RELATIONSHIP BETWEEN METABOLIC PROFILES AND OVARIAN FOLLICULAR FUNCTION IN DAIRY COWS

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INTRODUCTION

Feed intake ▼

Energy demand ▲

→ **NEB**

Uterine involution
Return to ovarian cyclicity

INTRODUCTION

Feed intake ▼

Energy demand ▲

→ **NEB** →

Uterine involution
Return to ovarian cyclicity

(Butler and Smith 1989)

First ovulation postpartum

Double ovulation?
Follicular cyst?

NEB

▼ Glucose

VFA → Glucose

(Volatile fatty acids)

most synthesized by the liver

(Reynolds et al., 1988).

After parturition

- decrease in insulin production by the pancreas

↓

decreased glucose utilization by insulin sensitive organs (adipose tissue and muscle).

- transient state of insulin resistance

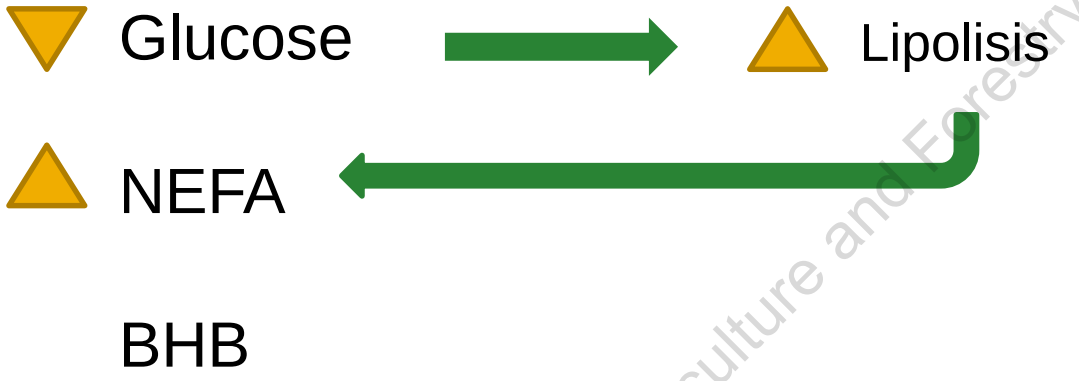
↓

allow the mammary gland to have additional glucose for milk production

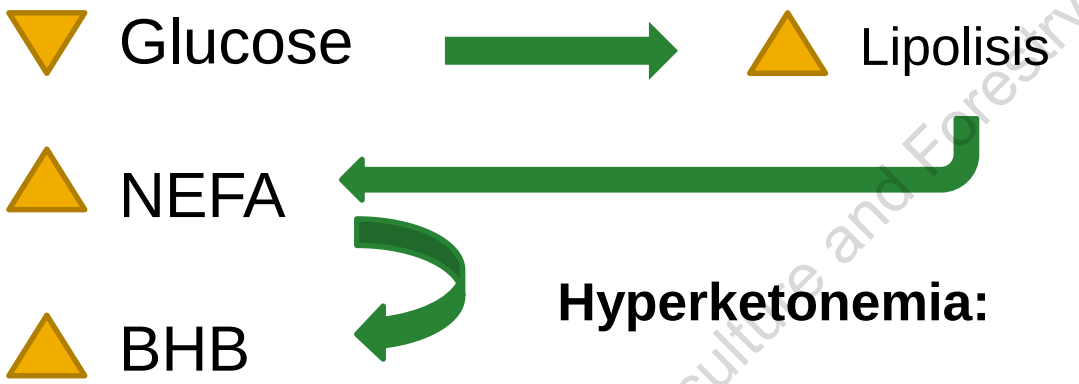
(McArtc et al. 2013)

alternative FUEL SOURCES are needed

NEB



NEB



Hyperketonemia:

- Decreased in appetite
- Weight loss
- Impaired immune function (Hammond et al. 2016)
- Decreased milk production (Duffield et al., 2009)
- Negative health events

NEB

- ▼ Glucose
- ▲ NEFA
- ▲ BHB
- Insulin
- IGF-1

During gestation ▲ Insulin, IGF-I

After parturition ▼ Insulin, IGF-I

(Taylor et al. 2003)

NEB

- ▼ Glucose
- ▲ NEFA
- ▲ BHB
- ▼ Insulin
- ▼ IGF-1

Involved in first ovulation pp

- Stimulate oestradiol-17b (E2) production in the granulosa
- Proliferation of follicular cells
- Dominant follicle maturation

NEB

- ▼ Glucose
- ▲ NEFA
- ▲ BHB
- ▼ Insulin
- ▼ IGF-1

Involved in first ovulation pp

Predictors / Markers of ovarian dysfunction?

Primiparous vs Multiparous ?

(Meikle et al. 2004)

OBJECTIVE

To examine the relationship between plasma Glucose, NEFA, BHB, Insulin, and IGF-1 during transition period and ovarian follicular function in dairy cows of first, second and third or more lactations.

