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RUMINATION AND ACTIVITY DATA DURING THE CONDITIONING PERIOD OF BEEF CATTLE

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CHARACTERISTICS OF BEEF FARMING IN ITALY

- ✓ **Italy is the fourth main producer of bovine meat in EU-28**, following France, Germany and UK

- ✓ **The Italian self-supply of bovine meat is only 53%**

Slaughtered animals	000 Heads	Meat %
Veal calves	635	12
Bulls	54	14
Cows	478	
Young bulls /heifers:	**1304**	**74**

- 8% Imported for slaughtering
- 92% Grown in Italy
  - 47% **Imported Mainly from France**
    - >300 kg: **51%**
    - 80-160kg : **33%**
    - 160 -300 kg : **1%**
    - <80kg : **15%**
  - 53% From national Cow-calf farms

Ismea 2016

YOUNG BULLS/HEIFERS FARMING CHARACTERISTICS IN ITALY

	Intensive farming		Extensive farming
	Light beef	Heavy beef	
Live weight, kg	450 - 500	600 - 650	650
Age, months	14-16	16-20	16-24
Bovine meat, %	**12**	**46**	**16**
Breeds	Dairy crosses, French breeds (females)	French breeds and crosses	Italian breeds (Chianina, etc.)
Feeds	Maize silage, concentrates	Maize silage, concentrates	Pasture and concentrates
Daily growth, kg	0.9-1.3	1.3-1.5	1.4 – 1.8

Production in Veneto

- 23% bovine meat
- 8% of beef farms
- Highly specialised farms
- Animals imported from France
- High daily growth (1.5 kg/day)

Farming phases

1. Conditioning (40 -50 days)
2. Growing (moderate/high) starch and high protein)
3. Fattening (High starch)

BOVINE RESPIRATORY DISEASE (BRD): A CRITICAL ISSUE

BRD

- ✓ Major cause of morbidity and mortality
- ✓ The most expensive disease in beef cattle
- ✓ **Prevalence**: 10 -20%
- ✓ Causal agents: (viruses, bacteria and mycoplasmas)

Predisposing factors

(Webster, 2011)

- ✓ Season (late autumn–early winter)
- ✓ Overcrowding
- ✓ Poor sanitation
- ✓ Inadequate ventilation
- ✓ Fluctuating temperatures
- ✓ Inadequate nutrition
- ✓ Transport
- ✓ Etc.

Stressors during conditioning period

- ✓ Extended transport (truck)
- ✓ Radical change of housing
- ✓ Change of feeding
- ✓ Hierarchical competition
- ✓ Viruses and bacteria in new environment
- ✓ Etc.

BRD: PREVENTION DIAGNOSIS AND THERAPY

Prevention

- ✓ Vaccination
- ✓ Metaphylaxis
- ✓ Proper housing
- ✓ Proper feeding

IBR,
BRSV,
PI-3,
BVD
Mannheimia
Histophilus

Diagnosis

- ✓ Clinical examination

- **Sensorial depression**
- **Nasal discharge**
- **Cough**
- **Dyspnoea**
- **Low or no appetite**
- **Fever (Temperature > 39-39.5 °C)**

Therapy

- ✓ Antibiotic
- ✓ Anti-inflammatory drug

Early diagnosis allows an **immediate therapeutic intervention** and **minimizes the severity of the disease** and the **long-term health consequences**

AIMS

- ✓ **Acquire data** on beef cattle activity and rumination
- ✓ Assess whether or not data provide a reliable **prediction of weight gain**
- ✓ Verify whether or not collected data help in the **early detection of diseases** (in particular BRD).

