The Effect of Growth Period Treadmill Training on Voluntary Physical Activity in Adulthood

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Summary

Exercise during childhood and adolescence may increase adult activity levels, either by establishing activity as a habit or by inducing physiological changes that reduce the effort associated with exercise. This research used guinea fowl (*Numida meleagris)* as a model to investigate how growth-period exercise affects voluntary exercise behaviors in adult animals.

Introduction

A quarter of the world's population does not meet the recommended levels of physical activity and around 80% of adolescents are insufficiently physically active [1], a major contributing factor to increased risk of mortality and metabolic and cardiovascular disease [2]. Exercise during childhood and adolescence has the potential to not only establish activity as a habit, but also to reduce physical barriers to exercise in adulthood by making it less effortful. Our lab recently found that guinea fowl that underwent treadmill training during growth had larger aerobic capacity than controls following training, and remarkably this difference persisted after a 6-month period of no forced exercise in large pens. The elevated exercise capacity results in a relative effort of movement that is lower in adult animals that underwent growth-period exercise. As part of this ongoing study of the effects of growth-period exercise on locomotor function and energetics using a guinea fowl animal model, we examined the voluntary behavior of these same guinea fowl when singly housed in a large pen during the 6-month washout period. We hypothesized that animals that underwent extensive treadmill training during growth exhibit higher levels of movement in their pens compared to untrained control animals, indicating that training leads to higher voluntary levels of adult activity.

Methods

A total of 60 guinea fowl were acquired as two-days old keets. At 2 weeks of age, they were separated into an exercise group (EXE) and a control group (CON). EXE birds were trained on treadmills with a 6° incline for 5 days a week at a speed of 1.33 ms^{-1}. The CON group remained in their cages during the training period, with no exercise outside of the cages except for occasional treadmill accommodation runs. After one year of training, both groups were transferred to large pens for 6 months and training ceased. During this period, activity was recorded three times daily for 10 minutes using an overhead video camera sampling at 20 frames per second. The 6-month period was separated into three 2-month periods. The videos for a subset of these birds (EXE n=9; CON n=10) during the third of these periods were analyzed using DeepLabCut markerless pose estimation software to track individual bird movements in each video. The total distance traveled per unit of time was calculated for each animal.

Results and Discussion

DeepLabCut successfully tracked four markerless points on each animal as it moved in its pen in three videos per animal.

Figure 1: The 4 markerless points from DeepLabCut on a guinea fowl at three time points in a single video. The four markers are: head (purple), shoulder (blue), tail base (yellow), and tail end (red).

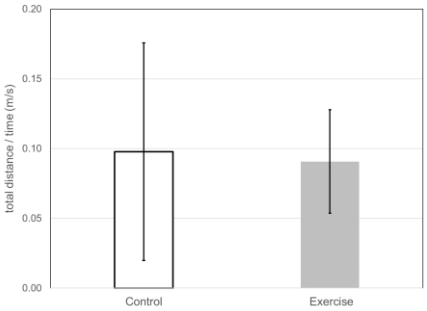

Figure 2: The average distance traveled, time normalized for the length of the videos analyzed.

The average distance traveled per unit time for each group show no significant differences between groups ($p = 0.789$; 0.091 ± 0.04 m/s for EXE and 0.098 ± 0.08 m/s for CON).

Conclusions

The results do not support our hypothesis. Because the post-washout between-group difference in aerobic capacity cannot seemingly be attributed to differences in the voluntary activity of the birds during the washout, it may be that the birds developed lasting physiological or structural adaptations that caused their aerobic capacity to remain elevated even without further training. Further analysis of videos from all time points is currently underway.

Acknowledgments

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References

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