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UNIVERSITÄT BERN
Veterinary Physiology

Session 37: marco.graber@physio.unibe.ch

Physiological differences between metabolically stable and instable cows

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Introduction

- The transition period for dairy cows is critically important to health and production
- In some cows adaptation to lactation is more successful than in other cows
- Past health status is usually not included in studies

Objective

To understand the differences in plasma parameters and mRNA levels of hepatic parameters during the transition period up to mid lactation in dairy cows characterized based on their past health status

Materials & Methods

Field study in Switzerland

- Cantons (states) Berne and Lucerne

Materials & Methods

Previous lactation: selection of the cows for the field study

Criteria	Range
milk fat percentage	> 4.5 %
fat /protein ratio	> 1.5

- Allocation to the farms
- Selection of farms with at least four cows
- 232 dairy cows of parities 2 to 13
- Breeds: Brown Swiss (98), Holstein Friesian (18),

  Red Holstein (74) and Simmental x Red Holstein (42)

Materials & Methods

Classification of cows as metabolically stable or instable

- Questionnaire
- prevalence of important production/metabolic diseases during the cow's life
  - ketosis, milk fever, mastitis, endometritis, cystic ovarian disease, placental retention, displaced abomasum, claw problems

Materials & Methods

Scoring system

Disease	Points
ketosis, milk fever	10
mastitis, endometritis, cystic ovarian disease, placental retention, displaced abomasums, claw problems	2

- Division by number of lactations

Materials & Methods

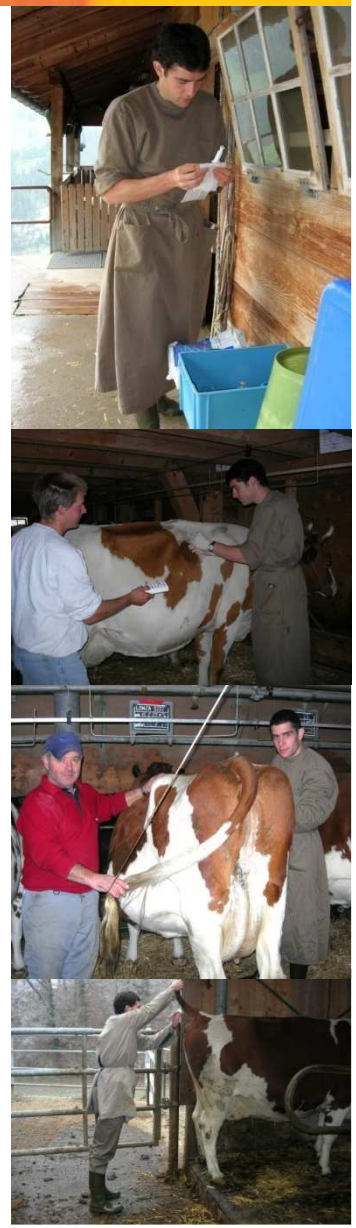
Classification

Group	Criteria	Number of cows
Stable	**≤ 2** points per lactation No occurrence of ketosis or milk fever	154
Instable	**≥ 4** points per lactation Repeated occurrence of ketosis, milk fever, other met. diseases **2 to 4** points per lactation Once ketosis or milk fever Repeated occurence of disorders during 2nd lactation	41

Materials & Methods

Current lactation: data and sample collection

- Blood and liver tissue samples
  - 3 weeks ante partum
  - 4 weeks and 13 weeks post partum