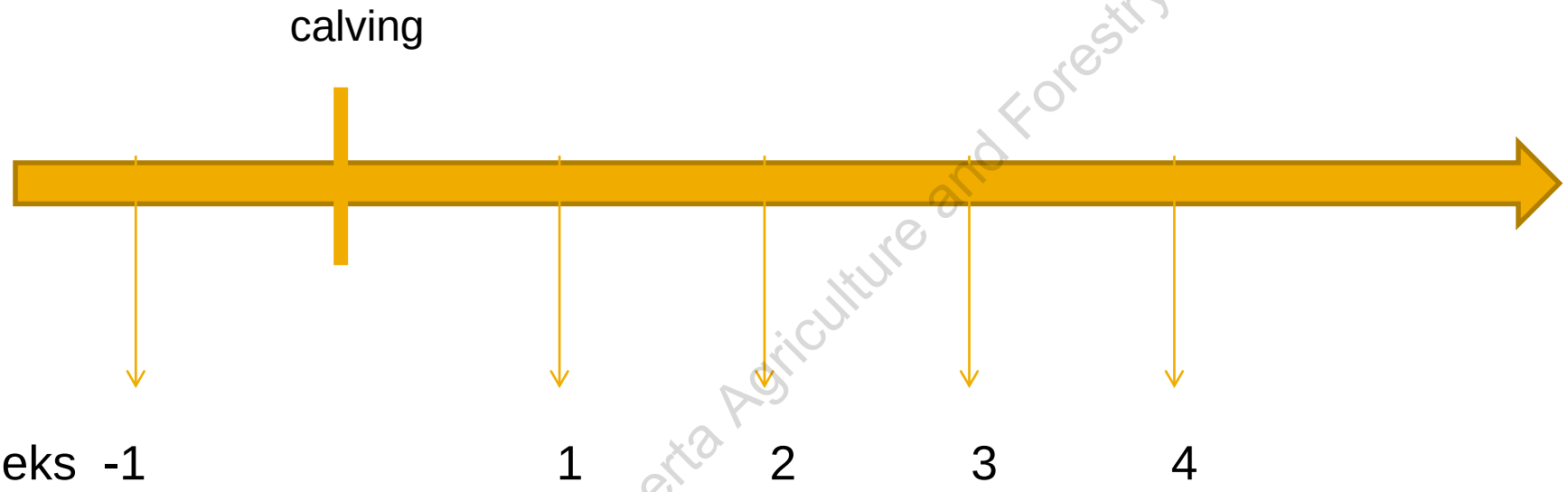
MATERIAL AND METHODS

Dairy Research and Technology Centre (DRTC)

169 Holstein from 3 studies in the same herd

Colazo et al., 2009
Dyck et al., 2011
Subramaniyam et al., 2016

Blood Sampling



Determination of:
- Glucose
- Non-esterified fatty acids (NEFA)
- Insulin (INS)
- Insulin-like growth factor-1 (IGF-1).
- β-hydroxybutyrate (BHB) (n=109 cows)