MATERIAL AND METHODS: ANIMALS AND HOUSING

Animals

- ✓ **Breed:** Charolais
- ✓ **N°:** 108 bulls coming from France
- ✓ **Age**: 390±49 days
- ✓ **Live weight:** 453±21 kg

Farm

- ✓ **Location:** Veneto (RO), Italy
- ✓ **Extension:** 800Ha,
- ✓ **N° animals/year: 6000**

Housing

- ✓ Animals were located in a roofed stable and grouped in 11 pens
- ✓ The pens were (14 x 5 m) and had straw bedding
- ✓ Continous water availability

MATERIAL AND METHODS: EXPERIMENTAL DESIGN

Duration of the trial: 70 days

Actions on the animals the day after arrival

- ✓ Grouping
- ✓ Weighing
- ✓ Clinical examination
- ✓ SCR collars fitting
- ✓ Vaccination
- ✓ Metaphylaxis

Daily activities throughout the trial

- ✓ Animals were checked twice daily to verify their health condition and the right position of collars
- ✓ Any symptoms and therapies have been regularly recorded.
- ✓ Data on rumination and activity were recorded by collars every 2 hours and then summarized as values of total daily rumination and activity

Actions at the end of the trial

- ✓ Weighing (to determine weight increment)
- ✓ Clinical examination
- ✓ Removing of the collars
- ✓ Translocation of the animals to another stable

MATERIAL AND METHODS: TECHNOLOGY USED

Heatime® Pro System /HRLDn Tag (SCR Engineers Ltd)

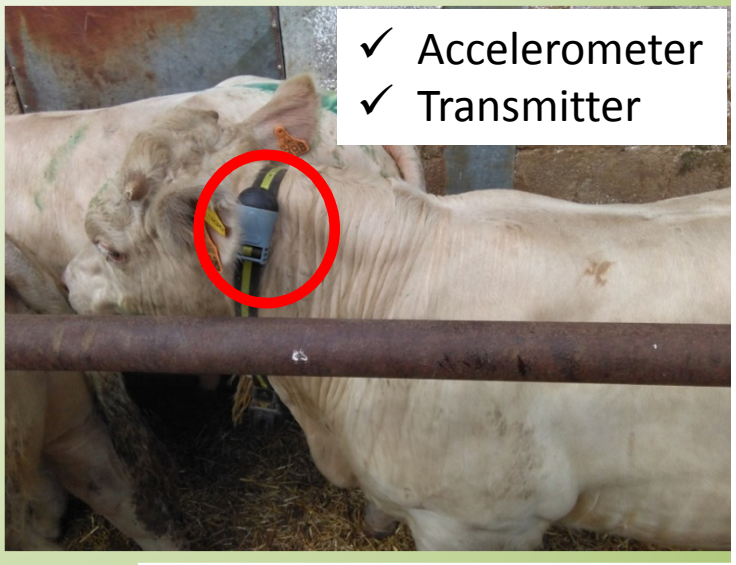
Functions

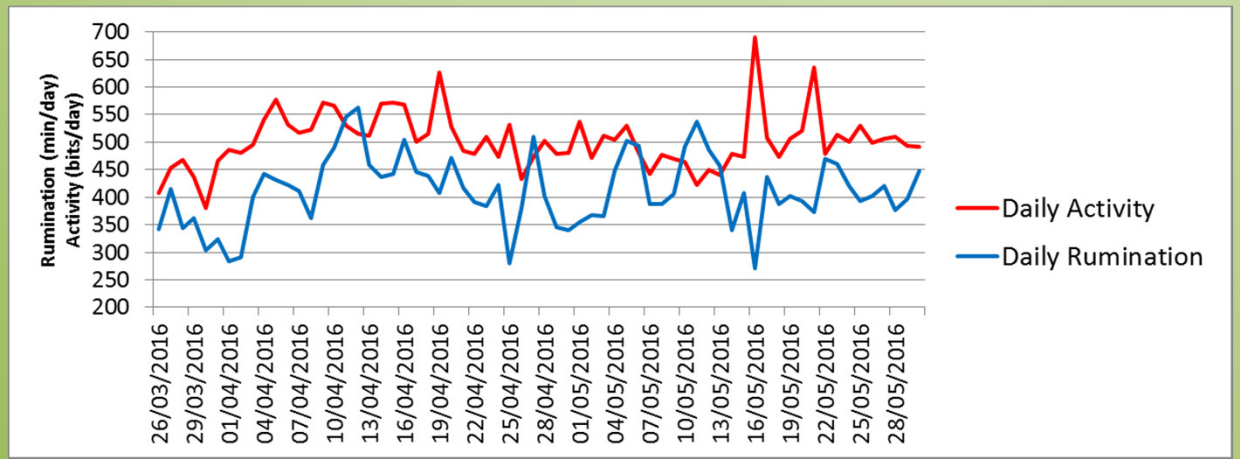
- Animal identification
- Real-time individual neck activity level

  (0–253 bits/2h)
- Real-time individual ruminating time
- All data were transferred automatically

  to the herd management software

  (DataFlow2, SCR Engineers Ltd ., Netanya, Israel).