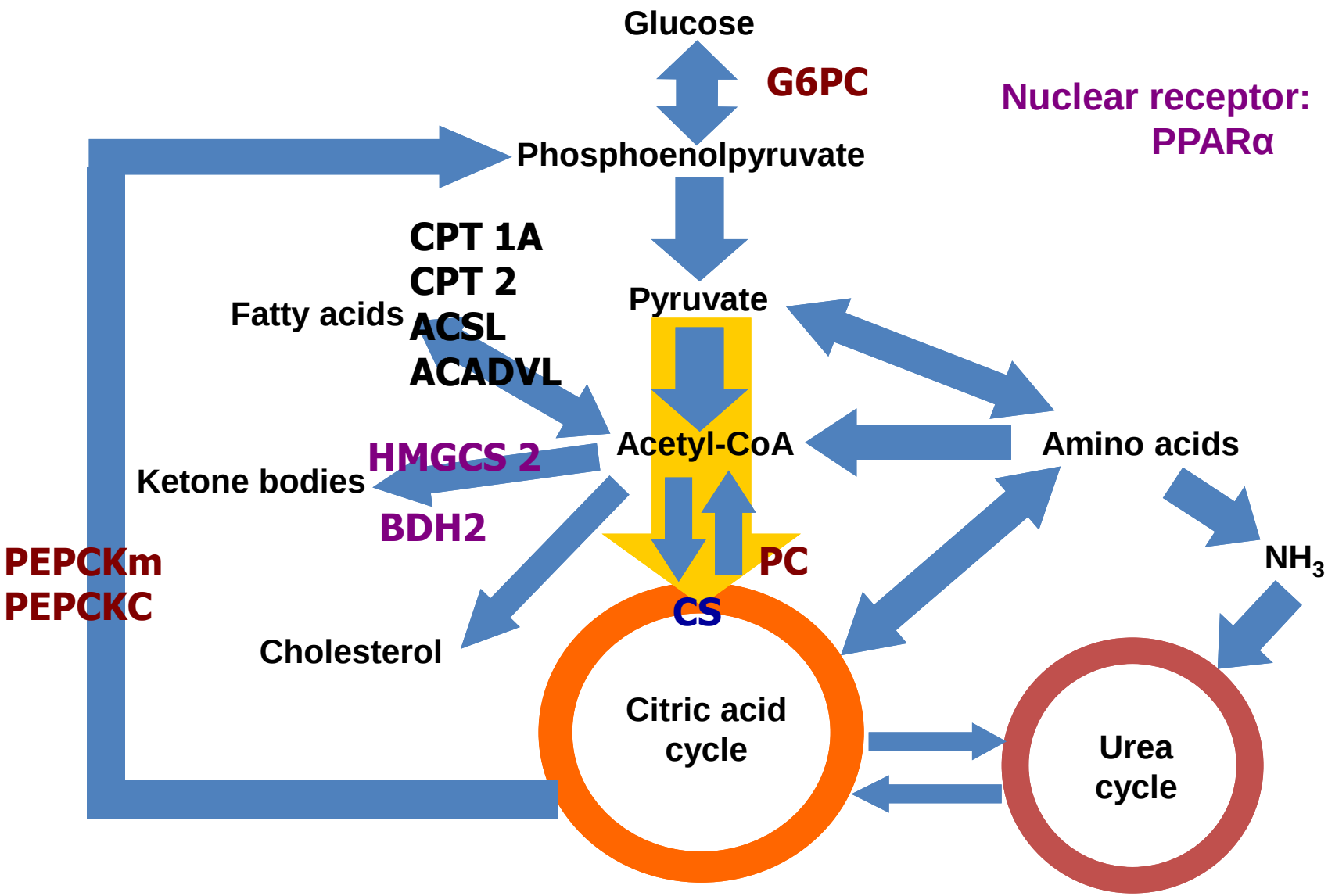


Materials & Methods

- Analysis of metabolites and hormone in blood plasma: *BHBA, NEFA, glucose, urea, triglycerides, cholesterol, protein, albumin, T_3, T_4, insulin, IGF-I*
- Quantitative determination of mRNA expression of hepatic enzymes and receptors by real-time RT-PCR

Roter-Gene™ 6000 (Corbett Research, Sydney, Australia)