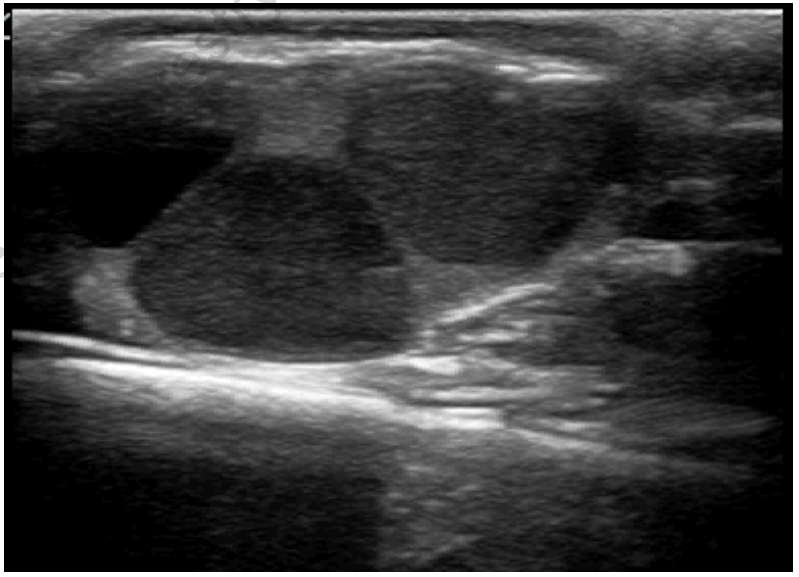
Plasma
Store in –20 ºC until analyses

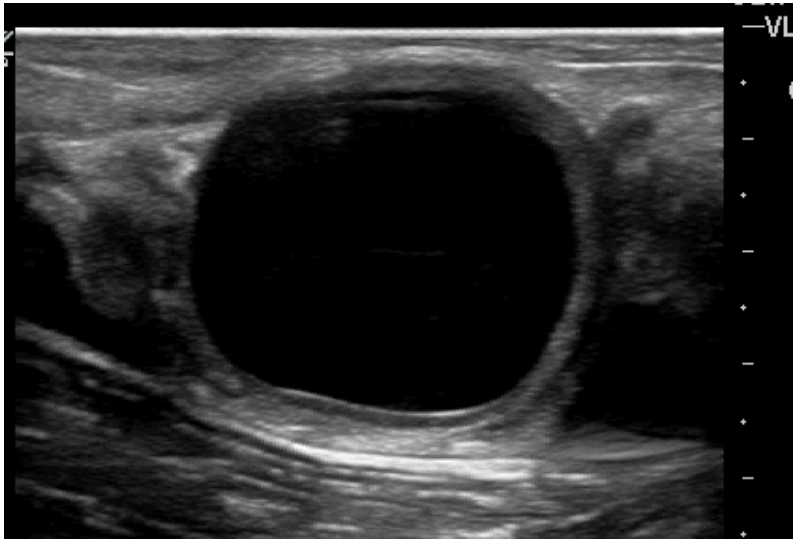
Ultrasound examination

Twice weekly from week 1 to 8 postpartum

Ovarian structures were recorded to determine:

- Calving- first ovulation
- First double ovulation (DOV)
- Follicular cyst (FC)
  (follicle ≤ 25 mm without CL)





Statistical analyses

Time-series data analyzed by repeated measures
PROC MIXED

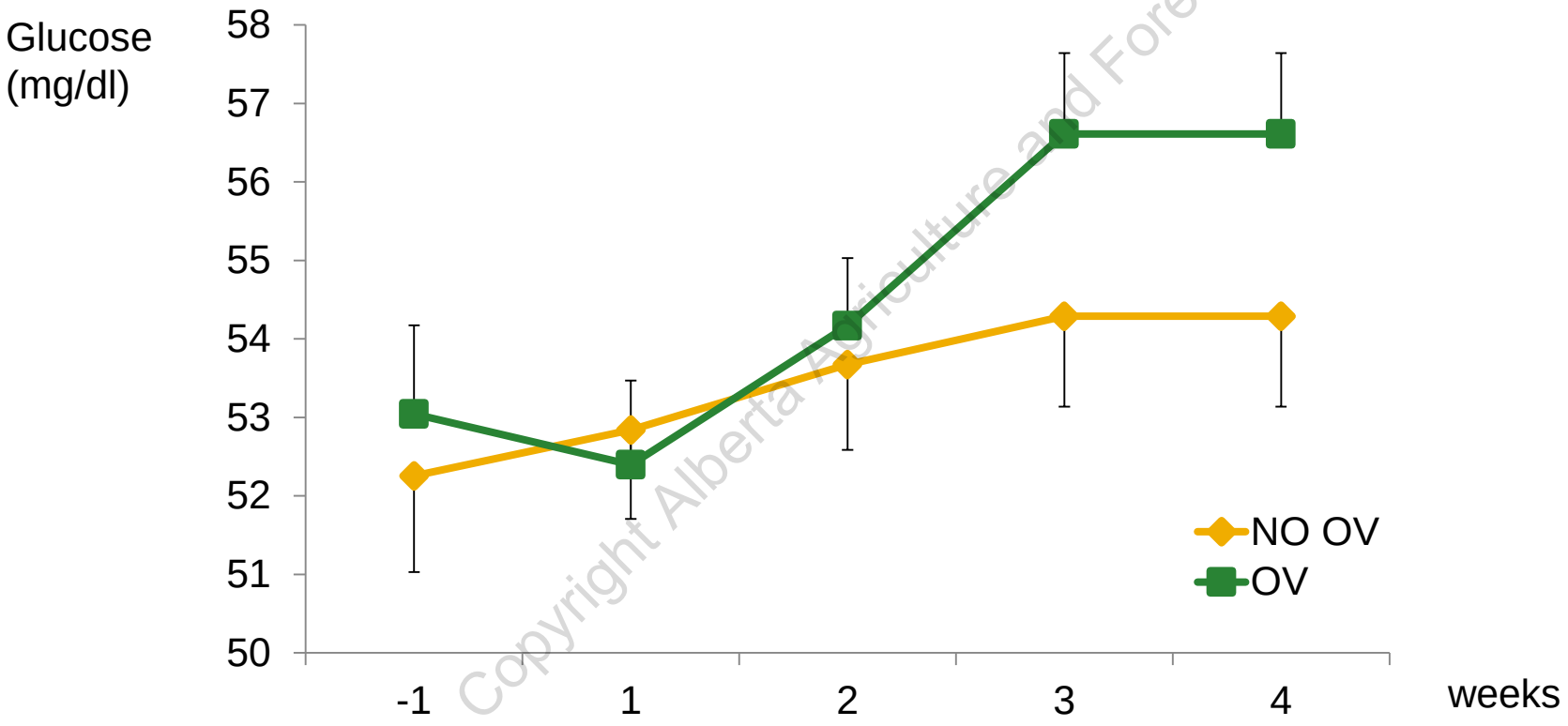
- Dependent variables→
  - GLU
  - NEFA
  - INS
  - IGF-1
  - BHB
- Independent variables →
  - ovulatory status (OV; ovulation < w 5 pp)
  - DOV
  - FC

To account for effects of parity
- primipara
- secundipara
- multipara (≥3rd parturition).

