** the animal was reluctant to move, it was gently pushed into the box.

Performed analysis

3. Behavioural parameters during the exposure to the CO_2:

Dip-lift CO_2 stunning system (Source INTECAL)



•Objective:
- **induction of the unconsciousness (it is not immediate)**

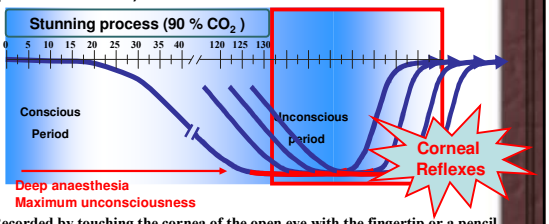
• Side effects: AVERSIVE GAS
- **irritation of the nasal mucosal membranes and lungs** (Peppel & Anton, 1993)
- **sense of breathlessness** (EFSA, 2004)

Unpleasant situation

- **Retreat attempts : pigs backing away** (Dodman, 1977)
- **Gasping: onset of breathlessness** (Lambooij et al.,1999)
- **Loss of posture: onset of unconsciousness** (Raj & Gregory 1996)

Performed analysis

4. After the stunning procedure: Anaesthesia effectiveness (Corneal reflexes)



• Recorded by touching the cornea of the open eye with the fingertip or a pencil

- **Last reflex to disappear during loss of consciousness** (EFSA, 2004)
- **First reflex to reappear as consciousness returns** (EFSA, 2004)

Performed analysis

1. In the farm:
- Feed intake

2. In the raceway (to the CO_2 stunning system):
- Time to cross the raceway
- Voluntary movement

If after **1 minute** the animal was reluctant to move, it was gently pushed into the box.

3. Behavioural parameters during the exposure to the CO_2:
- First retreat attempt
- First gasp
- The time to loss posture

4. After the stunning procedure:
- Presence of corneal reflexes

At **0**, **15**, **30**, **45** and **60** seconds.

Statistical analysis

Software: *Statistical Analysis System (SAS, v 8.01)*

Procedure: *proc glm*

Model:

$$Y_{ijk} = \mu + DIET_i + HAL_j + (DIET \times HAL)_{ij} + e_{ijk}$$

$Y_{ijk} = ijk\ observation$

$\mu = mean\ of\ the\ model$

$DIET_i = diet\ effect\ (i = C, Mg, Trp)$

$HAL_j = HAL\ gene\ effect\ (j = HP, HN)$

$e_{ijk} = residual\ of\ the\ ijk\ observation$

Significance level: $P<0.05$

Results & Discussion

- **Feed intake:**
  No differences among diets (C, Mg & Trp):
  Mean = **1.90 ± 0.47 kg/d**

- **Behaviour in the raceway to the CO_2 stunning unit:**
  No differences among diets (C, Mg & Trp)
  No differences between genotypes (HN-NN & HP-NN)

  Means: Time to cross the raceway = **244.2 ± 4.07 s**
  Voluntary movement = **49.1 %**

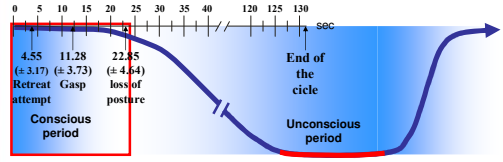
Results and Discussion

- **Behaviour in the CO_2 stunning system: Aversion to the CO_2**

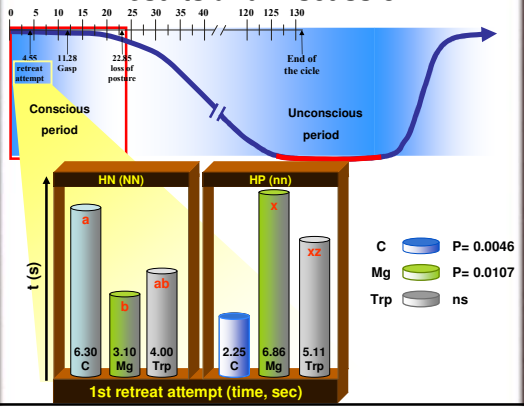
  No differences among diets (C, Mg & Trp)

  No differences between genotypes (HN-NN & HP-nn)

  Mean values:

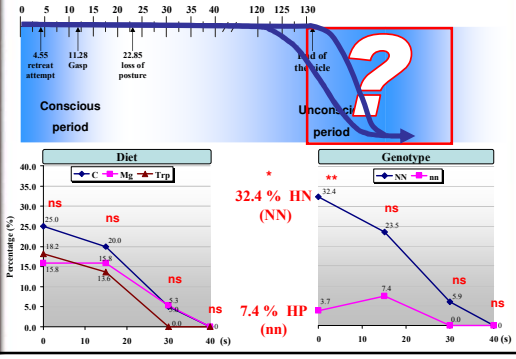


Results and Discussion



Results and Discussion

Stunning Effectiveness: CORNEAL REFLEXES



Conclusions

1. **Supplementation of Mg in the diet of pigs could have a positive effect on animal welfare of HP (nn) pigs, decreasing the aversiveness to the CO_2 gas.**

2. **The exposure to 90 % of CO_2 during 132 s induced the unconsciousness earlier in the HP (nn) group than in the HN (NN) one, indicating that it could be more effective in HP animals.**