Assessment of Bone Turnover Markers in Marmoset Serum

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Introduction

Bone turnover markers (BTMs) are useful in clinical practice as they are non-invasive, inexpensive and can be used for monitoring both anti-resorptive and anabolic treatment or side effects of treatments. Non-human primates are widely used in bone research, but limited number of studies have assessed the utility of biochemical markers for monitoring bone turnover in non-human primates[1-3]. The objective of this study was to measure BTMs in marmosets (Callithrix jacchus), and their variations with age and sex.

Materials and Methods

Serum samples (5 animals per group) collected from marmosets (Callithrix jacchus) were obtained from Silabe-Université de Strasbourg (Niederhausbergen, France):

1) Male donors, age 1-2 years (subadult)
2) Female donors, age 1-2 years (subadult)
3) Male donors, age 5-7 years (adult)
4) Female donors, age 5-7 years (adult)

C-terminal cross-linked telopeptides of type I collagen (CTX-I), N-terminal mid-fragment of osteocalcin (OC), procollagen I N-terminal propeptide (PINP) and bone-specific alkaline phosphatase (BAP) were measured using IDS-iSYS Multi-Discipline Automated System (IDS). Tartrate-resistant acid phosphatase 5b (TRACP 5b) was measured using IDS-iSYS Multi-Discipline Automated System (IDS) and BoneTRAP® (TRAcP 5b) ELISA manual assay (IDS).

Statistical analysis was performed with statistical software R. Normal distribution and homogeneity of variance was checked and when necessary, prior to statistical analysis data was transformed using logarithmic transform in order to obtain proper statistical model fit to data. Statistical analysis was performed using fixed effects model (corresponds to one-way ANOVA). The pairwise comparisons were performed using model contrasts and adjusted for multiple comparisons. If the assumptions of statistical models were not fulfilled after transformations, non-parametric Kruskal-Wallis test was used to evaluate differences among groups, and Dunn's test was used for statistical comparisons between groups. All the tests were performed as two-sided tests.

Results

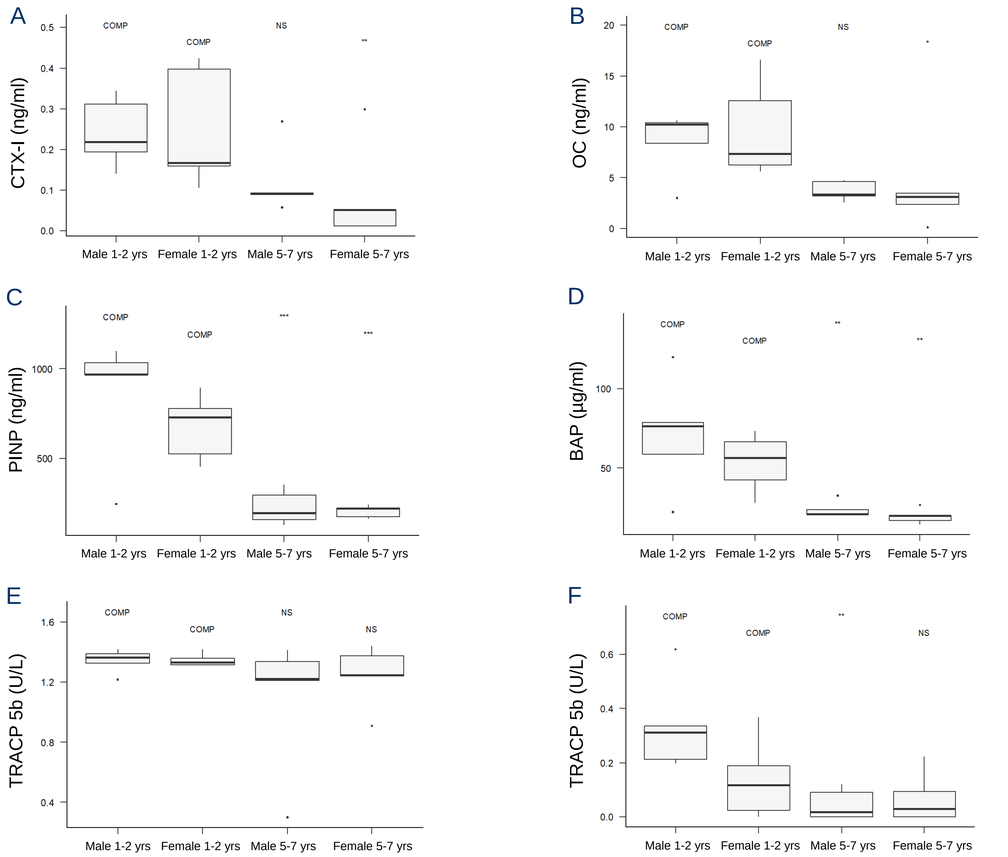

Figure 1. Bone turnover markers in 1-2 years and 5-7 years old marmosets. A) CTX-I, B) OC, C) PINP, D) BAP and E) TRACP 5b measured using IDS-iSYS Multi-Discipline Automated System, and F) TRACP 5b measured using BoneTRAP® manual assay. Boxes represent the range between the 25th and 75th percentiles with a horizontal line at the median. Black dots indicate outliers. * p<0.05, ** p<0.01, ***p<0.001 compared to the 1-2 years group.

Summary

- Values obtained for TRACP 5b, PINP and BAP were within the quantitation range of each assay. For CTX-I and OC, values obtained were within the quantitation range in 1-2 years old marmosets and in 5-7 years old male marmosets.
- Higher levels of CTX-I and OC were observed in 1-2 years old females compared with 5-7 years old females. Similar trend was observed in males.
- Higher levels of PINP and BAP were observed in 1-2 years old males and females compared with 5-7 years old males and females.
- Higher levels of TRACP 5b were observed in 1-2 years old males compared with 5-7 years old males using manual BoneTRAP® (TRAcP 5b) ELISA. However, the levels obtained remain below the assay quantitation limit. Automated human TRAcP 5b (BoneTRAP), IDS, Cat# IS-4100 / IS-4140, could not detect difference between 1-2 years old marmosets and 5-7 years old marmosets.

Conclusions

Higher bone turnover (assessed by CTX-I, OC, PINP and BAP) was observed in subadult (1-2 years old) marmosets compared to the adult (5-7 years old) marmosets, which is expected due to high skeletal growth velocity and rapid bone turnover. The results suggest that these iSYS automated assays designed for clinical samples could be used for determining BTMs in marmoset serum.

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References

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