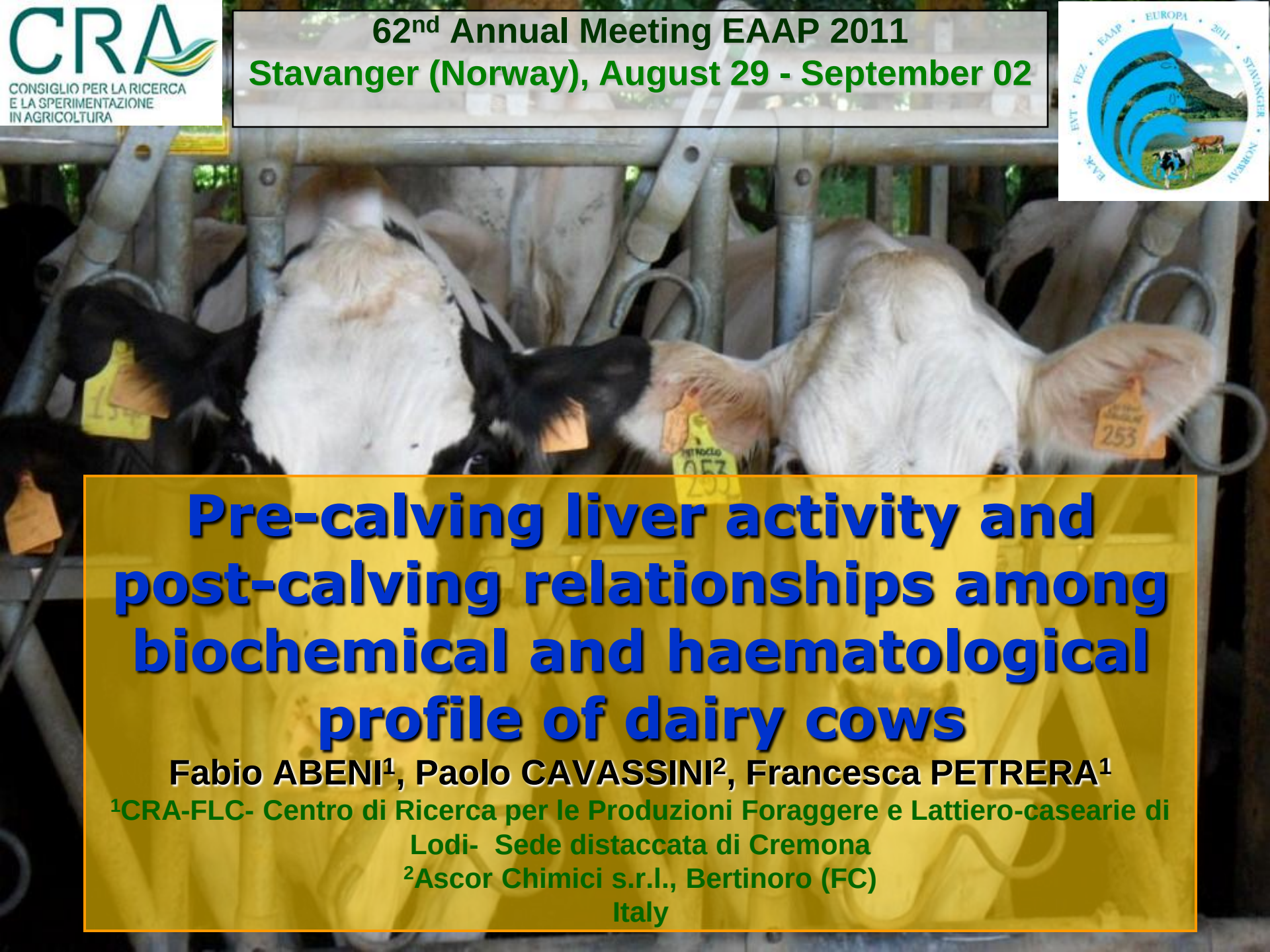
62nd Annual Meeting EAAP 2011
Stavanger (Norway), August 29 - September 02



