

## ABSTRACT

### COMPARISON OF THE RESPONSE OF FEMORAL LENGTH, WEIGHT, DIAMETER, AND THICKNESS RESULTING FROM LOW AND HIGH INTENSITY SWIMMING DURING GROWTH PERIOD IN MALE WHITE RATS (*RATTUS NORVEGICUS*)

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During growth period, bone, as an important organ that supports the body, also grows. Bone strength depends on its density and thickness. Training may have effect on bone by increasing its size, mass, and density. It is also well-recognized that bone thickness and mass are always subjected to change, both addition and reduction, through the process of remodeling.

The objective of this study was to prove that low and high intensity swimming may increase the response of skeletal length, weight, diameter, and thickness. This study used separate sample pretest-posttest control group design involving 40 male white rats (*Rattus norvegicus*) aged 1 month. Treatments given were (1) low intensity swimming (receiving load 3% of BW), and 2) high intensity swimming (receiving load 9% of BW), three times a week (Monday, Wednesday, Friday) for 6 weeks.

The results of descriptive analysis of the independent variable in all treatment groups showed difference results. The variable of bone length in pretest group was  $22.49 \pm 0.82$  mm, posttest group  $30.30 \pm 0.69$  mm, low intensity swimming  $30.93 \pm 0.81$  mm, and high intensity swimming  $31.63 \pm 0.54$  mm. The variable of bone weight in pretest group was  $0.28 \pm 0.02$  g, posttest group  $0.44 \pm 0.03$  g, low intensity swimming  $0.47 \pm 0.04$  g, and high intensity swimming  $0.51 \pm 0.05$  g. The variable of bone diameter in pretest group was  $2.06 \pm 0.07$  mm, posttest group  $2.75 \pm 0.06$  mm, low intensity swimming  $2.82 \pm 0.08$  mm and high intensity swimming was  $2.94 \pm 0.09$  mm. Finally, the variable of bone thickness in pretest group was  $143.26 \pm 21.71$   $\mu$ , posttest group  $265.53 \pm 41.18$   $\mu$ , low intensity swimming  $272.98 \pm 79.23$   $\mu$  and high intensity swimming  $311.94 \pm 47.68$   $\mu$ . The results of normality test revealed that all groups had normal distribution ( $p > 0.05$ ). Homogeneity test on initial bodyweight showed homogeneous results ( $p > 0.05$ ). The analysis of maturation effect revealed that all dependent variables showed increased growth resulting from maturation. Results of Manova test on the change response due to treatment revealed that treatment provides significant difference (Hotelling's trace,  $p < 0,05$ ). It was observable from the results of discriminant test that the variable of bone length and diameter provided significant contribution to change response resulting from treatment ( $p < 0.05$ ), while the variables of bone weight and thickness had no significant contribution to change response that resulted from treatment ( $p > 0.05$ ).

The activity of bone formation progresses highly during growth period. At the early phase of this period, longitudinal bone growth is faster than mineral deposition process. At the end of growth period, longitudinal bone growth is

reduced and bone mineral content increases rapidly, immediately reaching its peak.

In conclusion, low and heavy intensity swimming may increase bone length, weight, diameter, and thickness. However, bone length and diameter have the significant contribution to the change of response resulting from treatment.

**Keywords:** *lower intensity swimming, high intensity swimming, bone length, weight, diameter, and thickness*

