EFFECT OF PINEALECTOMY AND RESISTANCE EXERCISE ON RATS TIBIAE MORPHOLOGY, MINERAL QUANTIFICATION AND MECHANICAL PARAMETERS

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Introduction

The exposition of shift workers to light at night supresses the melatonin (ME) production. ME supression may contribute to the development of osteoporosis, which can be prevented and treated by resistance exercise (RE). This study evaluated the effect of ME supression by pineal gland (pinealectomy) and the RE on rats tibiae morphology, mineral quantification and mechanical parameters. The project was approved by the local ethics committee (protocol 2014-00939). There was no conflict of interests.

Methods

40 Wistar male rats

Control (CNS) | Pinealectomized (PNX)

Exercised (CNEX) | Pinealectomized/exercised (PNXEX)

↓

Pinealectomy (40 days old)

↓

14 days of recovery

↓

② CNS CNEX PNX PNXEX

Adaptation to resistance exercise (2 weeks)

↓

Initial maximal strenght test

Resistance exercise in stairs
3 sessions a week
9 climbs per session
120 sec of rest between climbs

1,13 m
80° inclination

↓

③ CNS CNEX PNX PNXEX

↓ ↓

Resistance exercise (8 weeks) and maximal strenght test every 15 days

→

④ CNS CNEX PNX PNXEX

Final maximal strenght test

↓

Trabecular microarchitecture (micro-CT)
Mineral quantification (DEXA)
Mechanical parameters (3-point bending test)

Two-way ANOVA with Bonferroni post-test (GraphPad Prism 6.0) were used. The significance level was at least P<0.05.

Results

Maximal voluntary carrying capacity (MVCC).

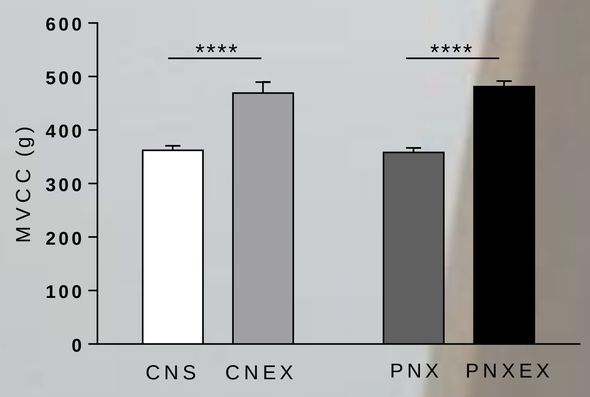

Fig. 1 – MVCC of control (CNS), exercised (CNEX), pinealectomized (PNX) and pinealectomized/exercised groups (PNXEX). Values expressed as mean ± SEM, ANOVA (Two-way) (GraphPad Prism 6.0) Bonferroni post test, n=10. ****P<0.0001 CNEX vs. CNS and PNXEX vs. PNX.

