HOMA, QUICKI and RQUICKI in healthy Holstein-Friesian cows during early lactation

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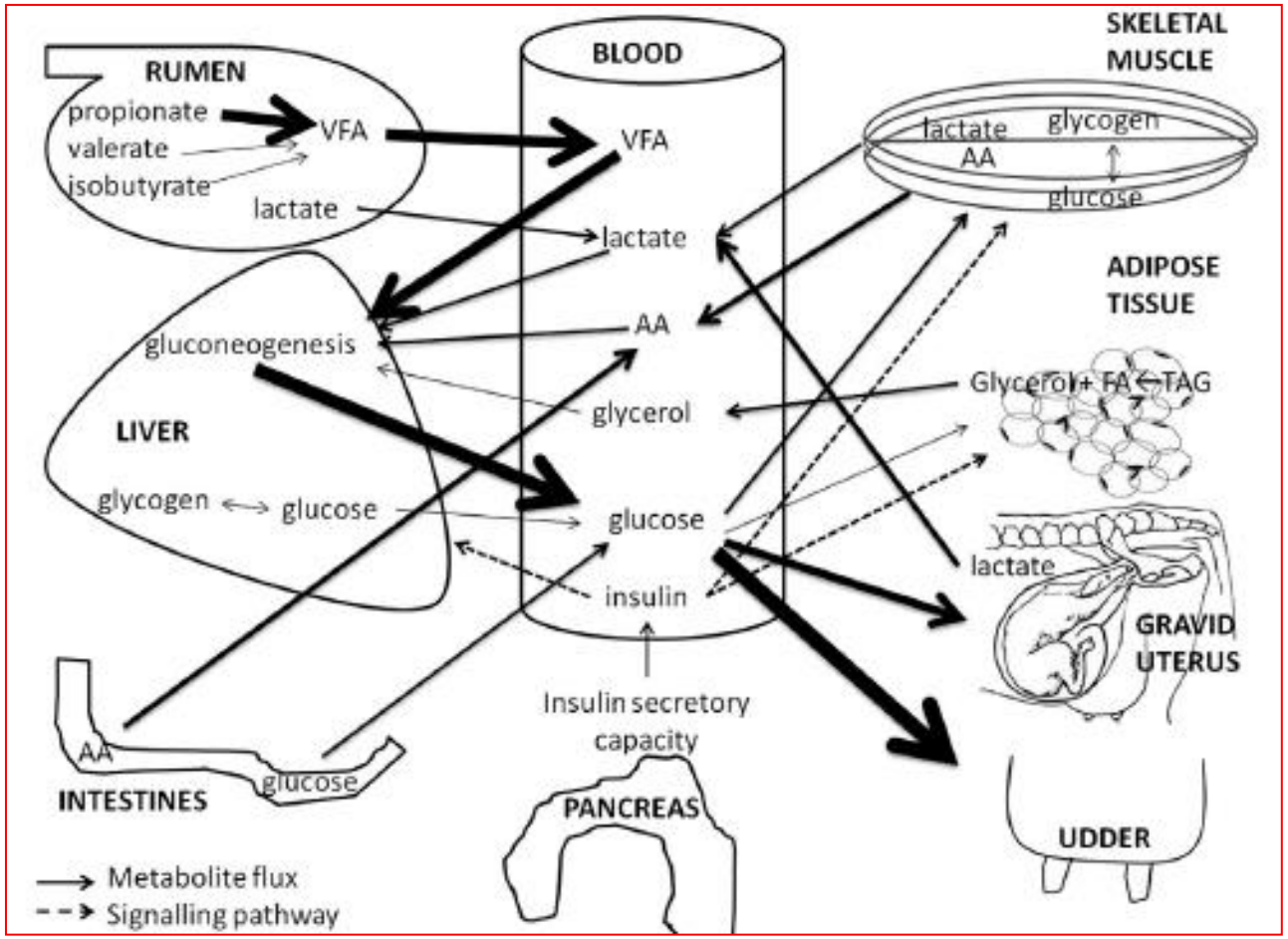
RUMINANTS

