

## Effect of parity and age at first calving of dairy cows on dynamics of milk calcium contents and blood biomarkers of bone accretion and resorption throughout lactation.

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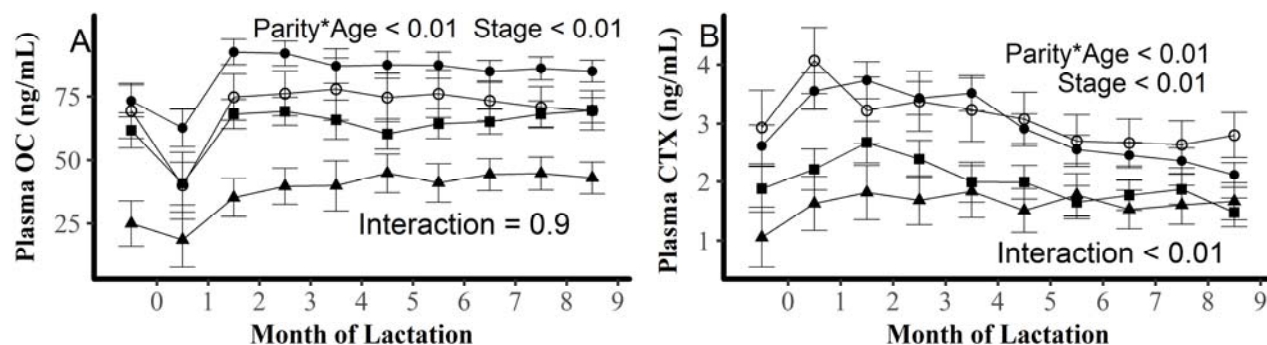
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**Take home message** Analyses of plasma biomarkers of bone accretion and resorption throughout lactation illustrates that older cows have less bone remodelling and lower capacity to mobilise their bones.

**Introduction** At the beginning of lactation, dairy cows face a huge increase in their calcium (Ca) requirements due to their important milk production. These requirements cannot be satisfied by Ca ingestion. It has been shown that cows mobilize Ca from their bone and that Ca reserves in bone can be restored later during lactation. The amplitudes of these cycles of bone reserve are difficult to quantify on important number of cows and for that reason, its consequences on cows' health remains to be determined. It has been shown that the mammary gland can be involved in the regulation of calcemia by decreasing milk Ca content and increasing bone resorption when calcemia decreased (Van Houten, 2004). The objective of this study was to determine if a link could exist between individual dynamics of milk Ca content and amplitude of bone mobilisation cycles.

**Material & methods** Thirty-three dairy cows were involved (n=17 in first lactation, n=10 for second lactation and n=6 for third or higher rank of lactation). Cows were fed *ad libitum* with a constant total mixed diet throughout lactation. Milk and blood samples were collected 15 days before expected date of calving and from 15 days after calving and every 4 weeks after. Ca and phosphorus (P) contents were analysed in milk. Ca, inorganic P, osteocalcin (biomarker of bone accretion) and CTX (biomarker of bone resorption) were also measured in plasma. Data were analysed with proc MIXED of SAS, including effects of parity and stage of lactation and their interaction as fixed effects, and using the repeated statement on cows. Individual milk Ca content dynamics were also characterized using factorial approach (PCA), and effect of dynamics was analysed with the interaction of stage of lactation using proc MIXED of SAS.

**Results & discussion** Both plasma contents of biomarkers of bone accretion and resorption were lower as the parity increased ( $P < 0.05$ , Figure 1). These results suggested that older cows had less bone remodelling. The amplitude of the increase of plasma CTX after calving was also higher in primiparous than in multiparous cows (interaction parity  $\times$  lactation stage,  $P < 0.05$ ). Three years old primiparous cows had also lower plasma osteocalcin contents than 2 years old primiparous cows, with values near to 2<sup>nd</sup> lactation cows. All primiparous cows had similar CTX contents.



**Figure 1** Effect of parity and stage of lactation on A) plasma osteocalcin concentration; B) plasma CTX concentration  
● Primiparous with calving at 2 years old; ○ Primiparous with calving at 3 years old; ■ 2<sup>nd</sup> lactation; ▲ 3<sup>rd</sup> lactation.

Amplitude of variation of milk Ca content at the evening milking, throughout lactation, also tended to be higher ( $P < 0.05$ ) in primiparous than in multiparous cows suggesting a weak link between milk Ca content and plasma CTX content. Three groups of milk Ca dynamics have been characterized by PCA. Neither these groups, nor the interaction between these groups and the stage of lactation affected plasma OC or CTX contents. This suggested that the evolution of milk Ca content throughout lactation is not linked to the dynamics of biomarkers when individual data are considered.

**Conclusion** The dynamics of plasma biomarkers of bone accretion and resorption clearly show that bone modelling is higher in younger cows and that first parity cows had higher amplitude of plasma content of CTX during lactation. However, the link between plasma biomarkers of bone accretion and resorption and milk Ca content seemed weak when considering individual variation.

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### References

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