Pre-calving liver activity and post-calving relationships among biochemical and haematological profile of dairy cows

Fabio ABENI[1], Paolo CAVASSINI[2], Francesca PETRERA[1]

[1]CRA-FLC- Centro di Ricerca per le Produzioni Foraggere e Lattiero-casearie di Lodi- Sede distaccata di Cremona

[2]Ascor Chimici s.r.l., Bertinoro (FC)

Italy

INTRODUCTION

Peripartum period of dairy cows

Metabolic **stress** and neuroendocrine **changes** (pregnancy, calving, and lactation)

Normal parturition → inflammatory-like conditions (Cappa *et al*., 1989)

⇓

Innate and **acquired** immune systems generally **depressed** (changes in WBC counts, ↓ chemotactic response, ↓ NEU and LYM function, impaired migration to the site of infection and phagocytosis)

⇓

❑ **Peripartum leukogram** (Meglia *et al*., 2005)

- Neutrophilia
- Lymphopenia
- Eosinopenia
- Monocytosis

⇒ **Stress leukogram** (Holtenius *et al*., 2004)

INTRODUCTION

Attempts to prevent problems and diagnosticate susceptible cows

To consider ⇒ **effort** required for analysis (n° of samples) and earliest possible **time** of analysis (Hachenberg *et al*., 2007)

NEFA: 1 wk postpartum (Hachenberg *et al*., 2007) ⇒ do we have sufficient time to prevent complications?

New markers ⇒ paraoxonase (**PON**, Bionaz *et al*., 2006), well related to liver function in transition cows, but more references will be necessary

Liver Activity Index (**LAI**, Trevisi *et al*., 2001) ⇒ generally considered after calving, well related to pre-calving liver activity

---

Aim: to evaluate the effect of a combined index of pre-calving liver activity (PLA) on post-calving biochemical and haematological profiles

MATERIAL & METHODS

Farm: Porcellasco (CRA-FLC, Cremona), 45° 10' N 10° 04' E 44 m asl

Animals: N = 22 pluriparous cows (Italian Friesian)

- 2 groups: 1 unsupplemented (CON); 1 supplemented with rumen protected choline (RPC; 50 g of commercial product, 50% choline as choline chloride)
- this paper discusses only results where PLA did not interact with RPC

Measurements and sampling:

Blood samples (5 mL, K_3EDTA; 10 mL, Li-heparin) from jugular vein, just before feed distribution (06.00 a.m.), from -4 to +5 wk around calving

Body condition score (BCS): weekly (Edmonson *et al*., 1989)

Milk production: daily, automated milking system (De Laval VMS, De Laval, Tumba, Sweden)

Milk composition: every 2 wk

MATERIAL & METHODS

Blood analyses: *Haematological measurements*

Automated analyser (Abbott Cell-Dyn 3700, Abbott Diagnostici, Italy)

WBC	NEU	LYM	MON	EOS	BAS
	NEU%	LYM%	MON%	EOS%	BAS%
RBC	HGB	HCT	MCV	MCH	MCHC
RDW		PLT	MPV	PCT	PDW

Blood analyses: *Metabolic profile (plasma)*

Clinical analyzer (ILAB 650 System, Instrumentation Laboratory, Lexington, MA, USA)

Glucose, total cholesterol, triglycerides, total protein, albumin, (globulins), urea, Ca, iP, Mg: (IL Test™ Kit reagent, Instrumentation Laboratory, Lexington, MA, USA)

NEFA: enzymatic-colorimetric test (NEFA C-Test Wako, Wako Chemicals GmbH, Germany)

BHB: kinetic enzymatic method (Ranbut D-3-hydroxibutyrate, Randox Laboratories, Ltd, UK)

Activities of ALT, AST, γ-GT: kinetic analysis using commercial kits

(IL TestTM Kit reagent, Instrumentation Laboratory, Lexington, MA, USA)

MATERIAL & METHODS

Milk composition

Fat, protein: Fourier-transform IR analyzer (Milkoscan FT 6000, Foss Electric, DK)

Somatic cell count (SCC): flow cytometry (Fossomatic 5000, Foss Electric, DK)

