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Fibroblast growth factor 23 decreases age-dependently in growing pig

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Introduction: The hormone fibroblast growth factor 23 (FGF23) is investigated as serum marker for bone health to facilitate diagnostics of mineralisation-related bone diseases due to its role in mineral homeostasis and being produced in the bone. Recent studies indicated an age-related change in FGF23 serum levels in parallel to bone-specific alkaline phosphatase (BALP) but little information is available on the relationship between FGF23 and bone growth [1,2]. In this study the connection between serum FGF23 levels and bone development was evaluated in suckling piglets. We hypothesized that FGF23 serum levels would linearly decline while the bone matures.

Animals, materials and methods. Metacarpal bone and serum samples were collected from 5 male and 5 female piglets [Large White x Piétrain] each on seven sampling time points [day of life (DoL) 3, 7, 14, 21, 28, 31 and 35], which covered the suckling and early post-weaning period. Bone weight, length, cortical wall thickness and area were determined with scale and calliper, bone density with water displacement, dry matter

with drying and ash with incineration. Serum levels of FGF23, BALP, osteocalcin and vitamin D were determined using enzyme-linked immunosorbent. Serum alkaline phosphatase, calcium and phosphor (P) were measured with enzymatic colorimetric assays. Data were subjected to ANOVA using PROC MIXED of SAS as repeated measures over time with fixed effects of day and gender considering piglets nested within litter as experimental unit. Additionally, Pearson correlations were calculated using PROC CORR of SAS.

Results and discussion: Until weaning (DoL28), bone parameters increased linearly but remained similar or decreased slightly afterwards ($p<0.05$). This was likely related to the decreased feed intake after weaning. Similarly, serum calcium and P decreased by 7 and 13% after weaning coinciding with decreased feed intake and hence decreased mineral intake ($p<0.001$). By contrast, serum P increased from DoL7 to 14 by 12% and decreased again by 15% on DoL21 ($p<0.05$). This was reflected in a 52%-increase of FGF23 from DoL14 to 21 ($p<0.05$) whose role is to decrease systemic P. Therefore, these results indicated regulatory mechanisms in the mineral homeostasis independent from bone growth. Overall, FGF23, BALP and alkaline phosphatase decreased from DoL3 to DoL35 by 80% ($p<0.05$), being opposite to increased bone development. Vitamin D steadily increased with a small drop on DoL28, being reflective of feed intake and changes in dietary levels ($p<0.001$). Serum osteocalcin increased by 54% from DoL3 to 7 and remained at this level afterwards ($p<0.001$). Serum parathormone increased during suckling period after DoL14 but dropped on DoL35 ($p<0.001$). Pearson correlation showed that FGF23, BALP and alkaline phosphatase correlated negatively with bone metrics ($-0.40<r<-0.88$, $p<0.05$) except

density while positively correlating with each other ($0.37<r<0.91$, $p<0.05$). This indicates their involvement in bone growth. Vitamin D correlated positively with bone metrics ($0.47<r<0.67$, $p<0.001$) except density but negatively with FGF23, BALP and alkaline phosphatase ($-0.40<r<-0.64$, $p<0.05$).

Conclusion: Serum levels of FGF23 confirmed the hypothesized age-related decrease during the early neonatal phase. Moreover, data indicated that increasing serum P levels may have contributed to a corresponding peak of serum FGF23. Nevertheless, the data set reflects the involvement of FGF23 in bone growth with similar properties as BALP.

References: [1] Allen (2003) Vet. Clin. Pathol. 32(3):101-13; [2] Vlot (2018) Bone Sep:114:215-225; [3] Vötterl (2021) Transl. Anim. Sci. 5(2):txab059.

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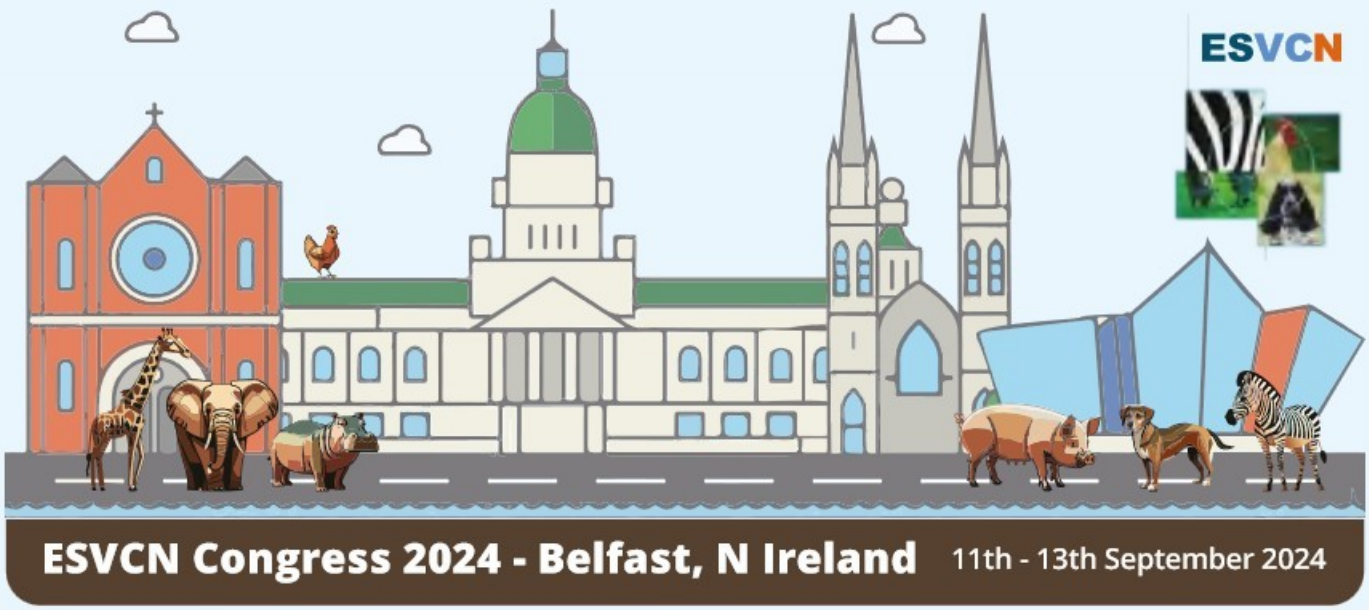

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