MATERIAL AND METHODS:

ACTIVITY AND RUMINATION PARAMETERS

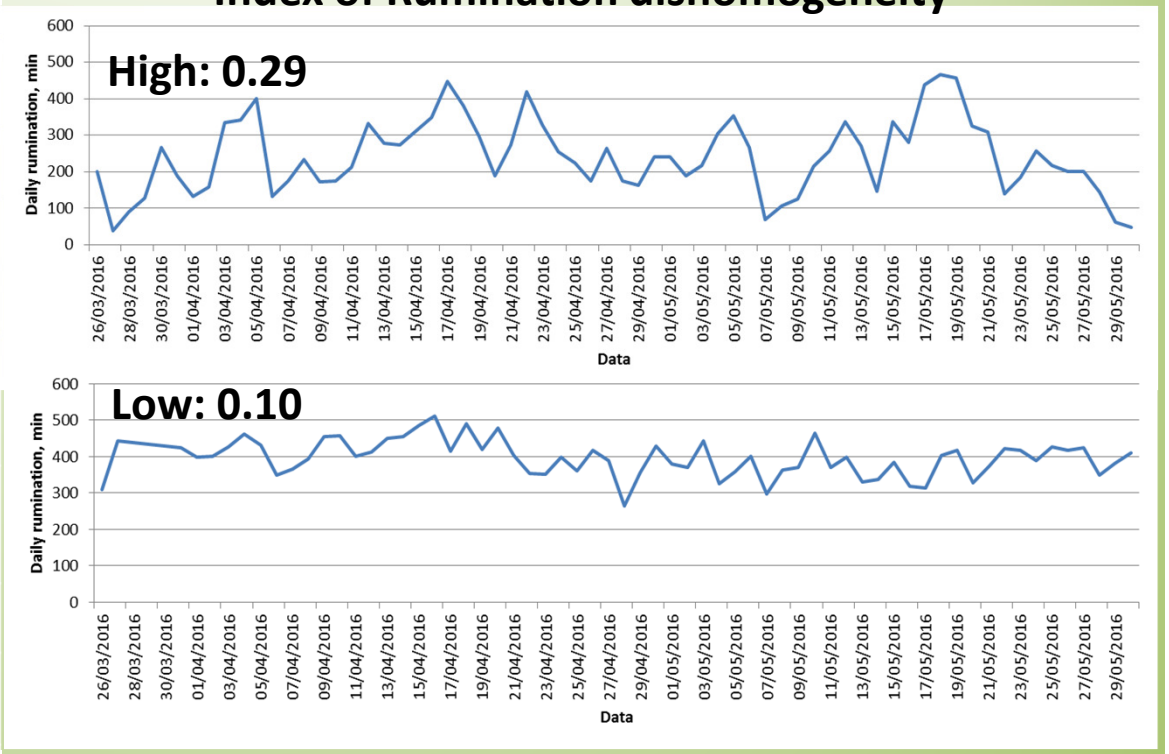
Rumination

- ✓ Average daily rumination, min
- ✓ Minimum Daily Rumination, min
- ✓ Rumination Range, min
- ✓ Daily index of rumination dishomogeneity
- ✓ Index of Rumination dishomogeneity