Calculations and Statistical Analysis

Energy-Corrected Milk (ECM) calculated according to Smith *et al*. (2002)

ECM = (0.3246 × kg of milk) + (12.86 × kg of fat) + (7.04 × kg of protein)

Test for normal distribution of variables; if not, Log_{10} transformed

Cows stratification according to PLA (4 wk before expected calving date), derived and modified from the LAI of Trevisi *et al*. (2001):

PLA = [plasma albumin (SD units) + plasma total cholesterol (SD units)]/2

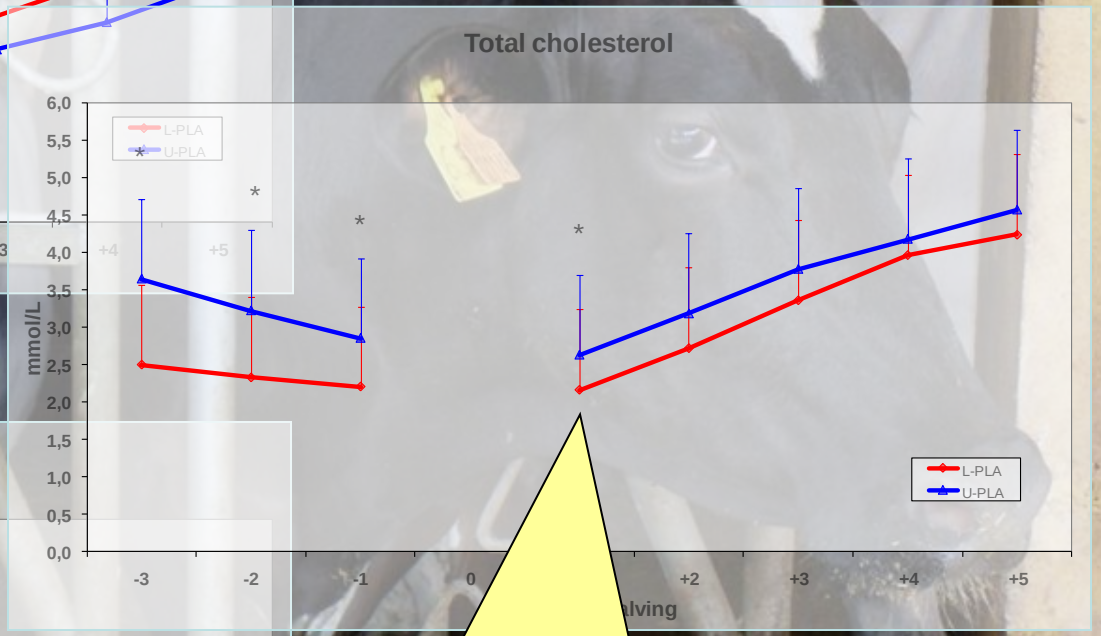
ANOVA (PROC MIXED), separately for pre- and post-partum data

FIXED EFFECTS: PLA index (L-PLA, U-PLA)**, diet supplementation, Time** (wk from calving) and all their interactions

COVARIANCE STRUCTURE for each variable according to AIC

RESULTS presented as **LSM ± SEM**; **DIFFERENCES**: significant if $P \leq 0.05$; a trend if $0.05 < P < 0.10$