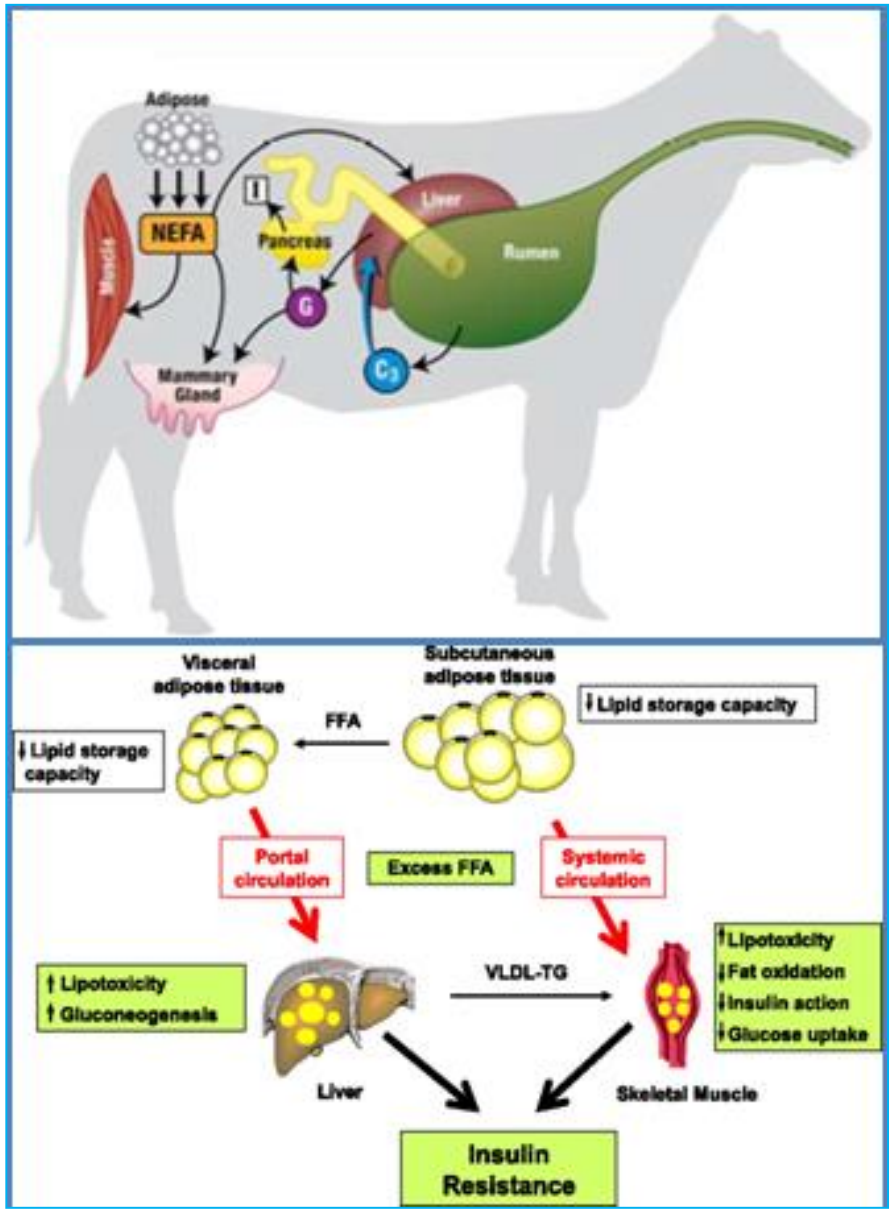


Koster & Opsomer, 2013

- Low peripheral glucose concentration and a low insulin sensitivity of the peripheral tissues
- Mammary gland and placenta absorption of glucose is independent of insulin