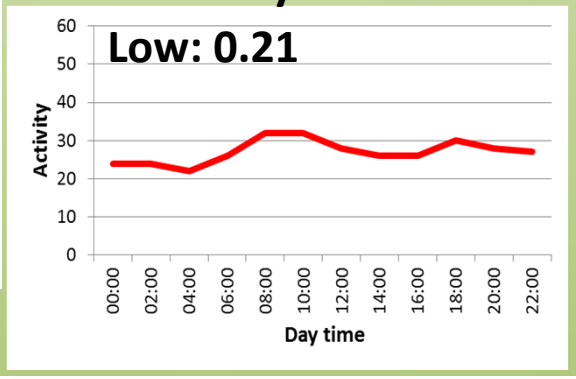
Activity

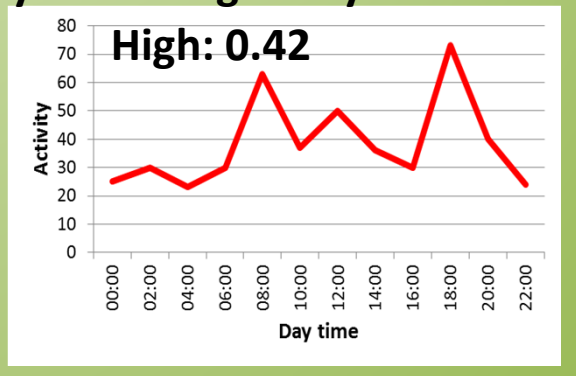
- ✓ Average daily activity
- ✓ Minimum daily activity
- ✓ Daily index of activity dishomogeneity
- ✓ Index of Activity dishomogeneity

Index of Rumination dishomogeneity



Daily index of activity dishomogeneity





MATERIAL AND METHODS: RATIONS

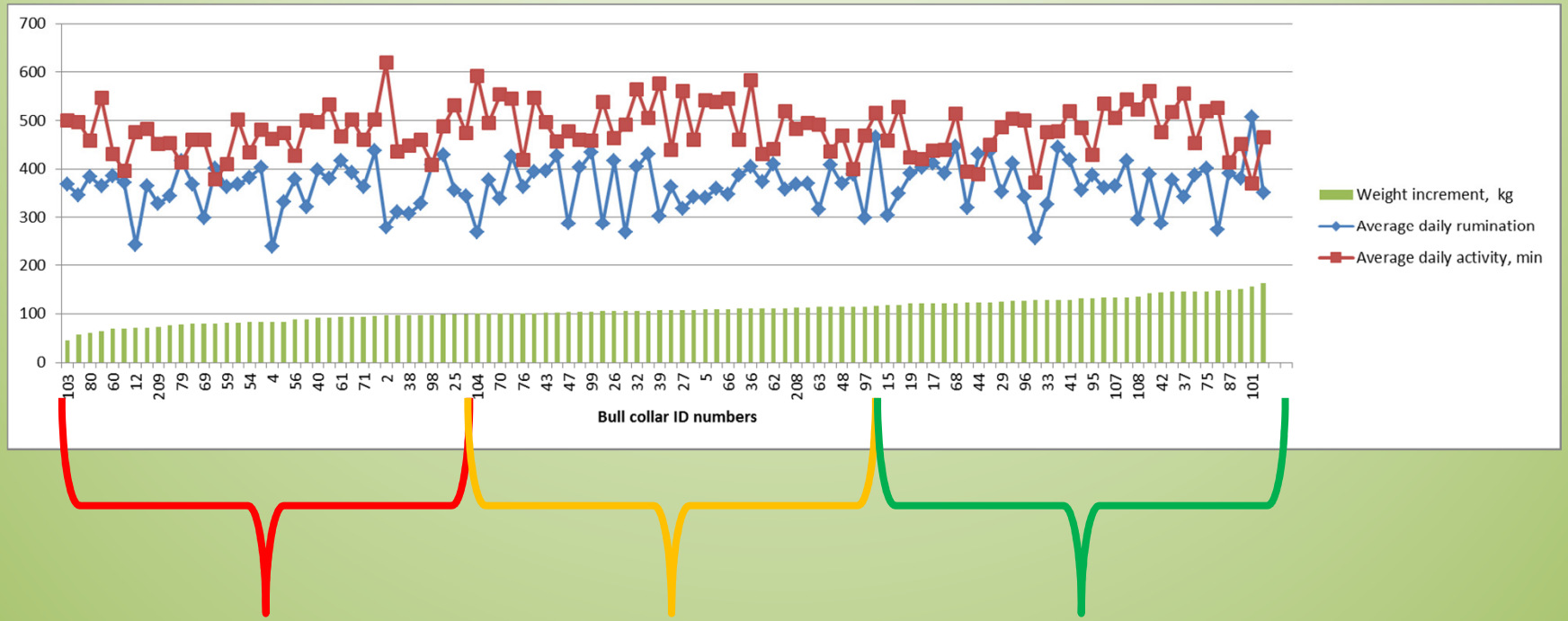
At the arrival animals were fed a ration based on hay and maize silage for 3 days