RESULTS - 1



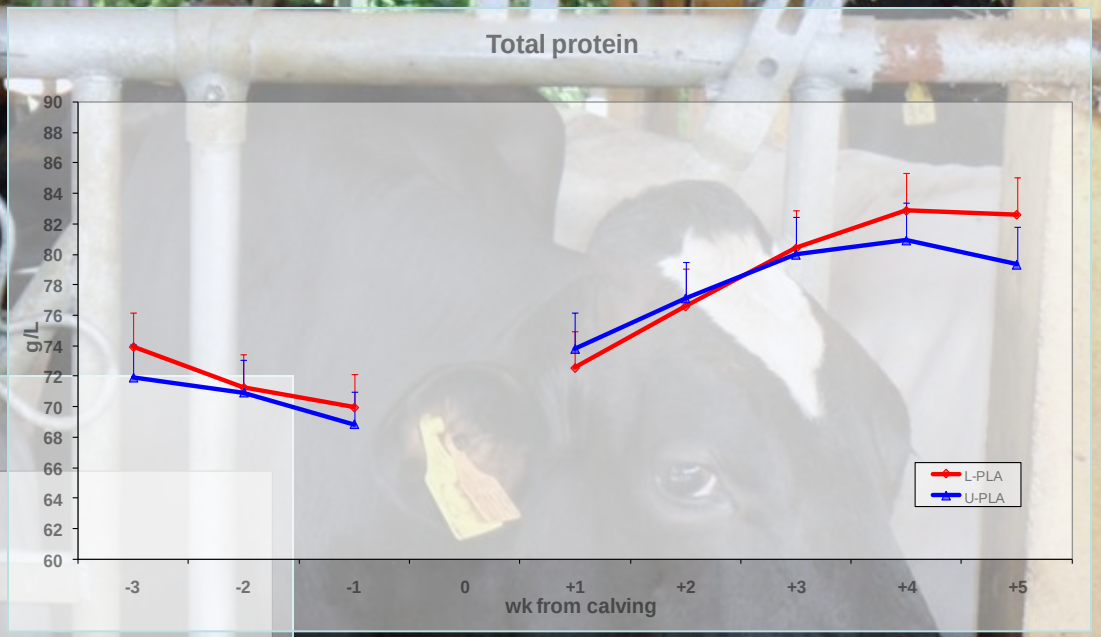
PLA parameters

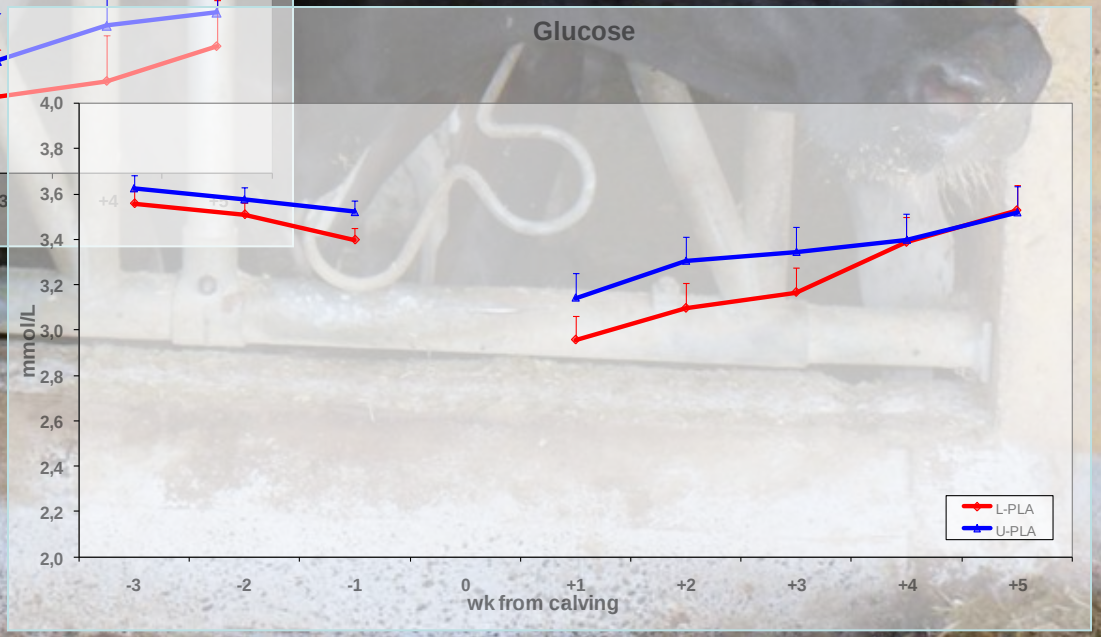
Plasma cholesterol after calving is consistent with that at the beginning of transition

1st wk U-PLA > L-PLA

AST: n.s., but …?

