

Metabolic adaptations in muscle after short bout exposure to recreational football: an intervention study in sedentary pre-menopausal women.

Suzanne Scott¹, Luke Connolly¹, Sarah Jackman¹, Jonathan Fulford², Karen Knapp³, Jude Meakin³, Rosey Davies¹, and Peter Krstrup¹

¹Sports and Health Science, University of Exeter, Exeter, United Kingdom, ²Exeter NIHR Clinical Research Facility, University of Exeter, Exeter, United Kingdom, ³CEMPS, University of Exeter, Exeter, United Kingdom

Target Audience

There is evidence that participation in recreational football induces positive adaptations in cardiovascular health (1) and bone (2) in untrained participants. Previous interventions have involved longer training bouts (typically 60 min. sessions 2-3 times per week) and the aim of the present study was to investigate whether a reduced exposure (13.5 min. twice weekly) was sufficient to induce measurable adaptations in muscle metabolism, in order to improve compliance and acceptability of a training intervention in pre-menopausal women, who may struggle to comply with more extensive training regimes alongside regular work and family commitments.

Purpose

This study aimed to provide researchers involved in public health initiatives with new evidence about the effect of small volume high intensity football training on cardiovascular health in pre-menopausal women. With this information researchers may be able to improve compliance and adherence to exercise with the overall aim of reducing barriers to exercise in this population.

Method

11 sedentary pre-menopausal women aged 25-45 years were recruited to train for 13.5 min. twice weekly for 16 weeks in short sided recreational football. Pre- and post- training intervention measurements of muscle metabolism were undertaken via ³¹P spectroscopy by examining metabolite responses in the quadriceps during single leg knee extensions. For these measurements participants were positioned in the bore of a 1.5 T superconducting magnet (Intera, Philips, The Netherlands) at the University of Exeter Magnetic Resonance Research Centre. Following baseline measures, participants performed two exercise tests to examine different aspects of muscle function. In the first, PCr recovery kinetics was investigated by undertaking short bouts of continuous exercise involving lifting weights via a pulley system and calculating τ , the time constant for the exponential recovery of PCr where:

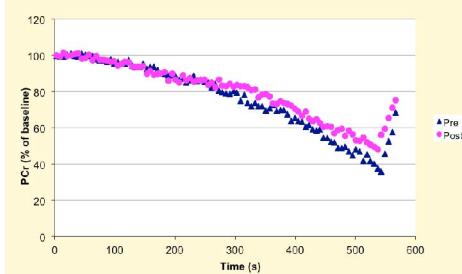
$$PCr_{(t)} = PCr_{end} + PCr_{(0)}(1 - e^{(-t/\tau)})$$

where PCr_{end} is the value at the end of exercise, $PCr_{(0)}$ is the difference between the PCr at end exercise and fully recovered and t is the time from exercise cessation.

After a recovery period, a ramp exercise protocol was undertaken, in which the work requirements were continually increased until the point of participant failure.



Results



Baseline values of PCr and PCr:Pi ratio were 32.2 ± 3.5 mM and 8.5 ± 1.4 pre training and 32.0 ± 3.0 mM and 8.5 ± 1.4 post training. Values of τ were, pre 35.1 ± 8.7 s, post 30.7 ± 7.7 s ($p=0.037$). For the ramp protocol, the time to exercise failure was, pre 250.8 ± 103.9 , post 282.8 ± 92.8 s ($p=0.18$) and the end exercise PCr values were, pre 17.6 ± 4.5 mM and post 19.0 ± 3.8 mM ($p=0.10$).

Figure 1. PCr depletion (% of baseline) Pre-Post 16 week football training intervention in a sedentary subject

Conclusion

This study demonstrated that two bouts of short-sided recreational football per week provided a sufficient training stimulus to induce positive changes in muscle metabolism in participants over 16 weeks. Results suggest that it may be possible to improve aerobic capacity with a much briefer exposure to the high intensity training stimulus than has been previously demonstrated (1,2), which may lead to increased compliance and greater acceptability of short sided football training as an intervention for improving cardiac health in sedentary, pre-menopausal women.

References

1. Randers MB, Andersen LJ, Orntoft C, Bendiksen M, Johansen L, Horton J, Hansen PR, Krstrup P. Cardiovascular health profile of elite female football players compared to untrained controls before and after short-term football training. *J. Sports Sci.* 2013; (13):1421-31.
2. Jackman SR, Scott S, Randers MB, Orntoft C, Blackwell J, Zar A, Helge EW, Mohr M, Krstrup P. Musculoskeletal health profile for elite female footballers versus untrained young women before and after 16 weeks of football training. *J. Sports Sci.* 2013;31(13):1468-74.