Average composition of the rations:	1° month	2° month
	Kg WW	Kg WW
Hay	0.60	0.00
Wheat bran	1.50	1.50
Straw	0.65	0.80
Vitamine and mineral mix	0.61	0.72
Protein and energy concentrate	1.25	0.00
Maize silage	6.20	5.00
Maize meal	1.14	2.60
Pressed beet pulp	3.4	5.00
Soybean meal	0.55	0.56
Total	15.9	16.2
Crude protein, %DM	**14.9**	**13.7**
NDF, %DM	37.0	35.0
Starch, %DM	25	30

MATERIALS AND METHODS:

GROUPING IN ADG CATEGORIES

For statistical analysis **animals were grouped** in three groups of the same size, **according to three catgories of ADG / Weight increment**



Low daily gain (LDG)
- up to 99 kg
- up to 1.42 kg/d

Medium daily gain (MDG)
- 100 to 117 kg
- from 1.47 to 1.67 kg/d

High daily gain (HDG)
- from 118 to 163 kg
- from 1.68 to 2.33 kg/d

STATISTICAL ANALYSIS

- ✓ **Data** on activity and rumination **were checked for normality** using PROC UNIVARIATE and Shapiro–Wilk test.
- ✓ **Perason's correlation coefficients** were calculated between average daily growth (ADG) and variables of activity and rumination.
- ✓ Furthermore data of activity and rumination were submitted to **one-way ANOVA according to the fixed effect of ADG** (3 levels: low, LWG, medium, MWG, and high, HWG).
- ✓ LSMeans of the ADG effect were separated using the probability of difference (PDIFF) option along with a Bonferroni adjustment for multiple comparisons.
- ✓ As regard as the effect of diseases on activity and rumination, data belonging to healthy condition and data concerning disease were subjected to a PROC MIXED, with time effect (Pre-disease vs. disease) and the animal as a random effect

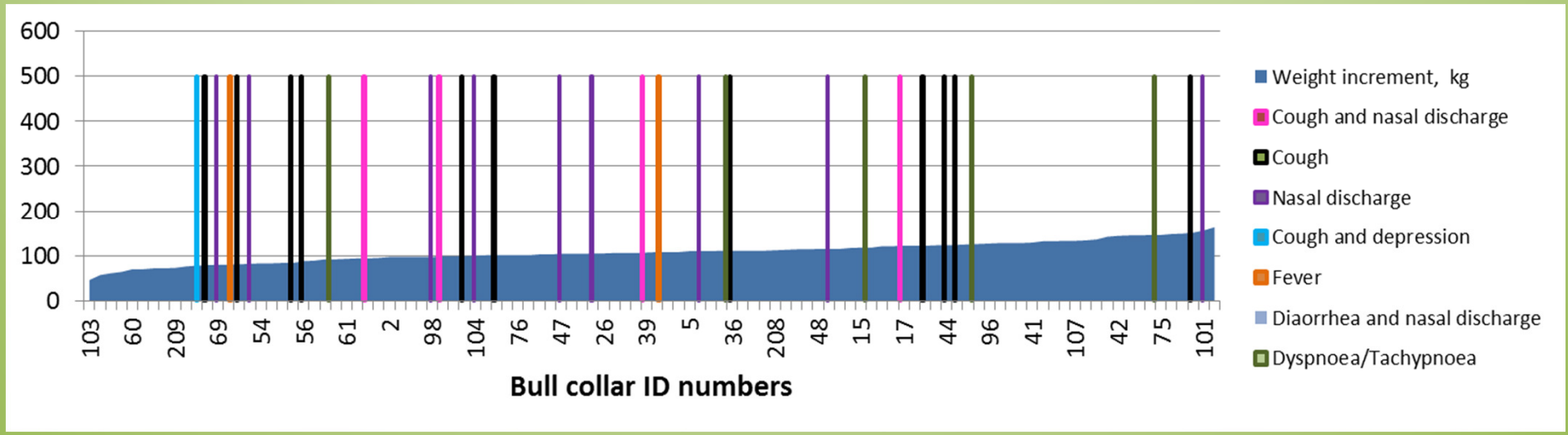
- ✓ **All of the statistical analyses were conducted using SAS software** (2010, release 9.3; SAS Institute Inc., Cary, NC, USA).

