8 weeks of specific badminton fitness training in Danish college students improves badminton specific performance and reduces body fat – a comparison between 8 weeks of regular high school badminton training and specific badminton fitness

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Introduction
Badminton is one of the most popular sports in Asia with more than 200 mill players worldwide. However, the beneficial effect of recreational badminton activities on health and performance is not well known. In contrast, a number of studies has recently shown recreational soccer to have a major impact on bone- muscle- and cardiovascular health, most likely due to the intermittent and intense nature of soccer. In addition, the rate of perceived exertion is lower during soccer compared to jogging and interval running, despite similar relative heart rates. Interestingly, the activity profile of badminton is similar to that of soccer, with repeated high-intensity actions. Thus, it could be of interest to investigate the longitudinal effects of recreational badminton on performance and health, especially as no studies has previously done this. Thus, the aim of the present study was to investigate a newly developed Danish Badminton Fitness concept (B-FIT) on health and performance among Danish high school students, some recreationally active but none were involved in regular badminton activities.

Methods
Design
Forty-four high school students from three classes were included in the study, which consisted of an 8-week intervention period (INT) with specific testing before and after. Two classes (n=28) were selected for B-FIT, whereas the third class completed a standard high school 8-week badminton program (BAD) as planned by the PE teachers. Students with a compliance less than 85% (7 of 8 sessions attended) were excluded. All participants in the project signed informed consent adhering to the Declaration of Helsinki.

Training
B-FIT consisted of core and resisted badminton specific full body exercises in 13 double stations (26 exercises in total). Each station comprised of 30s work periods with 15s of recovery (~50 min in total). In addition, ~25 min of badminton match play per training session.
BAD consisted of ~50 min of badminton match play in combination with ~25 min of running and light core training per training session.

Testing
Testing was completed on two separate days (>36h apart) before and after INT, with anthropometrics, jump height and B-SPEED on one day and 5+20m sprint test and B-END on another day.

Anthropometry
Weight, body fat percentage and body fat- and skeletal muscle mass (SMM) was measured using a body composition analyzer (InBody230, BioSpace, Korea) under standardized conditions.

Specific badminton performance
Specific on court badminton performance was evaluated with a specific on court speed test (B-SPEED) and an endurance test (B-END).

Briefly, B-SPEED consisted of 5x4 maximal actions to four sensors located in each corner of the court, performed in a randomized order. B-END consisted of two actions to each of the four sensors
located in each corner of the court separated by 10 sec of recovery. Time to complete each rally of eight strokes decreased until exhaustion.

Non-specific performance tests
Three counter movement jumps (CMJ) were completed. In addition, a 5+20m sprint test was completed using photocells (Witty, Microgate, Italy), each subject completed 2 runs separated by a minimum of 60 seconds of recovery.

Results
Training
Total time spent on training during INT was not different between B-FIT and BAD (677±14 vs. 688±19 min).

Anthropometry
B-FIT decreased (p<0.05) body fat mass by 0.7±0.4 kg after INT, which corresponded to a 0.9% point decrease in body fat percentage. BAD did not change body fat mass (0.1±0.4kg) or body fat percentage after INT.
B-FIT and BAD increased (p<0.05) SMM by 0.4±0.3 and 0.7±0.4 kg, respectively, with the increase in BAD tending (p<0.1) to be higher than in B-FIT.

Badminton specific performance
B-FIT and BAD both improved (p<0.05) B-SPEED performance (7.2 vs. 3.0% respectively) with no difference between them (see Table 1 for PRE levels). B-FIT improved (p<0.01) B-END performance by 42%, and more (p<0.05) than BAD, who did not improve (6%; p=0.70).

Counter movement jump and 20m sprint ability
B-FIT (n=19) and BAD (n=17) tended (p<0.1) to improve CMJ height, whereas no change was observed in the 5 and 20m straight-line sprint test (B-FIT n=25; BAD n=11).

Discussion
The present study demonstrated that 8-weeks of B-FIT, but not BAD, decreased fat mass and fat percentage in high school students. In addition, badminton specific performance (B-SPEED) improved with both B-FIT and BAD whereas only B-FIT improved B-END.
The superior B-END performance after a period of badminton specific training (B-FIT) is supported by Walklate et al., reporting improved performance in a 300-meter shuttle run test as well as a custom-made badminton sprint test, while straight line sprinting was unchanged in Australian elite players following four weeks of badminton-specific repeated-sprint training. In addition, Young et al., observed training specific improvements in sprint performance (improved change-of-direction but not straight-line sprint performance) among recreationally active male subjects, emphasizing a need for badminton specific training for improvements in badminton specific performance.
Our data showed a decrease in body fat mass of 0.7±0.4 kg, which is lower than reported after 12 weeks of football training in sedentary males (2.7 kg). Discrepancies may be due to differences in training period (12 vs. 8 weeks) and weekly training volume (2-3x60min vs. 1x90 min per week). Nonetheless, despite a short intervention period in the present study, with only one weekly training session, B-FIT is effective in inducing health related changes in body-composition and improving badminton specific performance.

Perspectives
B-FIT can be integrated in normal PE lessons once a week in students PE lessons, and is effective in improving badminton specific performance and body composition, which may have a broad impact on general fitness and health. Further studies should provide an insight into the effects for groups of subjects of different age, gender, social background as well as the long-term effects and compliance in recreational B-FIT training, including the influence of training volume and intensity on the range of physiological adaptations.