Materials & Methods



Materials & Methods

Statistical analysis

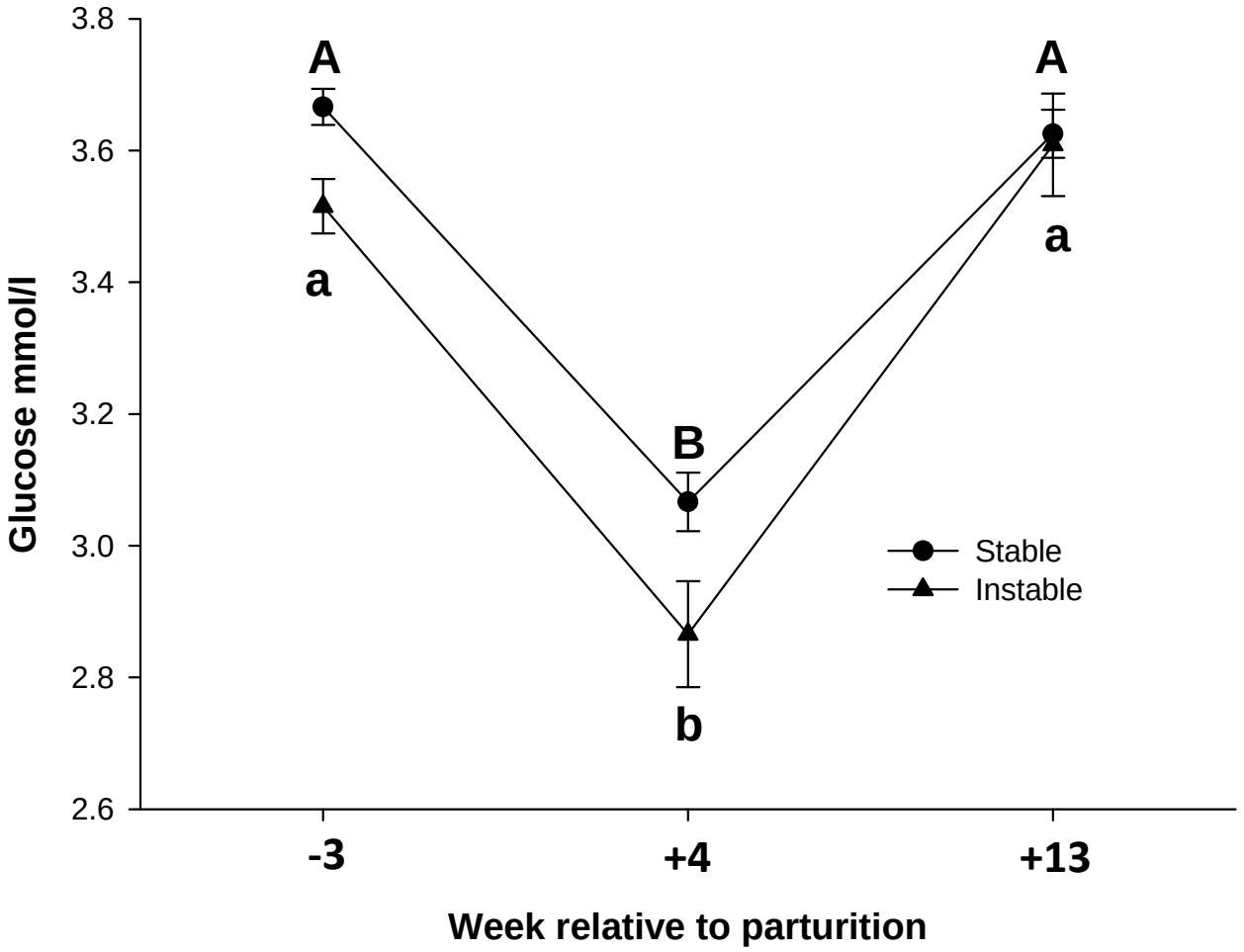
Mixed procedure from SAS including the fixed effects:

- Group:
  - Metabolically stable
  - Metabolically instable
- Time-point:
  - wk 3 a.p.
  - wk 4 and 13 p.p.
- Breed type:
  - Brown Swiss
  - Holstein
  - Red Holstein
  - Simmental x Red Holstein

Results: Milk production

	Metabolic group			
	Stable		Instable	
Variable	**wk 3 p.p.**	**wk 8 p.p.**	**wk 3 p.p.**	**wk 8 p.p.**
milk (kg/d)	35.1 ± 0.5	35.1 ± 0.6	35.3 ± 0.9	34.2 ± 1.1
fat %	4.7 ± 0.1	4.3 ± 0.1	4.5 ± 0.1	4.2 ± 0.1
fat/protein ratio	1.4 ± 0.02	1.4 ± 0.03	1.4 ± 0.04	1.4 ± 0.04