RESULTS - 2

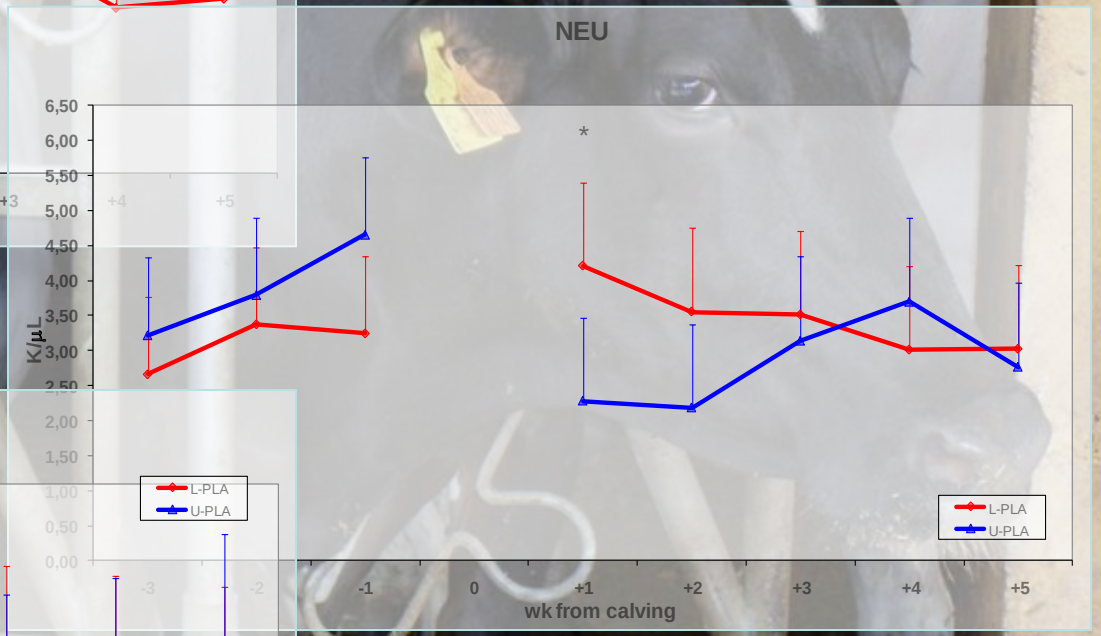




No difference in plasma total protein, urea, glucose, NEFA and BHB

No difference in BCS

RESULTS - 3



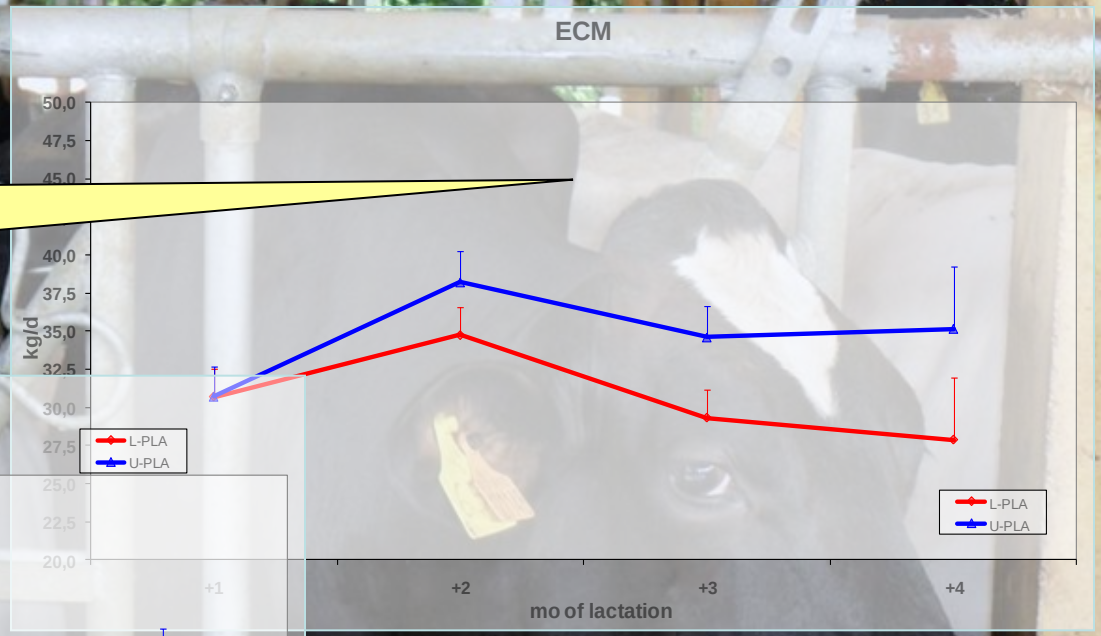
U-PLA cows exhibited slower decline in **MCV** after calving