Bone morphological parameters

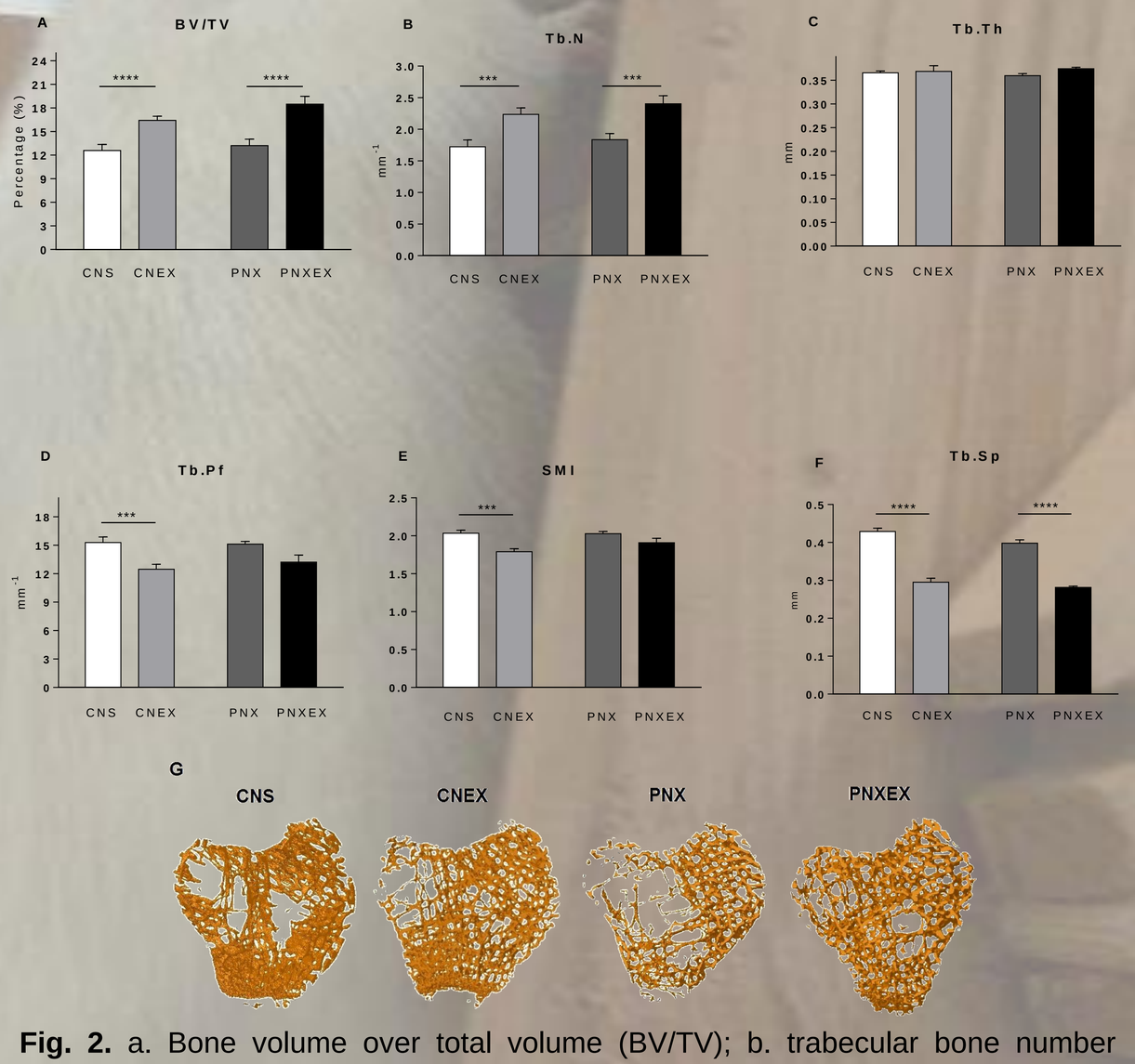

Fig. 2. a. Bone volume over total volume (BV/TV); b. trabecular bone number (Tb.N); c. trabecular thickness (Tb.Th); d. trabecular bone pattern factor (Tb.Pf); e. structure model index (SMI); f. trabecular bone separation (Tb.Sp) and g. trabecular bone samples. Values were expressed as mean ± SEM, ANOVA (Two-way) (GraphPad Prism 6.0) with Bonferroni post-test, n=10. ***P<0.001 CNEX vs. CNS and PNXEX vs. PNX; ****P<0.0001 CNEX vs. CNS and PNXEX vs. PNX.

Dual-energy X-ray absorptiometry.

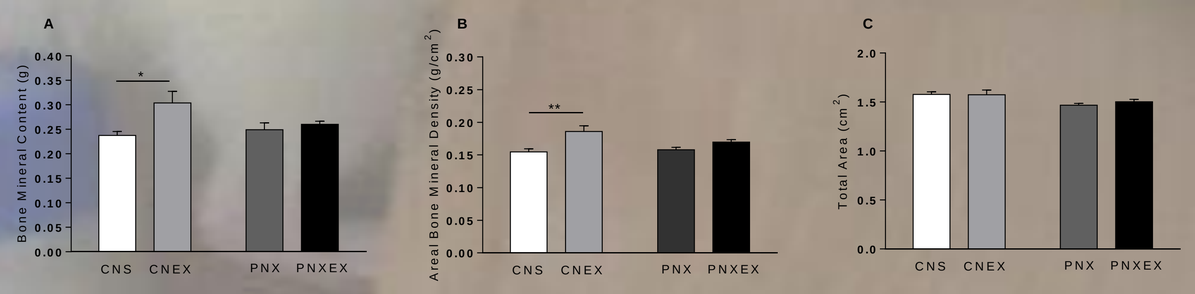

Fig. 3. Data were expressed as mean ± SEM, ANOVA (Two-Way) (GraphPad Prism 6.0) with Bonferroni post-test, n=10. *P<0.05 CNS vs. CNEX; **P<0.005 CNS vs. CNEX.

Mechanical testing (three point banding-loading).

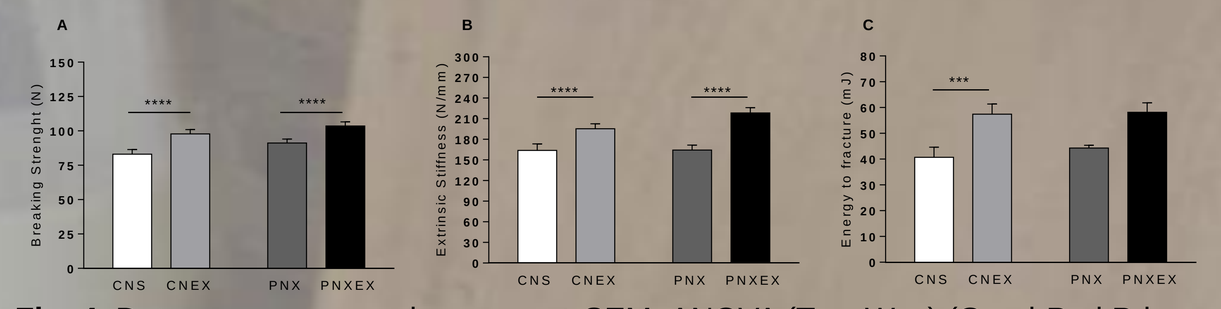

Fig. 4. Data were expressed as mean ± SEM, ANOVA (Two-Way) (GraphPad Prism 6.0) with Bonferroni post-test, n=10. ; ***P<0.0005 CNEX vs. CNS; ****P<0.0001 CNEX vs. CNS and PNXEX vs. PNX.

Conclusion

RE was effective on bone tissue improvement. Pinealectomy, by itself, had no influence on bone parameters evaluated. Although, it seems ME influence the effect of RE on trabecular bone pattern factor, structure model index, bone mineral content, areal bone mineral density and energy to fracture. Considering the strictly correlation between bone and skeletal muscle, further studies should be performed in order to verify the effect of pinealectomy and RE on skeletal muscle tissue.

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