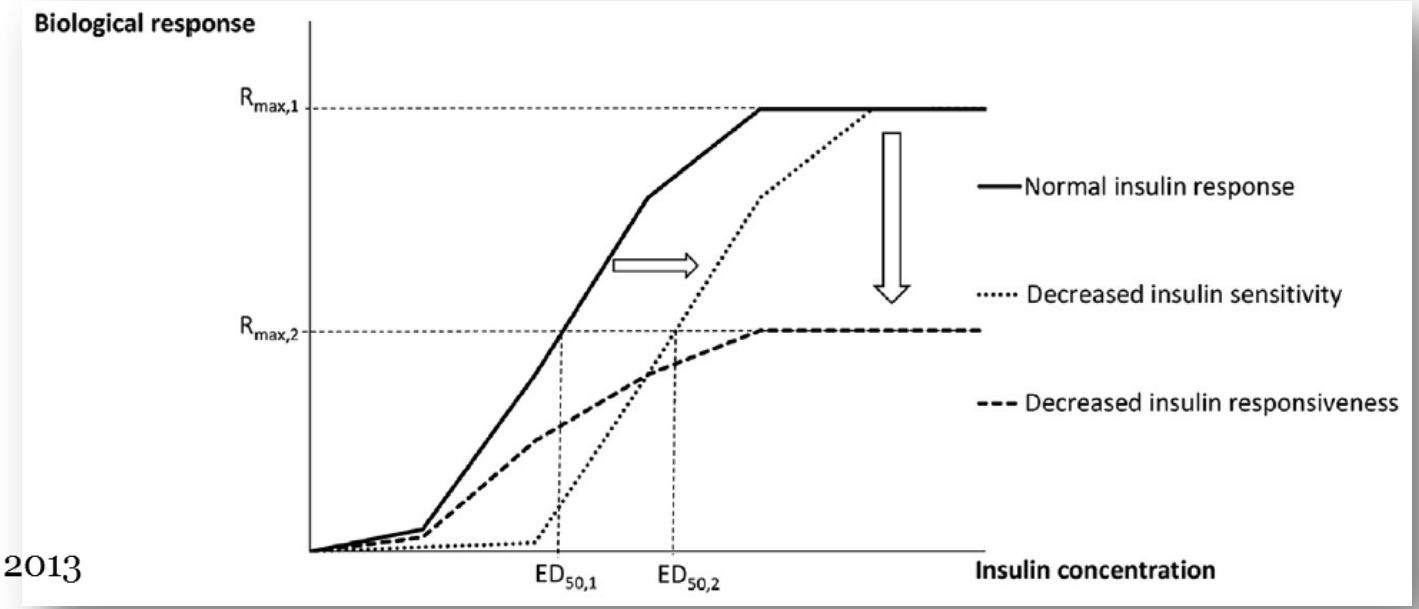
Transition period

- Defined as time from 3 weeks before calving till 3 weeks after calving
  - Intensive growth of foetus
  - Colostrum production
  - Calving
  - Beginning of lactation
- Strong homeorrhetic mechanisms
- The most critical time for dairy cows to succumb metabolic or infectious disease



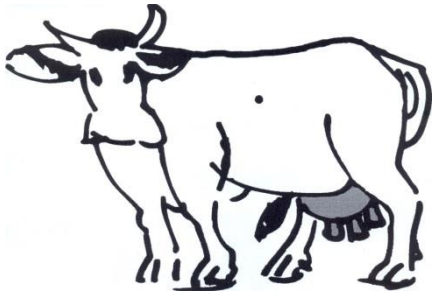
Insulin resistence

- may develop as part of *physiological* (pregnancy and lactation) or *pathological* processes
  - reduced tissue biological response in the insulin-sensitive tissues
  - biologic effect of insulin is not reduced but there is deficiency of insulin secretion



