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Grazing behavior and metabolic profile of 2 Holstein strains in an organic full-time grazing system

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ALP is part of the ALP-Haras Unit

Introduction

- **Situation in Switzerland:**
  - Selection of dairy cow genetics focus mainly on milk yield per cow
  - Milk production of Holstein cows is constantly increasing (www.holstein.ch)
  - 71% of agricultural area represents grassland

    Swiss Federal Statistical Office, 2011
  - The part of organic agricultural land is growing
  - Price for concentrate is high

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Introduction

- **What characteristics does a dairy cow need on a full-time pasture?**
  - Convert available biomass to a high amount of high quality milk
  - Able to adapt to short term feed restrictions
- **New Zealand Holstein cows:**
  - Well adapted to fulltime grazing systems
  - Genetics: reduced body weight, increase in feed efficiency, precocity, fertility and health (Shook, 2006; Miglior, 2005)
  - Milk yield per ha grassland

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Are there differences in the suitability of Swiss and New Zealand Holstein cows for an organic full-time pasture system?

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Materials and methods

- balanced complete block design.
- **Animals**: 2 strains:
  - 12 Farm-bred “Swiss” Holstein cows (H_{CH})
  - 12 New Zealand Holstein cows (H_{NZ})
  - pairs of cows according to no. of lactation, days since calving and age for primiparous cows
  - Characteristics of experimental animals:

Item	Cow strain		SE	Effect of Cow Strain (*P*-value)
	H_{CH}	H_{NZ}		
Days in lactation	123	123	4.4	0.89
BW (kg)	587	546	13.0	**0.01**
BCS	2.57	2.85	0.05	**<0.01**
Milk yield (kg/d)	22	21	1.03	0.3

BW = body weight, BCS = body condition score

After an adaptation period every cow completed 1 week of sampling period.

Materials and methods

- **Grazing management**

  Organic farm in Switzerland (824 m.a.s.l.)

  Rotational full-time grazing system without concentrate supplementation

- **Grass intake**

  Intake of each cow was estimated during 1 week

  n-alkane double indicator technique (Mayes et al., 1986)

- **Milk yield** was recorded twice daily and **milk composition** was analyzed 3 times per sampling period.

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Materials and methods

- **Grazing behavior** of each cow was recorded on 3 consecutive d over 24h

  automatic jaw movement recorder with pressure sensor (Nydegger, 2011)

- **Physical activity** of each cow was recorded over 72h, simultaneously with the grazing behavior

  IceTag^{TM} pedometer (IceRobotics Ltd., Edinburgh, UK)

- **Blood samples** of each cow were taken on 3 consecutive days at 7h, 12h and 17h by puncture of the vena jugularis