RESULTS AND DISCUSSION

GLUCOSE

No association with lactation



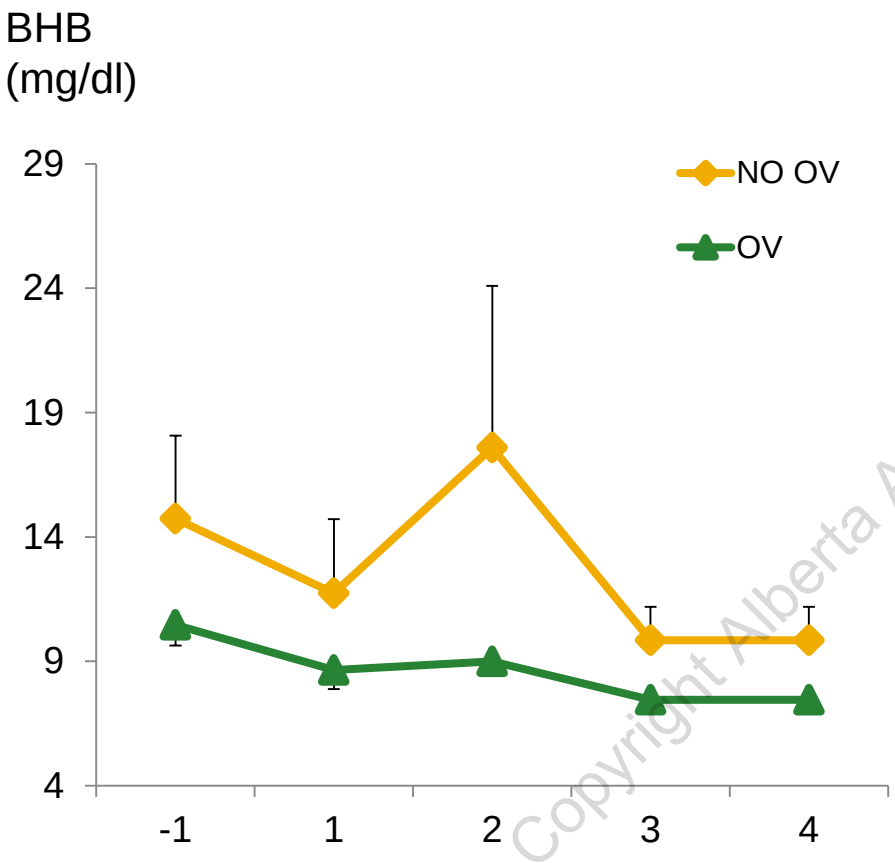
Greater GLU concentrations were associated with sooner resumption of ovarian activity

(Krause et al., 2014)