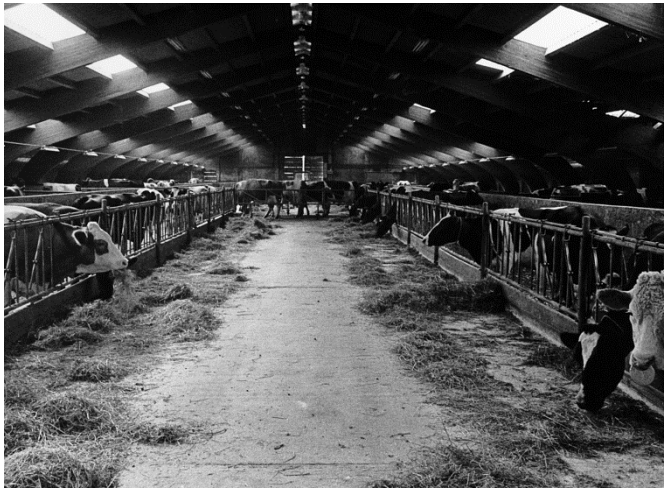
Koster & Opsomer, 2013

Insulin resistance indeces



- Predict insulin resistance from single blood sample measurement of insulin and glucose – surrogate indexes
  - **HOMA** = glucose (mmol/L) x insulin (μU/mL)
  - **QUICKI** = 1/ [log (glucose mg/dL)+log (insulin μU/mL)]
  - ➢Many studies demonstrated that NEFA has a role in development of insulin resistance
  - **RQUCKI** = 1/ [log (glucose mg/dL) + log (insulin μU/mL) + log (NEFA mmol/L)]

Material and methods



ANIMALS

- 40 HF cows
- second or higher parity
- milk yield of 7000 kg in previous lactation
- without any health issues in previous lactation
- no signs of disease at sampling time
- BCS 3 – 3.5

MANAGEMENT

- TMR according to NRC 2001 recommendations

BLOOD SAMPLING

- 3 – 7 days after calving
- *v. jugularis*

ANALYSES

- Insulin (ELISA, Cusabio)
- NEFA (spectrophotometry, Randox)
- Glucose (spectrophotometry, Randox)