RESULTS AND DISCUSSION: HEALTH STATUS

- Collars **were found displaced** on 36 bulls at least once **for a total of 55 episodes**
- **13 bulls lost their collars** at least once for a total of 20 times
- Data corresponding to episodes of displaced or lost collars were not taken into account for data analysis

Animals on the whole were healthy

	Cough	Nasal discharge	Fever	Diaorrhea	Sensorial depression	Dyspnoea
N° animal	16	14	2	1	2	6
Animal %	14.8	13.0	1.85	0.92	1.85	5.55

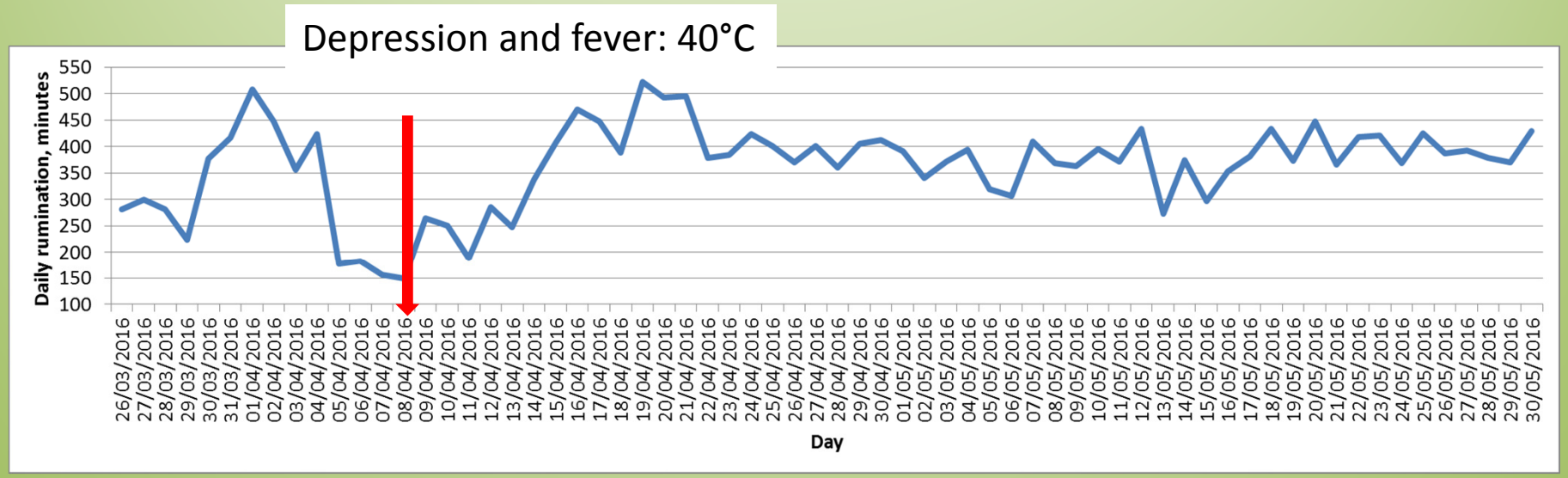


RESULTS AND DISCUSSION: DISEASE PREDICTION

✓ Animals with **nasal discharge** showed **an increase in daily Activity**

	Healthy	Nasal discharge	SEM	P
Average daily activity, bits/day	**422**	**446**	**27.7**	**0.088**