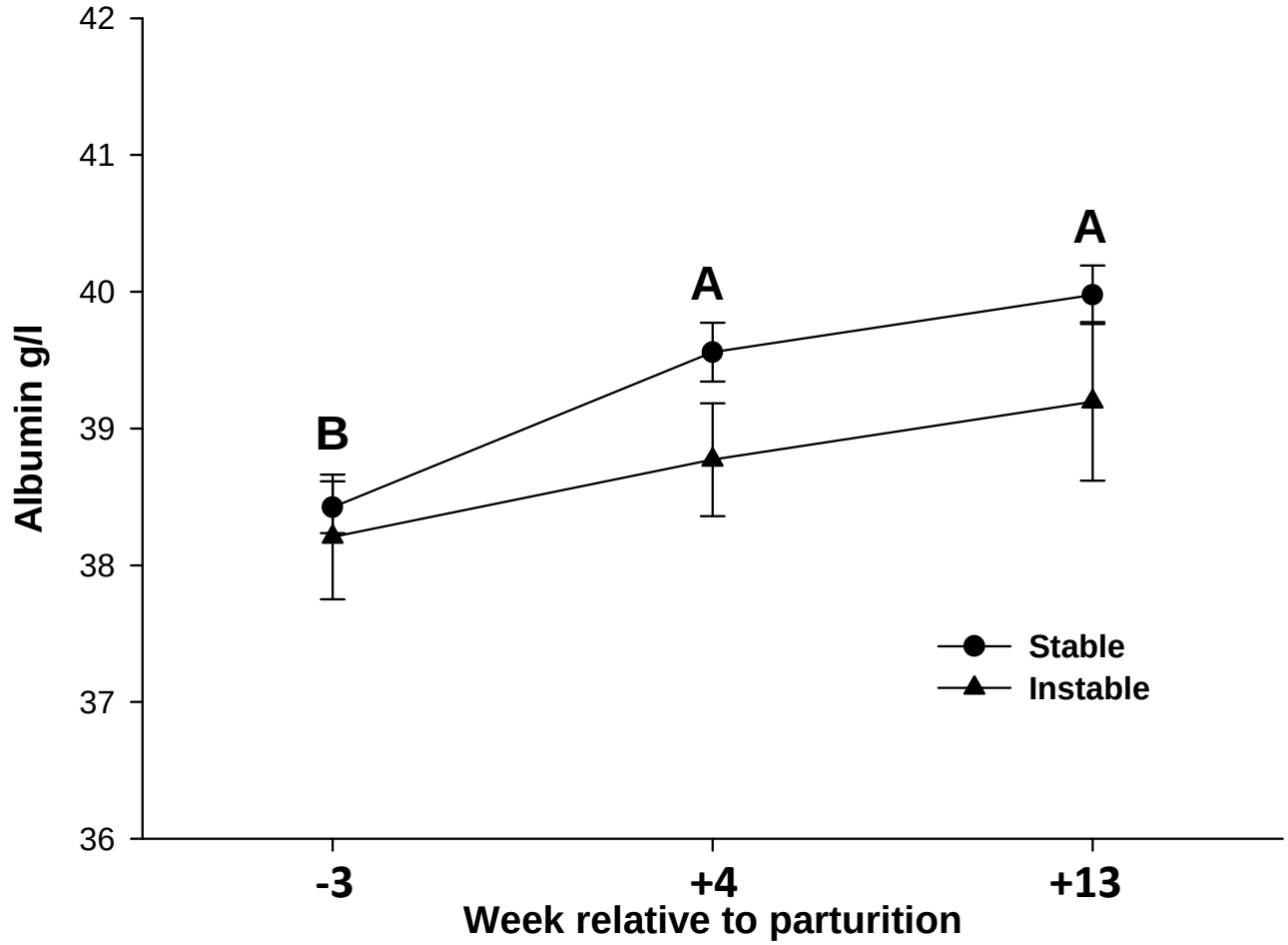
Results: Glucose



***P*-values:**

Time:	**< 0.01**
Group:	**0.03**
Breed:	**0.05**
