Preliminary study of calcium balance and bone mineralization improvement by a new calcium supplement in growing rats

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Background and aim. Osteoporosis is a very common metabolic disease, characterized by loss of bone mass generally in aged people (1). Calcium is essential for bone metabolism but calcium intake is often inadequate, therefore calcium supplements become primary calcium sources to prevent bone resorption. In particular, small bony fishes, having a large amount of bioavailable calcium (2), represent a good calcium source instead of milk and dairy products sometimes not well tolerated.

The aim of this study was to evaluate the efficacy on bone mineralization of a new calcium supplement, obtained by dorsal fish bones and characterized by a high content of phosphorus and proteins, compared to a commercial calcium supplement, composed only by $CaCO_3$ and $MgCO_3$, Lithotame (3), taken as reference compound.

Materials and methods. All experiments were performed according to Guiding Principles in the Care and Use of Animals (DL116/92).

Young growing male rats were fed low calcium diet for 2 months (control group CTR), to induce bone resorption and reduce bone formation, and compared with littermate rats receiving the same diet supplemented with Fish bone flour (FB) or Lithotame (LI).

Rats body weight was weekly monitored. After 8 weeks feeding periods, animals were killed, femurs and tibias were collected and their weight and length were measured. Femoral biomechanical properties were evaluated through dynamometer INSTRON (4), and bone mineral density of right tibias was evaluated through pycnometer (5). Tibias calcium and phosphorus levels were quantified by atomic absorption spectroscopy (6).

Results. Rats belonging to FB and LI groups exhibited a significant increase in body weight gain compared to animals on calcium dietary restriction (FB:250.6±9.4g and LI:252.5±7.5g vs CTR:220.0±5.7g; $P<0.05$). Calcium supplements significantly increased femur weight (FB:1127.9±11.9mg, LI:1149.1±33.0mg vs CTR:1012.2±0.9mg; $P<0.01$) and moderately improved their resistance to fracture (FB:442.1±17.1N, LI:453.5±16.9N vs CTR:397.0±7.4N). Moreover, treated groups showed higher tibia density values (FB:1077.4±16.8mg/ml and LI:1081.4±22.9mg/ml vs CTR:1040.9±15.6mg/ml) and a significant increase of calcium (FB: 224.9±5.5mg/tibias, LI:222.8±6.3mg/tibias) and phosphorus (FB:113.3±3.1mg/tibias, LI:110.6±3.3mg/tibias) bone mineral content compared to control one (CTR:197.8±5.2mg/tibias and 99.7±1.7mg/tibias respectively; $P<0.05$).

Conclusions. The results obtained showed that in young growing rats Fish bone had comparable efficacy on bone mineralization with respect to Lithotame. Further studies will be useful to investigate whether Fish bone could increase calcium bioavailability in calcium altered metabolic conditions, such as in a model of ovariectomized rats reproducing menopause status.

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