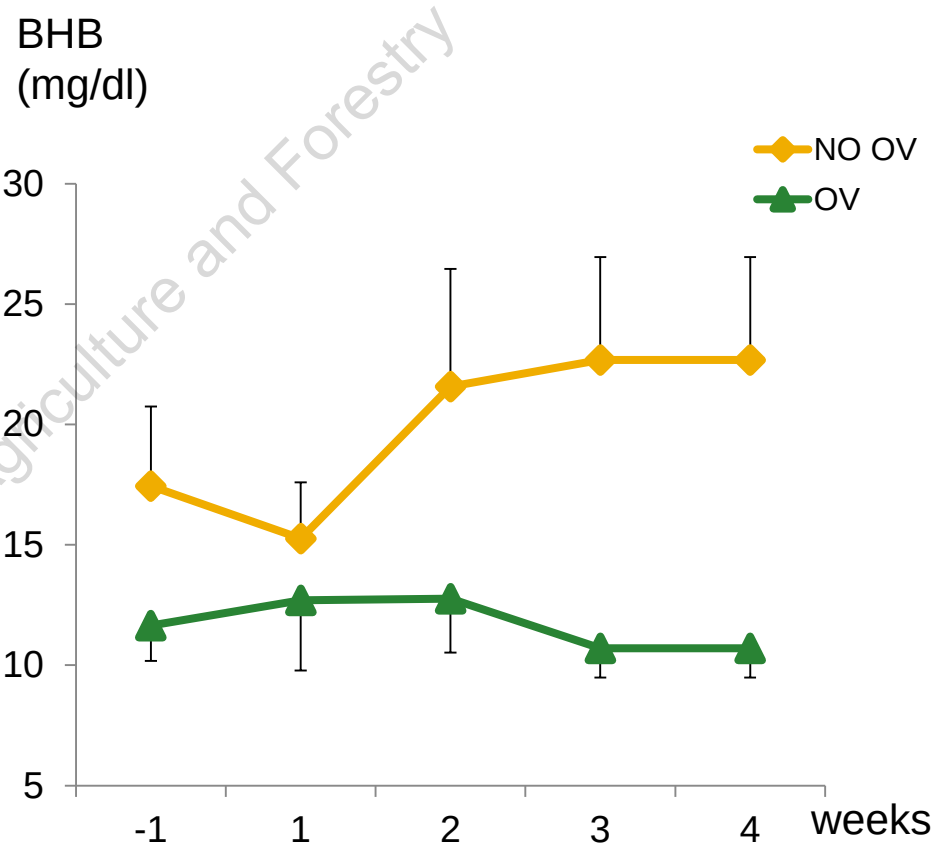
Also tendency to higher incidence of FC

BHB

Primiparous cows



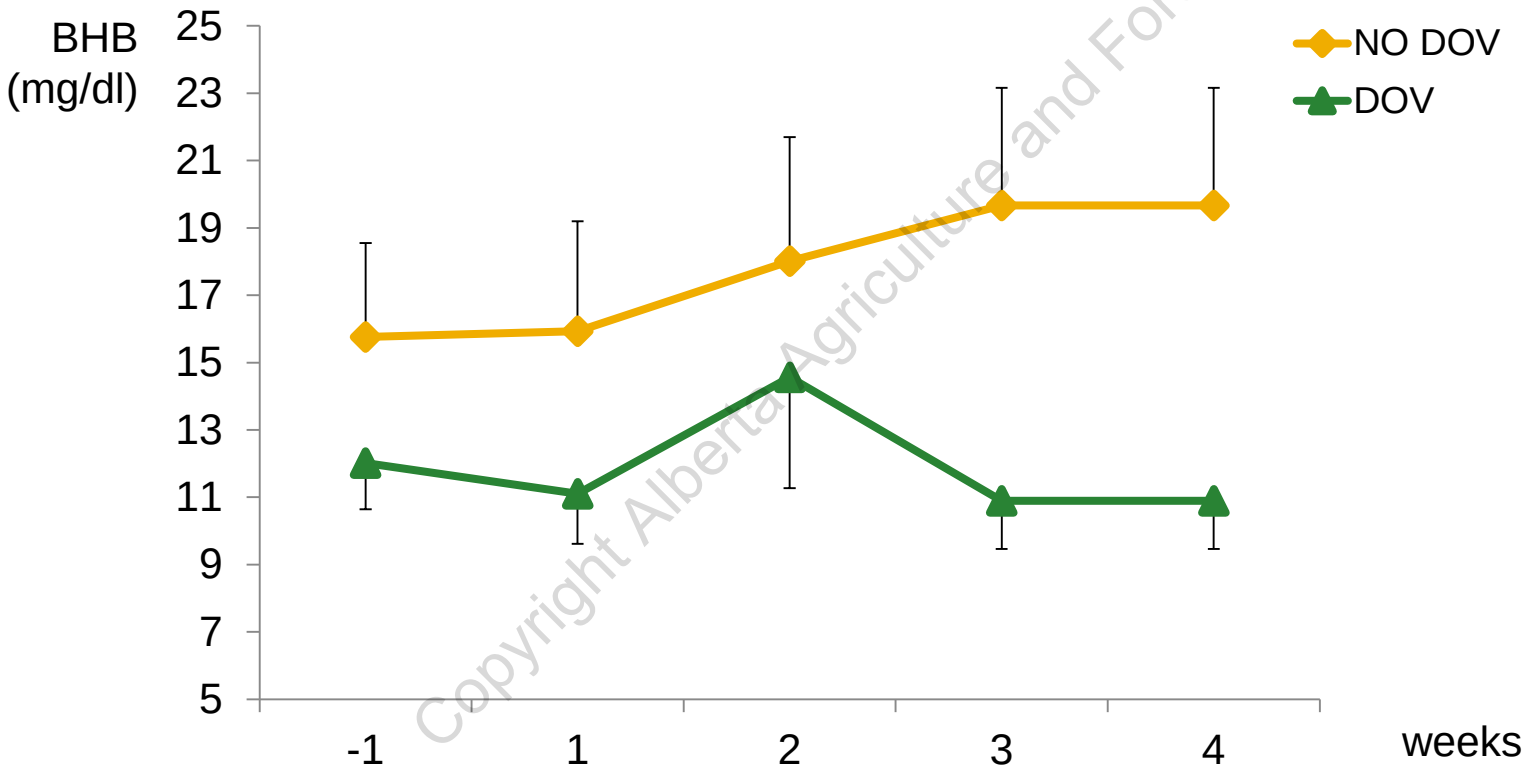
Multiparous cows



Lower BHB concentrations were associated with sooner resumption of ovarian activity in primiparous and multiparous cows