Time x Groups:	**0.24**

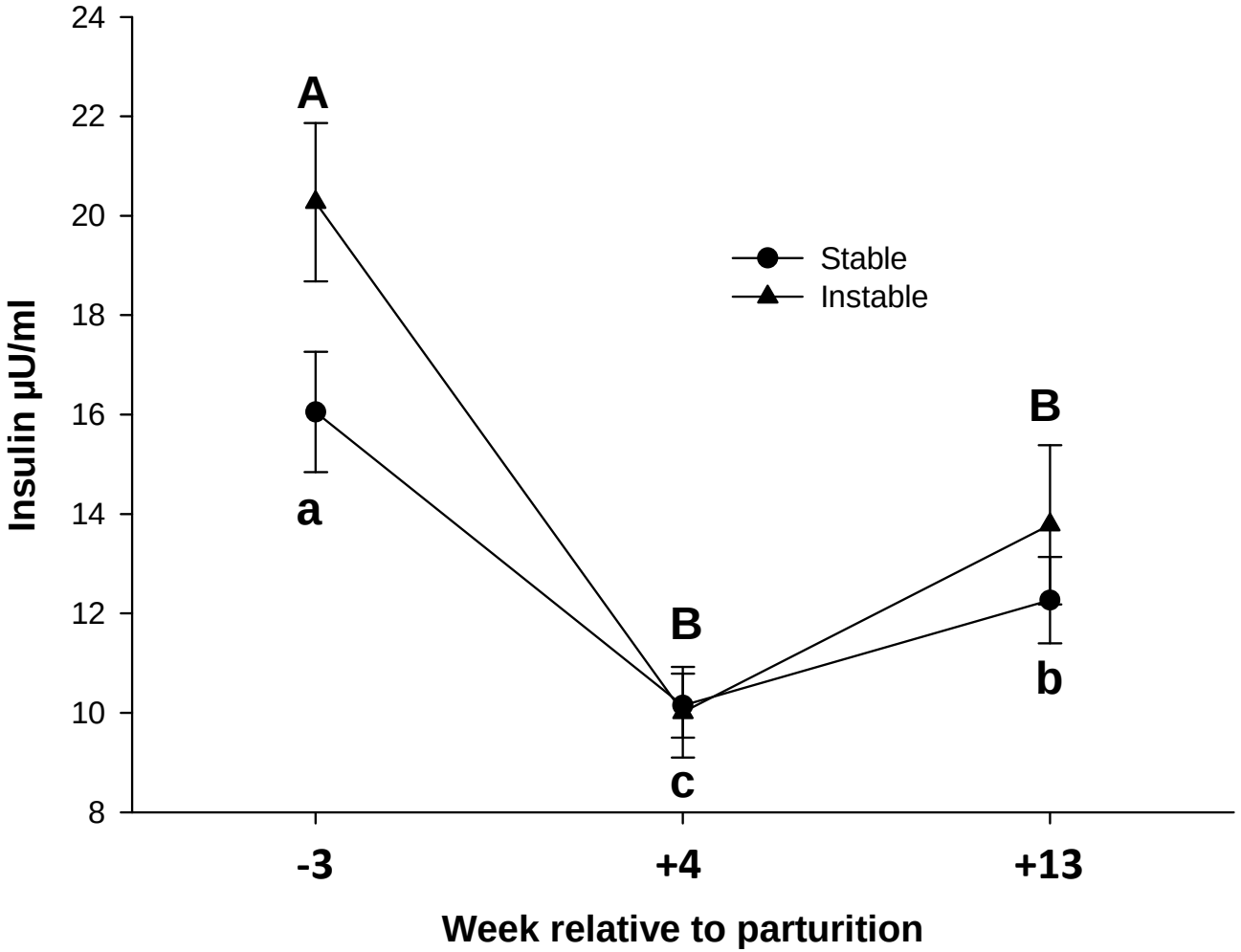
Results: Albumin



***P*-values:**

Time:	**<0.01**