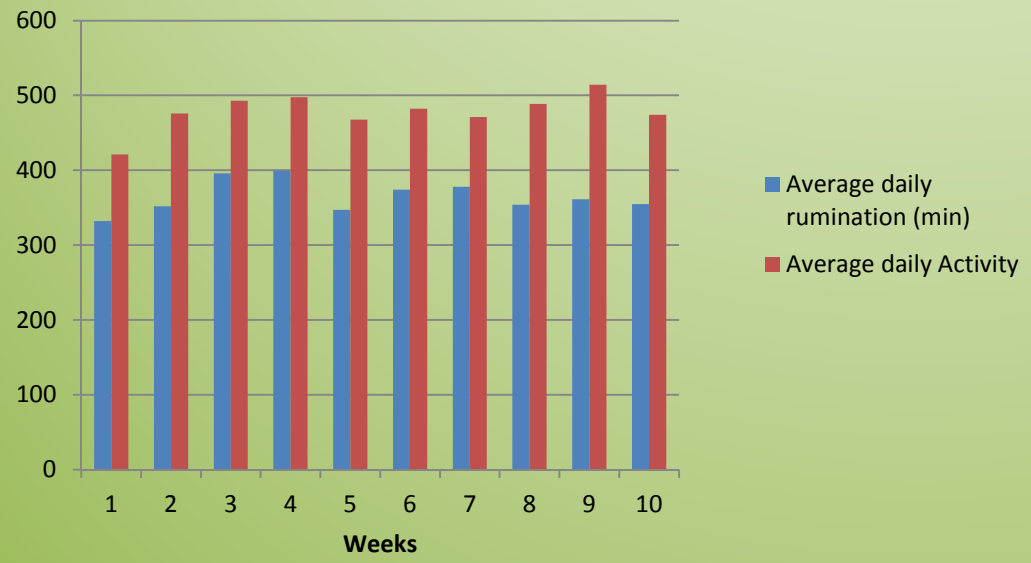
✓ **Fever** leads to a **reduction in daily rumination**



✓ **Drop in rumination** is probably consequent to a **drop in feeding** caused by the disease before the onset of visible clinical signs

RESULTS AND DISCUSSION: ACTIVITY AND RUMINATION

	Average	SD	Max	Min
Initial body weight, kg	453	21.4	514	398
Final body weight, kg	561	31.0	620	475
Daily weight gain, kg	**1.56**	0.34	**2.33**	**0.68**
Average daily rumination, minutes	**367**	50.8	**506**	**238**
Max daily rumination, minutes	510	56.7	672	355
Min daily rumination, minutes	**170**	82.2	**360**	**12**
Average daily activity, (bits)	**481**	50.6	**619**	**369**
Max daily activity, (bits)	677	130	1033	442
Min daily activity, (bits)	347	44.9	463	243



- ✓ In the first week bulls should adapt to new conditions
- ✓ They began to eat and ruminate more
- ✓ In the 5° week the fiber in the ration was reduced

RESULTS AND DISCUSSION: EFFECTS ON ADG

Wake but significant correlations (Pearson correlation coefficient) with ADG were found for:

- ✓ Minimum daily rumination, r : 0.25 (P=0.009)
- ✓ Rumen dishomogeneity index, r: -0.25 (P=0.008)

	LDG	MDG	HDG	SEM	P
Rumination					
Minimum Daily Rumination, min	**142b**	**170ab**	**197a**	13.2	**0.0184**
Rumination Range, min	**366a**	**336ab**	**315b**	14.0	**0.045**
Rumination dishomogeneity index	**0.184a**	**0.171ab**	**0.157b**	0.006	**0.0137**
Activity					
Average daily activity	**470**	**498**	**474**	8.29	**0.0421**
Daily index of activity dishomogeneity	**0.314b**	**0.353a**	**0.325b**	0.0073	**0.0009**

Average daily growth is significantly affected by

- ✓ **Dramatic drop in rumination**
- ✓ **Great variation in rumination** throughout the farming period
- ✓ **Variation in activity**

CONCLUSIONS

- ✓ **Patterns of rumination and activity** in beef cattle show **big variations** among individuals and throughout the conditioning period.
- ✓ **Rumination** pattern is affected by **feed intake**, **fiber content** and **fiber quality** and **its drop** below certain levels seems to **affect ADG** and may indicate **fever** at an early stage
- ✓ **Activity level** is related to **feeding time**, but also to **hierarchical competition**, **stress** and the presence of some symptoms but **its meaning is sometimes hard to determine**
- ✓ Patterns of activity and rumination promise to be useful in both **daily growth forecasting** and in **detection of diseases**, although further research is needed

THANKS FOR YOUR ATTENTION

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