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Journal of Sport and Health Science xx (2017) 1–10

www.jshs.org.cn

Original article

Fitness and health benefits of team handball training for young untrained women—A cross-disciplinary RCT on physiological adaptations and motivational aspects

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Received 6 June 2017; revised 7 July 2017; accepted 19 August 2017
Available online

Abstract

Purpose: The present study evaluated the effects of regular participation in small-sided team handball training on body composition, osteogenic response, physical performance, and cardiovascular risk factors, as well as well-being and motivation, in young untrained women.
Methods: Twenty-eight untrained 20- to 30-year-old women were randomized to a handball training group (HG; $n = 14$, height 170 ± 5 cm, weight 73 ± 11 kg, VO_{2peak} 37.7 ± 4.1 mL/min/kg) that trained 1.7 ± 0.3 time per week over 12 weeks (70 min 4v4 handball sessions) or an inactive control group (CG; $n = 14$, 169 ± 5 cm, 71 ± 12 kg, 38.1 ± 3.7 mL/min/kg). Physiological and psychological and motivational training adaptations were assessed pre- and post-intervention by DXA scans, blood sampling, physical tests, and questionnaires.
Results: The average heart rate (HR) over all training sessions was equal to 85% ± 6% HR_{max}. Between-group intervention effects were observed in favor of HG for muscle mass (2.1%, $p = 0.024$), proximal femur bone mineral density (0.8%, $p = 0.041$), Yo-Yo IE1 intermittent endurance test level 1 (IE1) performance (35%, $p < 0.001$), and incremental treadmill test performance (11.5%, $p = 0.003$), but not total fat mass ($p = 0.176$), mean arterial blood pressure ($p = 0.328$), resting heart rate ($p = 0.219$), or blood lipids ($p = 0.298$-0.854). In CG, no changes were observed in any of the measured physiological variables after the training period. Compared to CG, HG had an increase in intrinsic motivation ($p < 0.001$) and in the well-being subscale "energy" ($p = 0.010$).
Conclusion: Participation in regular recreational team handball training organized as small-sided games has marked beneficial effects on physical performance, musculoskeletal fitness, well-being, and motivation in untrained young women.

Keywords: Bone mineral density (BMD); Intensity; Intermittent; Motivation; Muscle mass; Physical performance; Recreational handball; Well-being

1. Introduction

The prevalence of lifestyle diseases associated with low cardiovascular and metabolic fitness is reaching pandemic proportions.[1] Thus, the expected increases in people with type 2 diabetes (T2DM) signifies the major societal challenge associated with a sedentary life.[2] It has been shown that regular participation in physical activities can markedly benefit individual health and that supervised training interventions can be used for both the prevention and treatment of lifestyle diseases.[3,4] However, the long-term adherence rates to exercise on prescription programs are poor.[5]

In Denmark, the sporting associations Danmarks Idrætsforbund and Danmarks Gymnastik & Idrætsforeninger, supported by the Danish government, have a vision that, by

Peer review under responsibility of Shanghai University of Sport.
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http://dx.doi.org/10.1016/j.jshs.2017.09.007

Please cite this article in press as: Therese Hornstrup, et al., Fitness and health benefits of team handball training for young untrained women—A cross-disciplinary RCT on physiological adaptations and motivational aspects, Journal of Sport and Health Science (2017), doi: 10.1016/j.jshs.2017.09.007

2025, 50% of the Danish population should be members of a local sporting association and 75% should be physically active.[6] The sporting associations find it difficult keeping young members interested in their teenage years and reaching out to sedentary people with no or little experience of sport where competition is not a major element.[6] Furthermore, it has been shown that the dropout rate with traditional "exercise on prescription programs" is high both in Denmark and worldwide,[5,7] and new strategies for the prevention of lifestyle diseases should be aimed at identifying activities that can motivate participants to remain active and hence provide an effective, long-lasting lifestyle change with prolonged physiological perspectives. Previous observations from studies conducted on team sport, performed as small-sided games, have shown marked beneficial health effects and development of social relationships in untrained sedentary men and women as well as people with hypertension, T2DM, and prostate cancer.[8-19] However, different team sports may attract and motivate different populations and increase individual incentive for sustained participation and therefore induce long-lasting lifestyle changes. We believe that handball is a team sport that may have great potential to reach out to sedentary populations in Denmark and other European countries because of its popularity in terms of television time, fan base, and appeal. However, it remains unknown whether small-sided handball training provides a physiological training stimulus that is as potent for fitness and health effects as small-sided football, while the motivational and psychological aspects of participation in an intervention involving small-sided handball training also remain unevaluated.