Group:	**0.06**
Breed:	**0.01**
Time x Groups:	**0.63**

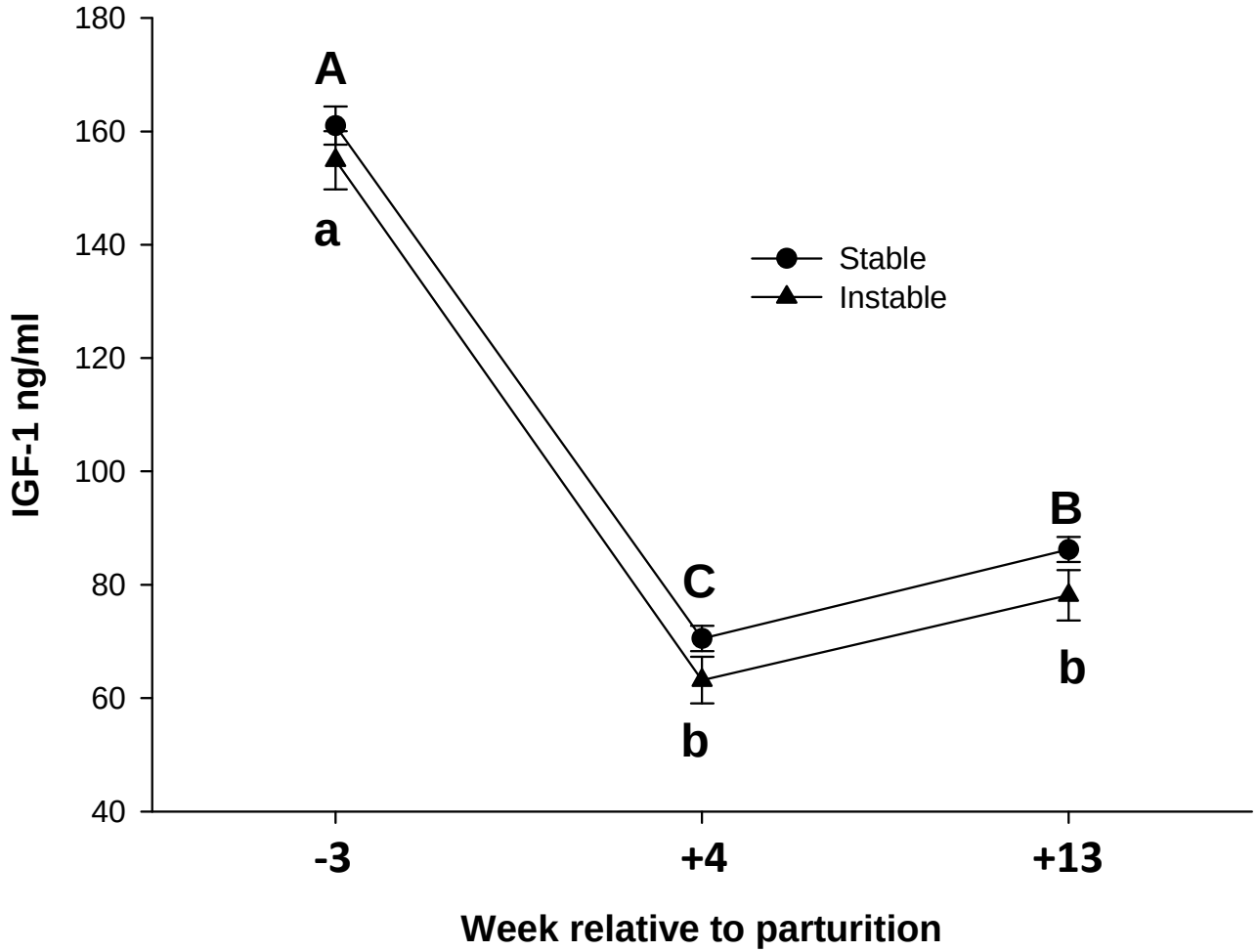
Results: Insulin