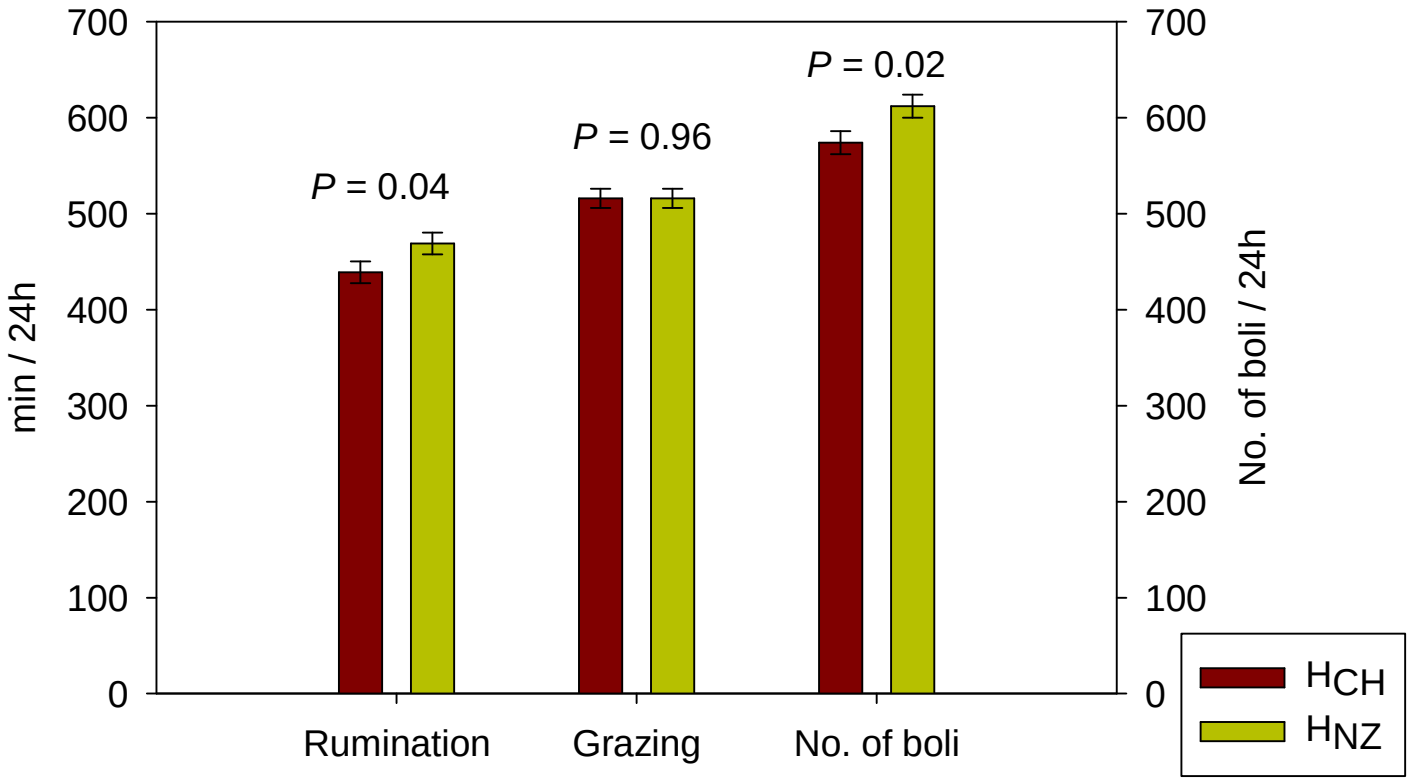
- **Statistical analyzes** were done following linear mixed models.