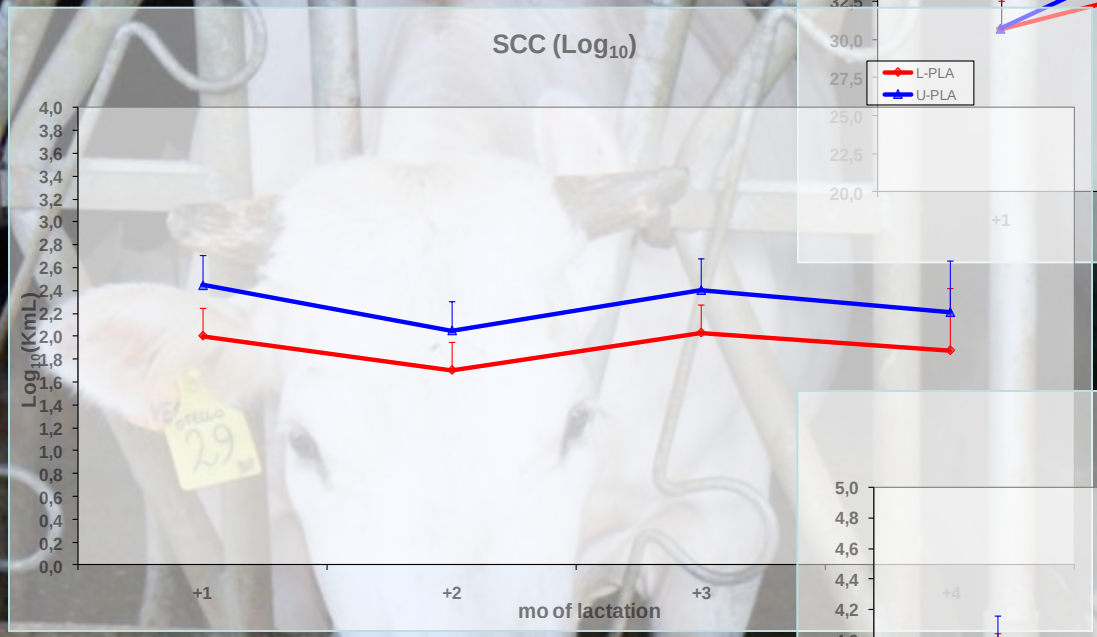
RESULTS - 4

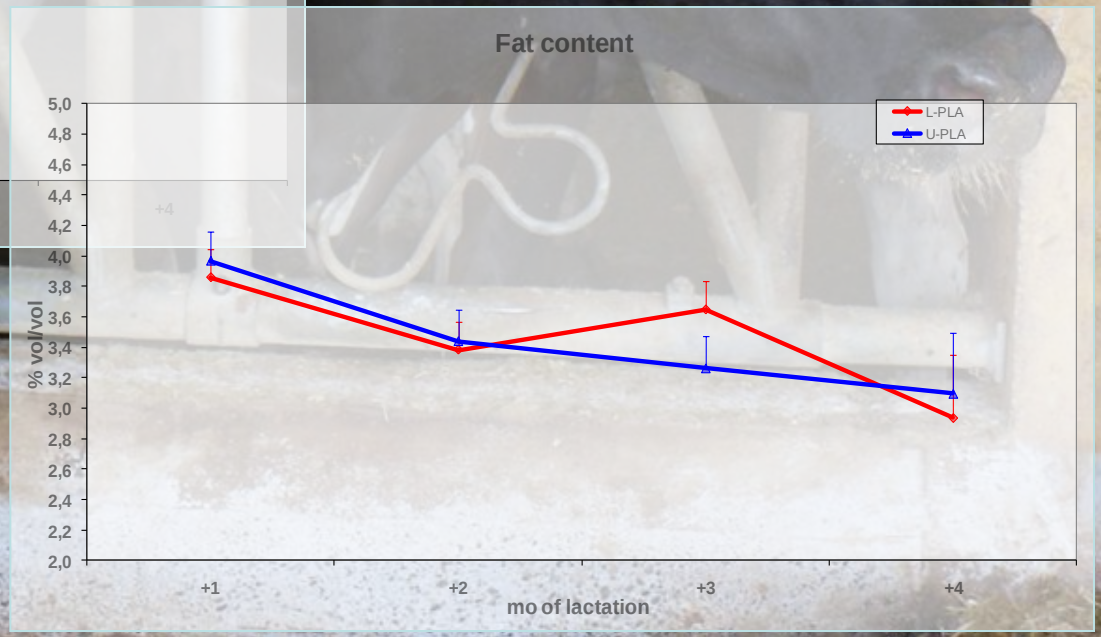
ECM

First 4 mo

U-PLA 34.67 vs. L-PLA 30.65 kg/d ($P < 0.05$)







RESULTS - 5

Correlations among metabolic profile and haematological features

1 wk postpartum

- ✓ plasma BHB – WBC (r=0.48, *P*=0.02)
- ✓ plasma BHB – NEU (r=0.57, *P*=0.006)
- ✓ plasma BHB – LYM % of WBC (r=-0.66, *P*<0.001)

DISCUSSION

A better PLA led to a better plasma cholesterol around calving

$\rightarrow$ Agrees with best periparturient performance as $\Uparrow$ plasma cholesterol, albumin, and urea postpartum (Bertoni *et al*., 2006)

Plasma [total cholesterol] $\rightarrow$ inverse correlation with total lipids in liver at days 3 and 8 postpartum $\Rightarrow$ beneficial role of high cholesterol in the prevention of fatty liver (Ametaj *et al*., 2005)

$\Rightarrow$ higher plasma cholesterol at -4 wk was confirmed in postpartum for cows with no fatty liver (Ametaj *et al*., 2005)

PLA $\rightarrow$ postpartum AST?

Marked plasma decrease of –APP [albumin, lipoproteins-cholesterol] was not associated with liver damage (AST and γ-GT) (Bertoni *et al*., 2008)

DISCUSSION

Pre-partum liver activity ⇒ improved haematological profile?

Pre-calving plasma [albumin] and [cholesterol] were already higher in High LAI than Medium and Low - No significant differences in haematological profile (Trevisi *et al*., 2010)

Plasma [albumin] and [total cholesterol] were greater during peripartum for cows without new IMI (Rezamand *et al*., 2007)

⇑ WBC and NEU (segmented) 15-6 d prepartum → 6-24 h postpartum in cows with > 40 mg TAG/g liver, not in cows with < 40 mg TAG/g liver (Zerbe *et al*., 2000)

BHB correlations with haematological profile 1 wk postpartum

⇒ Confirm the effects on NEU and LYM that are mirrored by their count in blood

CONCLUSION

Prepartum "marker" of liver activity (PLA) related with:

- **postpartum plasma cholesterol**
- **lactation performance in the first 4 mo**
- **WBC and NEU counts in 1st wk after calving not mirrored in milk SCC or clinical mastitis differences**

No significant outcome on:

- **postpartum NEFA and BHB**

⇒ Possible "roots" in liver condition at dry-off, with a cascade of effects in the relationships between metabolism and inflammation condition at calving and beginning of lactation

These results suggest further efforts to better understand the relationships between liver activity and cow ability to cope with inflammatory conditions just after calving

Thanks ….

…for your attention!