***P*-values:**

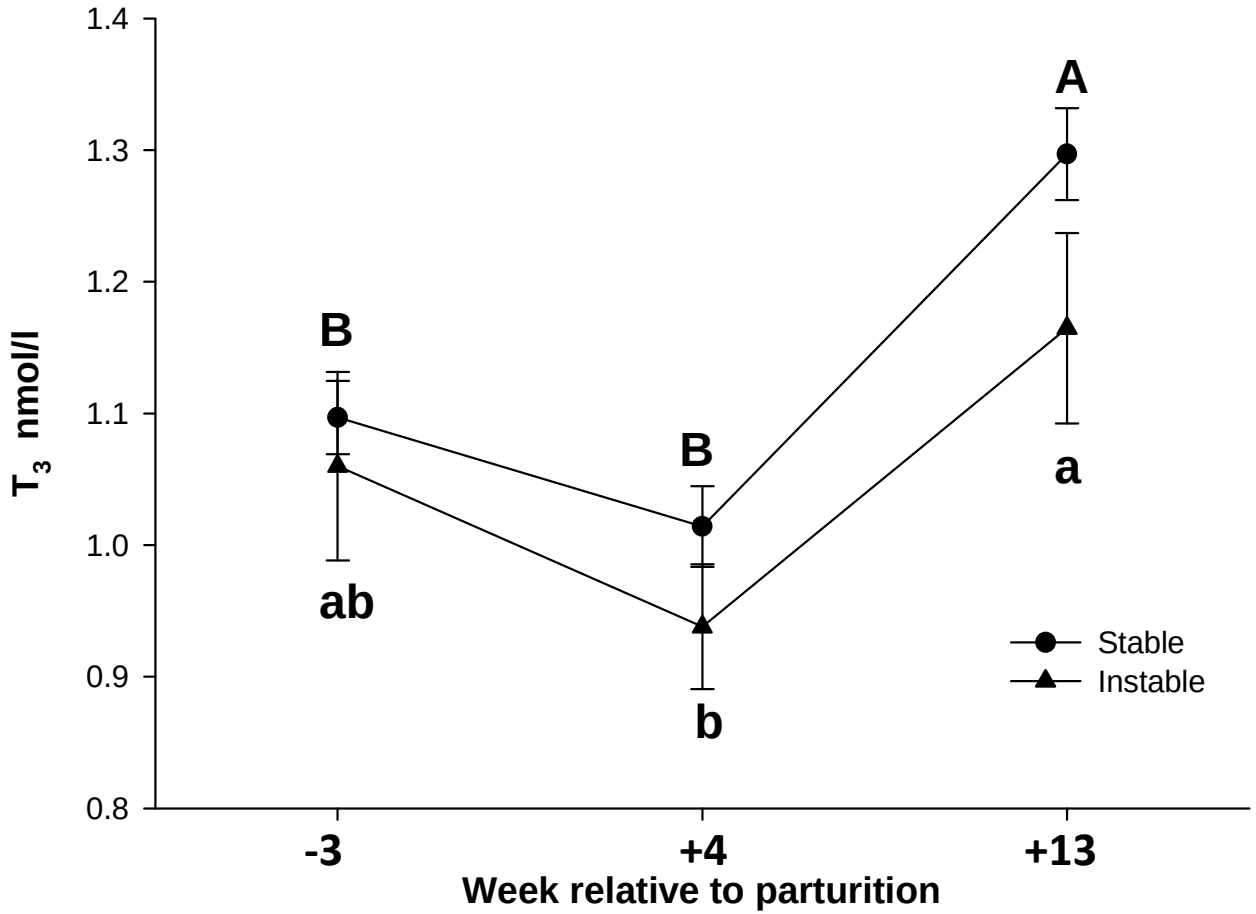
Time:	**< 0.01**
Groups:	**0.07**
Breed:	**0.59**
Time x Groups:	**0.28**

