Monitoring of the physiological and behavioral stress response of Holstein calves following mixing prior to marketing

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How can we reduce stress-related negative effects?
Introduction

- Beef cattle in Israel are reared until the age of 12-14 months.

- During cattle rearing stress-full events may decrease meat quality by interfering with proper meat acidification, and negatively affect the organoleptic properties of the meat (color, flavor, juiciness).
Stress inducing events

**Acute stress:**
Loading, transportation, crowdedness, mixing, starvation, close contact with man.

**Chronic stress:**
Nutritional, group transfer and mixing
Deleterious effect of stress on the meat

- Excessive degradation of glycogen
- Depletion of stored glycogen
- Lactic acid

Acute stress → Deleterious effect → Salehood → PSE (pH: 5.2) → Lactic acid → DFD (pH: 6.2) → Chronic stress
Incidence increases (Warriss, 2000) and ranges between 10-30%, but can reach up to 60% (Adzitey and Nurul, 2011).

What is the consumer preference?
Estimated annual loss of 20 million $ (Cassell et al., 1991).
A major cause of Dark Cutting Beef is mixing unfamiliar animals, thus promoting agonistic behavior in young bulls.

The abattoir requested for homogenous group assembling at least 3 weeks before marketing.
Study objectives

1. How can we monitor the behavioral and physiological effects of mixing in an objective and continuous manner?

2. Are 34 days prior to marketing enough in order to reduce mixing effects?
Experimental design

• 22 calves were reared between the ages 7-15 months, in groups of three in 9m² pens.

• 34 days prior to marketing calves were mixed from triplets into 2 groups.

• Weight measurements were performed once monthly, 1 day before mixing (DBM), 3 and 33 days post mixing (DPM).

• Calves were monitored for rumination, activity, metabolic and oxidative stress responses.

• Meat pH levels were measured 24 hours after slaughter.
Sensor monitoring

• Leg-activity (Pedometer Plus™, AfiFarm®)

• Neck-activity (Hi-Tag TM, SCR Engineers)

• Rumination duration (SCR)

Combination of sensors
1. Effect of mixing on weight gain

- **BM**: Weight gain (kg) = 1.095
- **3 DPM**: Weight gain (kg) = -2.05
- **33 DPM**: Weight gain (kg) = 0.555

**P = 0.04**

Age: 523 ± 0.3 days
2. Effect of mixing on leg-activity

\[ P < 0.0001 \]
3. Effect of mixing on neck-activity

![Graph showing activity index over time](image)

Activity index/ day

23/03/2013 23/04/2013 23/05/2013

P<0.0001
4. Effect of mixing on rest-bouts

5. Effect of mixing on rest time
6. Effect of mixing on rumination

\( P < 0.0001 \)
7. Effect of mixing on the energy balance

$P<0.0001$

![Graph showing effect of mixing on NEFA levels over time.](graph.png)

- Normal values in positive energy balance.
8. Effect of mixing on the anti-oxidative capacity

\[ P = 0.01 \]
9. Effect of mixing on meat pH

Incidence of meat pH<6 in this abattoir is 60%
Summary

• Early mixing decreased weight gain and increased activity and mean values were not restored a month later.

• Rumination decreased 24 hours following mixing but a recovery was recorded 2 days later.

• Mixing led to elevated oxidative and metabolic stress.

• Group mixing led to improper meat acidification.
Sensors for rumination and activity potentially enable us to determine the recovery time required following stress-inducing events.
Practical implementations

• Avoid mixing!

• If you must, mix early…

• Sensors - objective tool for welfare and productivity monitoring.

• Implement sensors for recommendations/guidelines in order to enhance meat quality in European legislation.
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