Grass intake, milk: results

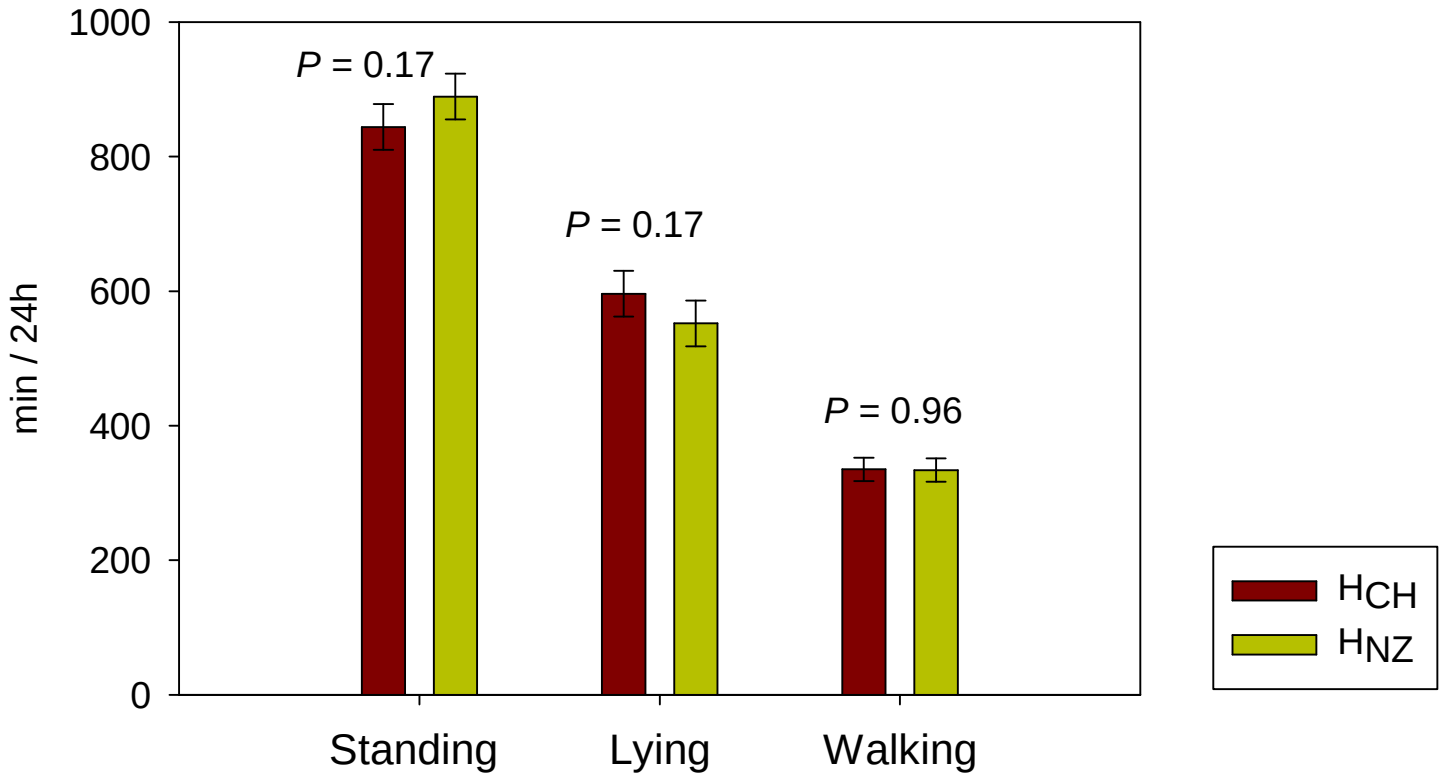
Item	Cow strain		SE	Effect of Cow Strain (*P*-value)
	H_{CH}	H_{NZ}		
ECM (kg/d)	20.1	20.2	0.87	0.90
ECM/$BW^{0.75}$ (kg/kg)	17.0	17.7	0.63	0.33
ECM/Grass intake (kg/kg DM)	2.09	2.14	0.12	0.69
Grass intake per cow (kg of DM/d)	9.98	9.54	0.28	0.27
Grass intake/$BW^{0.75}$ (kg/100kg)	8.40	8.51	0.22	0.73
Fat (%)	3.69	4.10	0.16	**0.05**
Protein (%)	2.92	3.20	0.05	**<0.01**
Lactose (%)	4.57	4.56	0.04	0.86
FPQ	1.03	1.05	0.02	0.51
Urea (ppm)	166	175	7.16	0.38

ECM = energy corrected milk, $BW^{0.75}$ = metabolic body weight, DM = dry matter, FPQ = quotient of fat to protein

Grazing behavior: results



Physical activity: results



Metabolic profile: results

Item	H_{CH}	H_{NZ}	SE	*P* - value
BHBA mmol/l	0.87	0.84	0.04	0.61
NEFA mmol/l	0.10	0.09	0.01	0.35
Glucose mmol/l	3.18	3.15	0.05	0.66
Cholesterol mmol/l	5.83	6.10	0.30	0.68
Triacylglycerides mmol/l	0.31	0.33	0.01	0.40
Urea mmol/l	2.96	3.18	0.11	0.19
Total protein g/l	75.8	73.0	1.49	0.18
Insulin µU/ml	11.6	11.8	1.40	0.90
IGF-1 ng/ml	84.4	106.0	7.54	**0.05**
T3 nmol/l	1.40	1.67	0.09	**0.01**
T4 nmol/l	43.1	46.9	2.29	0.23

BHBA = β-hydroxybutyrate, NEFA = non-esterified fatty acids, IGF-1 = insulin -like growth factor-1, T3 = 3,5,3´triiodothyronine , T4 = Thyroxin

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Conclusions

- H_{NZ} behave slightly differently compared to H_{CH}
  - longer rumination time
  - more No. of boli
- No differences in
  - physical activity
  - intake per kg of $BW^{0.75}$ and feed efficiency
  - metabolic load
- H_{NZ} seem to compensate feed restriction better than H_{CH} but could not use that advantage for increased feed efficiency.

No differences in the suitability of Swiss and New Zealand Holstein cows for use in organic full-time pasture systems in this short-term study were found.

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Thank you for your attention!