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Calcium metabolism during gestation and lactation in queens

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Objectives: Mobilization of Ca from bone and increased absorption from the gastrointestinal (GI) tract are required to re-establish homeostasis at the beginning of lactation. It has never been stated how queens react during the last weeks of gestation may play an important role in the development of hypocalcemia by disabling these Ca homeostatic mechanisms. Since it is not known how the Ca metabolism of queens reacts during gestation and lactation, this species was chosen. The purpose of the present study was to investigate the influence of reproduction on bone metabolism of queens.

Animals, material and methods: Nine European Shorthair queens aged 2.1 ± 0.8 years were used in this balance study. Before gestation the cats were fed a commercial canned cat food for adult cats (Ca: 0.66% DM, P: 0.79% DM, ME: 4732 kcal/kg DM) and during gestation and lactation a canned cat food for kittens (Ca 1.4% DM, P 0.97% DM, ME: 4622 kcal/kg DM) (Ospelt pet food, Bendorf, Liechtenstein). Blood samples were collected before gestation, at the end of gestation, at birth, and 2 times during lactation (2nd week, 4th week). Serum Ca, P, and Mg concentrations as well as epitopes of the carboxyterminal telopeptide of type I collagen (Crosslaps (CL)) and bone-specific alkaline phosphatase (bAP) were analyzed. Total bone mineral density (BMD) was quantified at the end of the gestation, at birth (2-3 days pp.), and at the end of lactation using dual x-ray absorptiometry (DEXA). Additionally, food and feces analysis were performed.

Results and discussion: Mean CL concentrations of queens showed an increase from the end of gestation until 2 weeks pp, and decreased in the 4th week of lactation. In contrast, mean bAP concentrations were low during the last weeks of gestation, decreased even more in the first weeks of lactation (2nd week lowest) and increased until 4th week pp. Total BMD decreased from gestation to levels which were only half as high at the end of lactation (4th week). Concentrations of total Ca were lower during lactation, but stayed within the normal reference values (Ca: 2.3-3.0 mmol/l; P: 0.8-1.9 mmol/l). The corresponding daily Ca and P intake and losses via feces are given in table 1.

Table 1: Ca- and P-intake and excretion via feces in 9 cat's pre-gestation, gestation, lactation

Mean \pm SE	Ca-intake g/kg BW ^{0.67} /d	Ca-feces g/kg BW ^{0.67} /d	P-intake g/kg BW ^{0.67} /d	P-feces g/kg BW ^{0.67} /d
Before gestation	0.12 \pm 0.00	0.13 \pm 0.01	0.14 \pm 0.00	0.07 \pm 0.01
4 th week gestation	0.40 \pm 0.04	0.40 \pm 0.04	0.28 \pm 0.03	0.18 \pm 0.02
7 th week gestation	0.41 \pm 0.02	0.44 \pm 0.03	0.29 \pm 0.02	0.18 \pm 0.01
2 nd week lactation	0.53 \pm 0.05	0.49 \pm 0.05	0.37 \pm 0.03	0.20 \pm 0.02
6 th week lactation	0.68 \pm 0.07	0.61 \pm 0.11	0.47 \pm 0.05	0.26 \pm 0.04

Discussion: The increase of CL concentrations in queens indicates that bone is resorbed at parturition and at the beginning of lactation. This is consistent with the findings regarding BMD. At the same time, less bone is formed, as indicated by the decrease of bAP concentrations. In conclusion, although the Ca content of diet was according to recommendations (NRC, 2006: Ca: 10.8 g/kg DM with 4000 kcal) in queens during late gestation and early lactation, the Ca intake was lower in 7th week of gestation than recommended (Ca: 0.565 g/kg BW^{0.67}) and Ca homeostatic mechanisms were activated. Increased bone remodelling during lactation represents physiological mechanisms to help the maternal skeleton adapt to greatly increased Ca requirements independent of the Ca supply. The mineral deficit in bone is reversible, since bone markers return to prepartum levels. An influence of gestation and lactation on Ca regulating mechanisms is obvious, but not necessarily dependent on the Ca supply during this period of reproduction.

Reference: NRC, 2006: Nutrient requirements of Dogs and Cats. National Academic Press, Washington, DC, 368-369