A recent study by Póvoas et al.17 concluded that handball (7v7) in 33- to 55-year-old untrained men is an intermittent high-intensity exercise mode with physical and physiological demands in the range of those found to have a positive effect on aerobic, anaerobic, and musculoskeletal fitness in adult individuals. Similarly, it seems that team sports, like other physical activity, can increase well-being in participants,[16] and it can be expected that recreational handball will produce similar effects in sedentary individuals. Also, little is known about the effects of recreational handball on motivation in sedentary individuals. However, it seems that team sports in general can be motivating for participants that are sedentary or unfamiliar with sports club participation.[15,16] From the perspective of self-determination theory,[20] team sports seem to be intrinsically motivating, meaning that individuals take part in the activity for the sake of the activity itself.[21] Research suggests that intrinsic motivation is a strong predictor of participation and adherence.[13,22]

We hypothesized that recreational handball could provide broad-spectrum fitness and health benefits analogously to recreational football, with combined effects on cardiovascular, metabolic and musculoskeletal fitness. The present study was therefore conducted with the aim of providing a novel and cross-disciplinary evaluation of cardiovascular, metabolic, and musculoskeletal adaptations, as well as well-being and motivational aspects of health, in young untrained healthy 20- to 30-year-old women following a 12-week period of small-sided 4v4 handball training.

2. Methods

2.1. Subjects

Forty-five untrained healthy 20- to 30-year-old women indicated an interest in participating in the study following an initial meeting (Fig. 1). To be eligible for participation, the subjects were not allowed to have any known familiar diseases, to be using daily medication, or to have smoked in the past 2 years. Additionally, the subjects were obliged to have a regular menstrual cycle length (25 to 32 days) with or without use of contraceptives. Furthermore, the subjects were not allowed to have been involved in any regular physical training for at least 2 years before recruitment. To ensure the subjects were untrained, they were required to have a peak oxygen uptake (VO_{2peak}) of 25-45 mL/min/kg. Three subjects did not meet the inclusion criterion for VO_{2peak} and were excluded after the medical screening. Another 2 subjects dropped out during baseline testing for personal reasons and illness, respectively. Forty subjects completed baseline testing. After baseline testing, the subjects were stratified for VO_{2peak} and body fat percentage and randomly assigned to either a handball training group (HG) ($n = 20$) or an inactive control group (CG) ($n = 20$). The groups ended up as follows before the 12-week intervention: VO_{2peak} (HG: 37.6 ± 4.1 mL/min/kg; CG: 37.7 ± 3.6 mL/min/kg), body fat percentage (HG: 36.0% ± 4.5%; CG: 35.7% ± 5.0%), and height (HG: 169.9 ± 4.9 cm; CG: 169.1 ± 5.1 cm). Two thirds of the subjects in HG had a little experience of handball, except

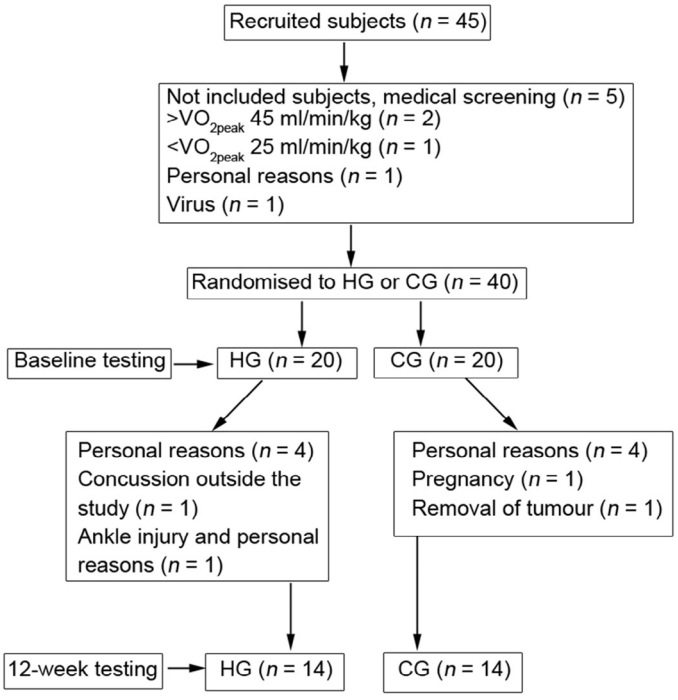

Fig. 1. Flow chart showing the process for recruiting untrained healthy 20- to 30-year-old female subjects. Forty-five women indicated an interest following an initial meeting. Forty subjects went through baseline testing and were randomized to handball training (HG; $n = 20$) or a control group (CG; $n = 20$). Twenty-eight subjects completed the 12 weeks of testing (HG; $n = 14$) and (CG; $n = 14$).

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