Results: IGF-1



P-values:	
Time:	< 0.01
Groups:	0.06
Breed:	0.12
Time x Groups:	0.98

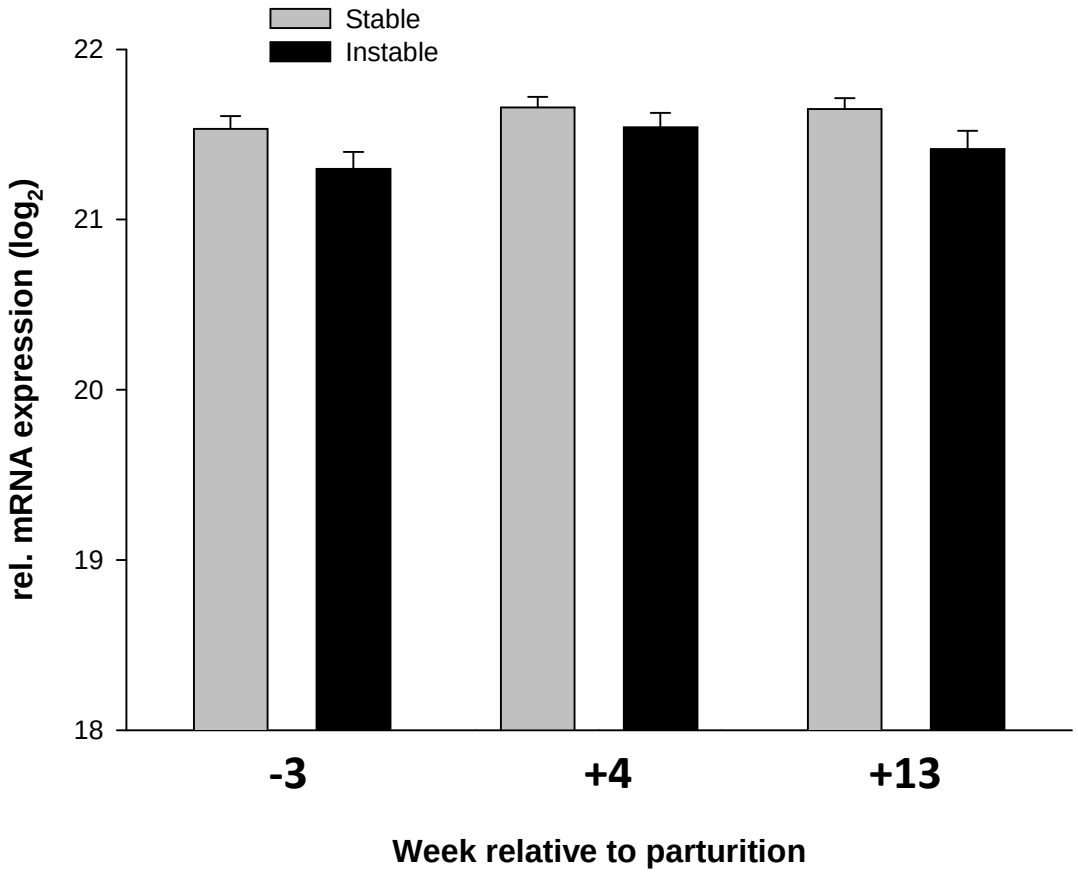
Results: T_3



***P*-values:**

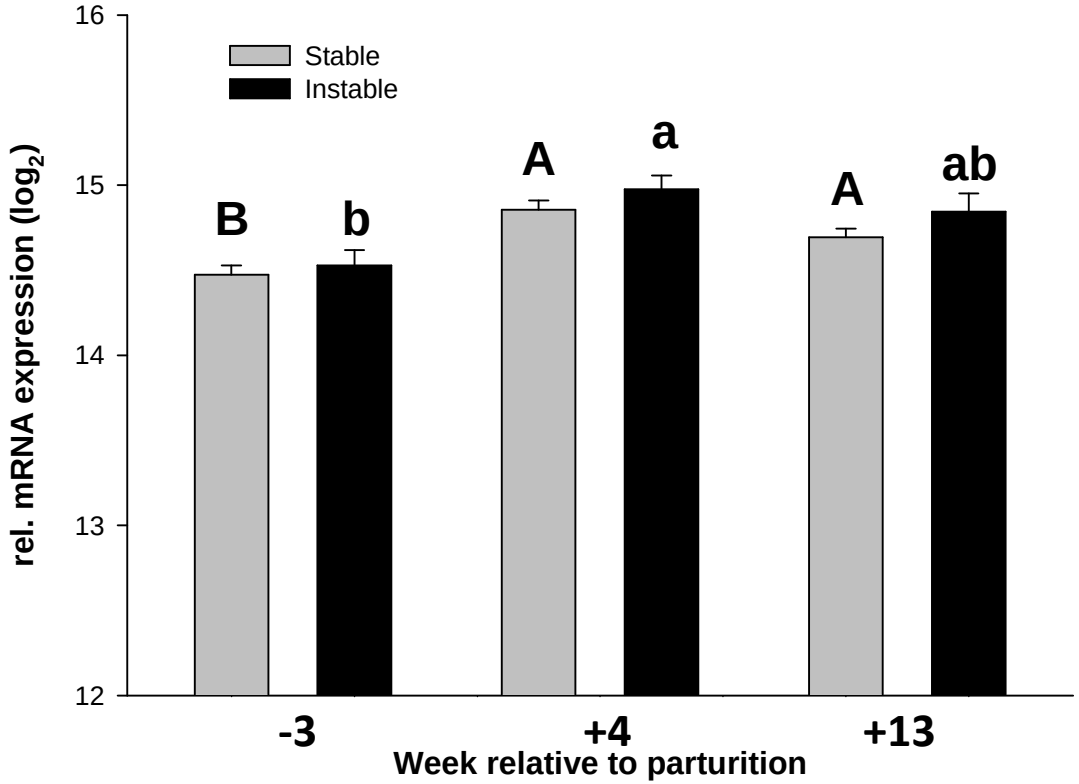
Time:	**< 0.01**
Groups:	**0.06**
Breed:	**< 0.01**
Time x Groups:	**0.66**

Results: HMGCS2



P-values:	
Time:	0.20
Groups:	0.02
Breed:	0.41
Time x Groups:	0.80

Results: CPT1A



***P*-values:**

Time:	**< 0.01**
Groups:	**0.04**
Breed:	**< 0.01**
Time x Groups:	**0.85**

Conclusion

- Grouping of cows according to past health status revealed differences in blood parameters and hepatic factors
- Milk production level did not seem to be related with metabolic instability
- Results suggest the presence of a genetic component underlying metabolism that in part determines the incidence of disorders

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Thank you for your attention!