CALCUALTIONS

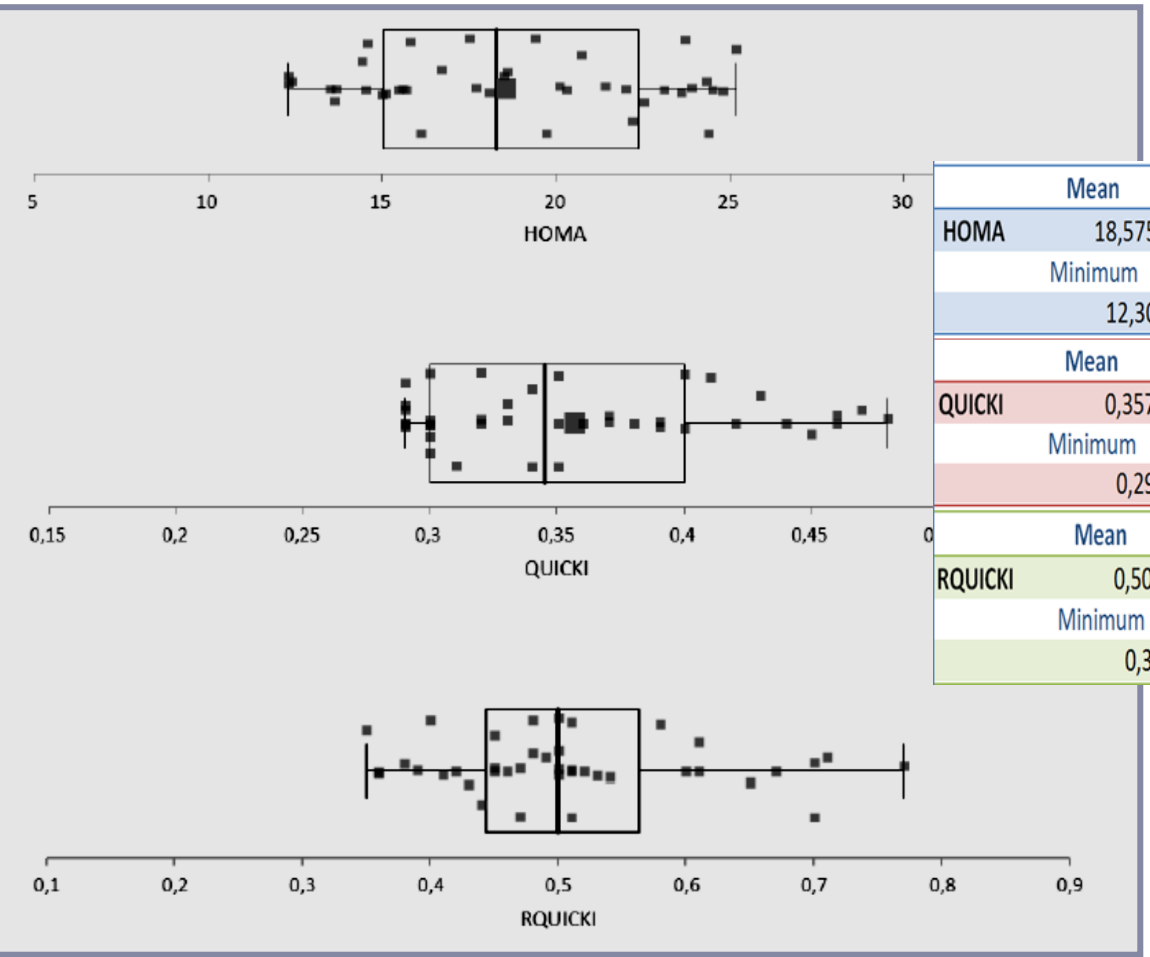
- HOMA
- QUICKI
- RQUICKI

STATISTICS

- Mean, standard deviation, reference interval

Results

- Graphic distribution of insulin resistance indices values in healthy cows during early lactation



	Mean	SE	SD	Variance	Skewness	Kurtosis
HOMA	18,575	0,6488	4,104	16,839	0,1	-1,35
	Minimum	1st quartile	Median	3rd quartile	Maximum	IQR
	12,30	15,042	18,300	22,375	25,20	7,333

	Mean	SE	SD	Variance	Skewness	Kurtosis
QUICKI	0,357	0,0094	0,060	0,004	0,6	-0,88
	Minimum	1st quartile	Median	3rd quartile	Maximum	IQR
	0,29	0,300	0,345	0,400	0,48	0,100

	Mean	SE	SD	Variance	Skewness	Kurtosis
RQUICKI	0,509	0,0164	0,104	0,011	0,7	0,02
	Minimum	1st quartile	Median	3rd quartile	Maximum	IQR
	0,35	0,444	0,500	0,563	0,77	0,119

Reference intervals of HOMA, QUICKI and RQUICKI in cows during early lactation

	Quantile		Limit	90% CI
HOMA	*Lower*	2.5%	10.172	8.348 to 11.996
	Upper	97.5%	26.978	25.154 to 28.802
QUICKI	*Lower*	2.5%	0.235	0.209 to 0.261
	Upper	97.5%	0.479	0.453 to 0.505
RQUICKI	*Lower*	2.5%	0.296	0.250 to 0.342
	Upper	97.5%	0.722	0.676 to 0.768

Discussion

- IR indices are adopted from human medicine, where they are measured after a overnight fast
- Studies about indices of insulin resistance in cattle are scarce.
- HOMA - **Haarstrich (2011)** noted HOMA value of 31.1±14.9 in lactating dairy cows, taht was higher compared to values in our cows. Cows in experiment obtained by Haarstrich were in day 182 of lactation, meaning in later lactation period compared to our cows. **Hackbart and coworkers (2013)** showed effect of dexamethasone on insulin resistance since HOMA index value were 5.0±1.0 before and 15.0±2.5 after application of dexamethasone.
- Our results showed that HOMA index has lower reproducibility (higher standard error) in comparison with QUICKI and RQUICKI.
- Our results (QUICKI and RQUICKI) are in agreement with results obtained by **Haarstrich (2011) .**
- RQUICKI index is calculated in range 0.35-0.68 (Holtenius and Holtenius, 2007; Balogh *et al.*, 2008; Kerestres *et al.*, 2009; Gross *et al.*, 2011). Our results are also in that range.

Conclusions

- Further studies are needed
  - To compare cows in different energy balance states
  - Healthy and diseased cows
  - To established reference intervals for cows at different stages of production
  - Validation

Thank you for your attention!

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