BHB

Multiparous cows

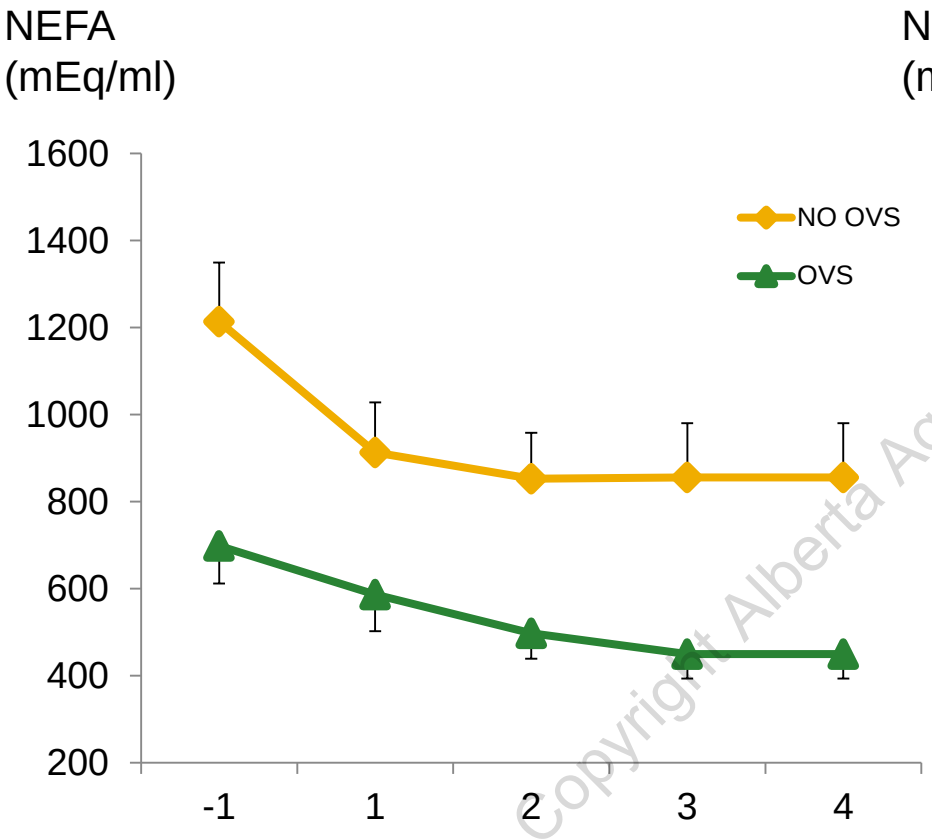


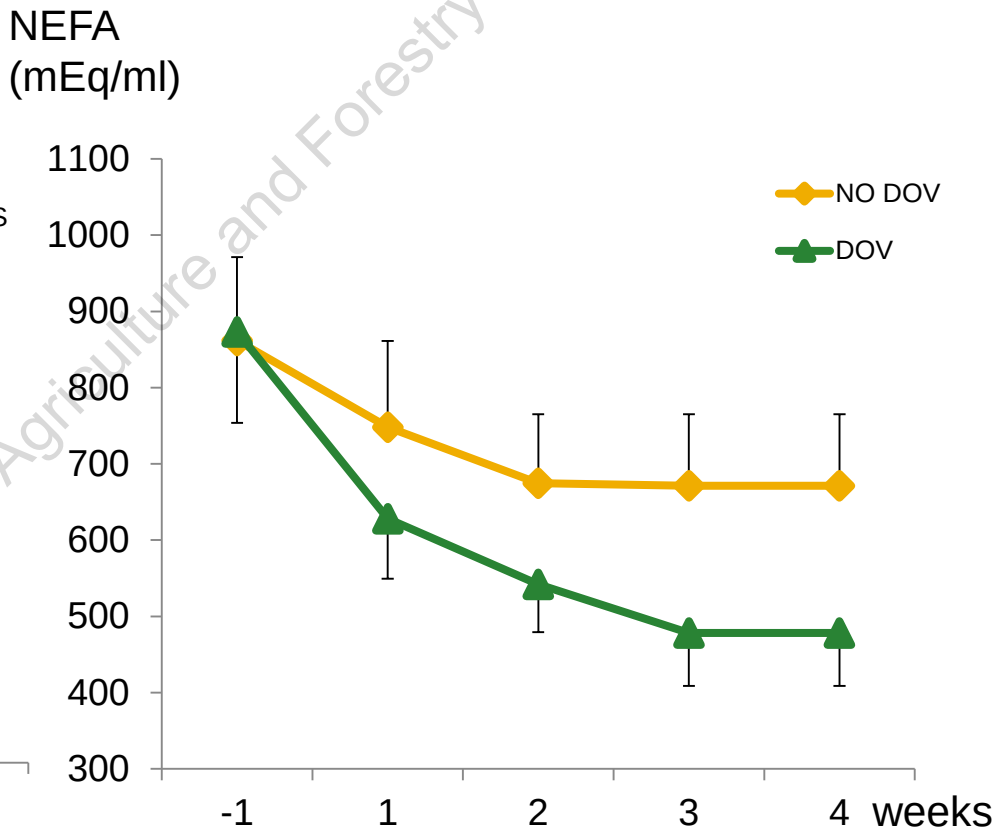
Lower BHB concentrations were associated with first double ovulation in multiparous cows

(No association in primiparous and secundiparous)

NEFA

Multiparous cows





Lower NEFA concentrations were associated with sooner resumption of ovarian activity and first double ovulation in multiparous cows

Results also show that greater NEFA levels were associated to FC (Jackson et al., 2011)

High Glucose

Low BHB

Low NEFA

(lower NEB)

Sooner return to cyclicity

But….

