The Role of Fatty Acids On the Development & Survival of Pregnancy

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Virtus Nutrition™
The Role of Fatty Acids on the Development and Survival of Pregnancy
Early Pregnancy Losses Are Substantial

597 lactating cows flushed on day 5 or 7 after AI:
419 ova-embryo recovered
347 cleaved embryos
280 live embryos

The Role of Fatty Acids on the Development and Survival of Pregnancy Conceptus Cells at the Onset of Elongation

- Elongation starts around day 14 of development
- On day 15 after breeding → different stages of elongation
- Uterine flushing of 160 lactating dairy cows with synchronized ovulation

90 Cows Pregnant
60 Conceptuses Recovered

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<tr>
<th>Size in mm</th>
<th>Recovery, n (%)</th>
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<td>1–4</td>
<td>18 (27.7)</td>
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<td>5–19</td>
<td>26 (40.0)</td>
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<tr>
<td>20–60</td>
<td>21 (32.3)</td>
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Microarray

- Ovoid
- Tubular
- Filamentous
The Role of Fatty Acids on the Development and Survival of Pregnancy Elongation Requires Changes in Lipid Metabolism

= Upstream regulators with increased activity

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- Upstream regulators with increased activity

The Role of Fatty Acids on the Development and Survival of Pregnancy
Lipid Metabolism of the Uterus During Diestrus

n = 30 lactating cows receiving TMR in a freestall barn

Samples Collection
Within parity, cows were randomly assigned to uterine flushing and biopsy on days...

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Concentration of P₄ by RIA
Concentration of FA & OxyL by LS-MS
Abundance of LD by IHC

Ticiani et al. (2019) J. Dairy Sci. (abstract)
The Role of Fatty Acids on the Development and Survival of Pregnancy
Lipid Metabolism of the Uterus During Diestrus

IHC of endometrial biopsy

Lipid droplets in the endometrium:
- Day 5
- Day 10
- Day 15

Area of the endometrium occupied by lipid droplets, %

↑ 4-fold

Lipidomics of uterine flushing

Fatty acids in uterine flushing:
- Day 5
- Day 10
- Day 15

Concentration, pg/mL

↑ 2-fold

29 fatty acids identified
52% PUFA
n6:n3 ratio = 3.7:1

Oxylipids in uterine flushing:
- Day 5
- Day 10
- Day 15

Concentration, pg/mL

↑ 2-fold

63 oxylipids identified
Most of them derived from n6 FA
The Role of Fatty Acids on the Development and Survival of Pregnancy
Lipids as Regulators of Conceptus Elongation

Day of estrous cycle: 4 8 13 14 15 16 17 18 19

- Ovary
- CL
- Oviduct
- Exposure of the endometrium to progesterone
- Lipid content in endometrial epithelial cells
- Utilization of lipids by the embryo/conceptus

PREGNANT UTERINE HORN

The Role of Fatty Acids on the Development and Survival of Pregnancy
Lipids as Regulators of Conceptus Elongation

Day of estrous cycle: 4 8 13 14 15 16 17 18 19

Is this process affected by diet, BCS, healthy status?
When should we supplement FA in the diet?
What sources of FA should we supplement?

Ribeiro et al. (2016)
Reproduction 152:R115–R126
• Early pregnancy losses are substantial in dairy cattle, and failures in conceptus elongation seem to be part of the problem.
• Lipid metabolism is critical for conceptus elongation, and the metabolism of PUFA, through the activity of COX2 and PPARγ, seem to have a central role in this process.
• Ovarian progesterone affects lipid metabolism of the uterus and prepares the uterine environment for elongation of the conceptus.
• In practical terms, it is important to evaluate the concentration and sources of PUFA in the diet fed to lactating cows, and supplementation of sources that result in greater absorption of PUFA should be considered.
• Multiple studies have shown positive effects of supplementation of n3 fatty acids on fertility of lactating cows.
• Start supplementation early postpartum (helps to resolve inflammation postpartum) and keep until the breeding period (optimize uterine environment).
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