Higher incidence of first double ovulation pp

Higher incidence of FC

High Glucose

Low BHB

Low NEFA

(lower NEB)

Sooner return to cyclicity

But….

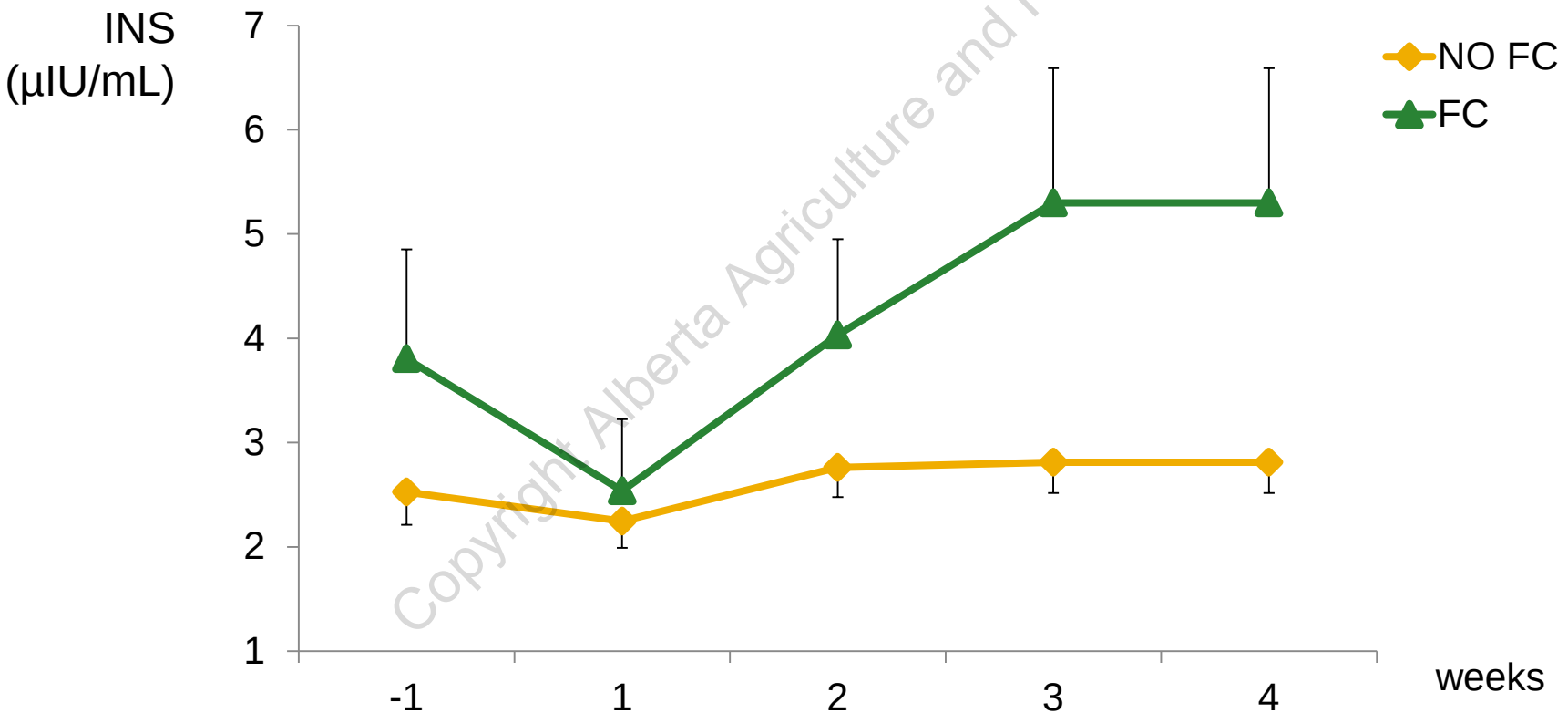
Higher incidence of first double ovulation pp

Higher incidence of FC

Good markers in multiparous cows

INSULIN

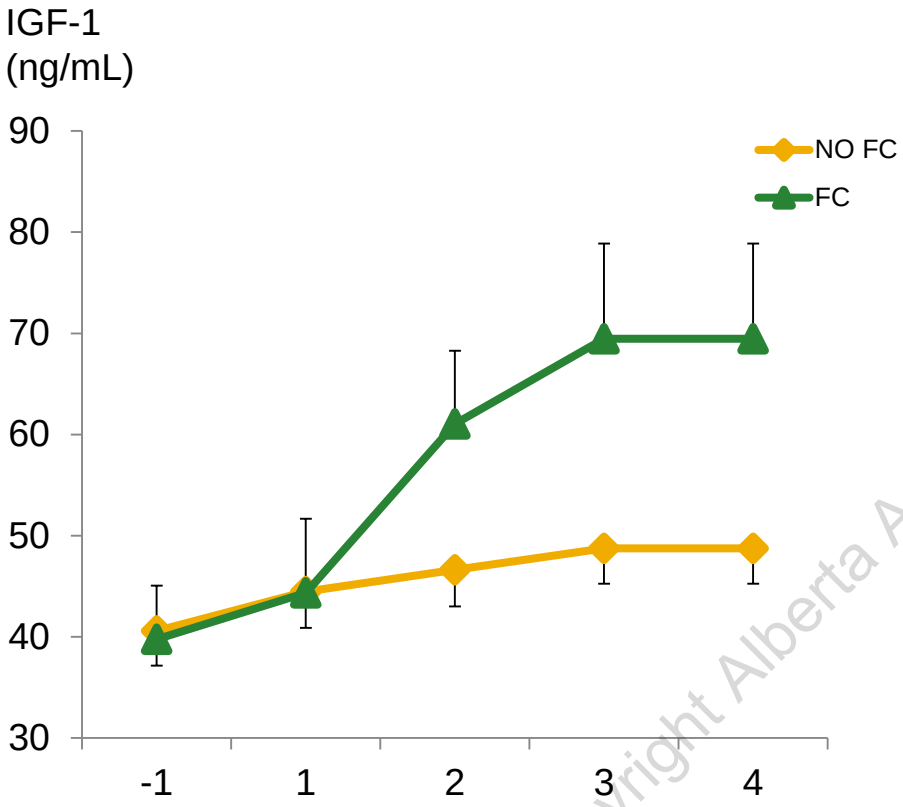
Secundiparous cows

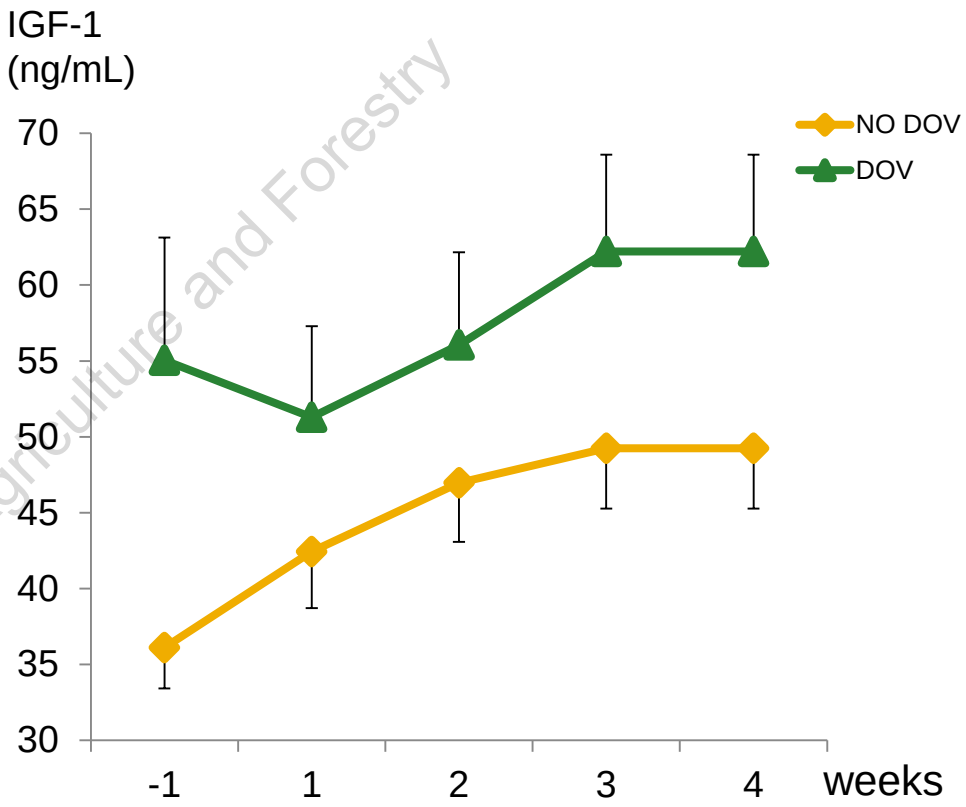


Greater insulin concentrations were associated with FC

Secundiparous cows

IGF-I





Greater IGF concentrations were associated with FC and DOV

(In multiparous, greater IGF concentrations → sooner ovulation pp)

Insulin ⟷ IGF-I

CONCLUSIONS

- Sooner resumption of ovarian activity was associated with greater GLU and IGF-I, and lower BHB and NEFA concentrations.
- Higher incidence of double ovulation was associated with lower BHB and NEFA, and greater IGF-I concentrations.
- Higher incidence of follicular cysts was associated with greater GLU, NEFA, insulin, and IGF-I concentrations.
- No interactions were observed between GLU, ovarian structures and number of lactation.
- Interactions were observed between BHB, NEFA, IGF-I and insulin and ovarian structures and number of lactation.

Thank you…

Any questions?