Exercise intensity of recreational sport: Impacts of sex and fitness

Dear Editor-in-Chief,

Adherence to traditional modes of exercise (running or cycling) in the general population is low. Sport is proposed as an alternative form of exercise that may induce similar health benefits while being more enjoyable and eliciting greater adherence (Berg, 2010). While several sports are classified as vigorous-intensity (>6 METS) exercise (Ainsworth et al., 2000) and participation in sport in a research setting can improve aerobic fitness (Bangsbo et al., 2010; Edgett et al., 2012) very little information is available regarding the intensity of sport in a recreational setting. It is also unclear if the intensity of sport is influenced by sex or aerobic fitness.

We examined the relative (%HRmax) and absolute (METs) intensity of sport (Soccer and Frisbee) in 49 individuals (27 male, 22 female; see Table 1 for participant characteristics) participating in intramural Men’s or Women’s Soccer, or co-ed frisbee. After providing informed consent, participants wore heart rate monitors (Polar Team2 Pro system, Polar, Lachine, QC) during two games of their intramural sport (Soccer, 80 min/game; Frisbee, 40 min/game). Player substitutions were recorded and only HR data from game play were included in final analysis. On a subsequent visit to the lab resting VO2 and HR were measured and VO2peak and HRmax were assessed using a metabolic cart (Moxus AEI Technologies, Interface Box, Pittsburgh, PA) during an incremental ramp exercise test (25W-min⁻¹) to volitional fatigue on a cycle ergometer (Monark, Vansbro, Sweden).

HR data from game play was analyzed to determine average relative intensity (%HRmax). Exercise VO2 was estimated from HR reserve using the resting and peak VO2 and HR values obtained in the lab with previously developed equations (Strath et al., 2000). METs were calculated by dividing average relative VO2 (mL·kg⁻¹·min⁻¹) by 3.5 (mL·kg⁻¹·min⁻¹ per MET). Total kcal was calculated by multiplying the total O2 consumed by 5, assuming a relationship of ~5 kcal per L of O2. Two-way ANOVAs and Tukey’s post hoc tests were used to determine the relationship of sport (Soccer and frisbee) with average HR (Men’s soccer, 164 ± 11; Women’s soccer, 157 ± 12; Men’s Frisbee, 157 ± 12; Women’s Frisbee 160 ± 13) or relative HR (%HRmax; Figure 1A). Estimated METs were significantly (P<0.05) higher in men than women (Figure 1C). Estimated total kcal were also greater (p < 0.05) in men (soccer, 890 ± 235; frisbee, 440 ± 200) than women (soccer, 508 ± 119; frisbee, 370 ± 195), but differences observed in total kcal between soccer and frisbee were absent when total exercise time was considered (kcal·min⁻¹ of game play) in both men (soccer, 7.9 ± 1.1; frisbee, 7.4 ± 0.7) and women (soccer, 4.8 ± 0.9; frisbee 5.7 ± 1.4).

No significant (p < 0.05) relationship was observed between VO2peak and average HR (slope = 0.02, y-intercept = 160, r² = 0.004), or VO2peak and relative HR (%HRmax; Figure 1B). Conversely, VO2peak was positively correlated with estimates of absolute exercise intensity (METs; Figure 1D), total energy expenditure (kcal; slope = 0.23, y-intercept = -190, r² = 0.41) and the estimated rate of energy expenditure (kcal·min⁻¹; slope = 0.002, y-intercept = -0.15, r² = 0.88).

Consistent with previous reports for participants in small sided soccer games (Randers et al., 2010) the current study demonstrates that both intramural soccer and frisbee elicit relatively high heart rates (average HR >80% of HRmax; Figure 1A) independent of sex and aerobic fitness (Figure 1B). These results indicate, in agreement with recent reports (Bangsbo et al., 2010; Edgett et al., 2012), that participation in recreational sport should be expected to elicit both cardiovascular and metabolic adaptations associated with high relative intensities of exercise (Tjonna et al., 2008).

Participation in exercise with absolute intensities above 6 METs appears important for maintaining and/or improving health (Haskell et al., 2007). While we have confirmed that the mean estimated METs in the current study (Figure 1C) are consistent with soccer and frisbee constituting vigorous intensity exercise (Ainsworth et al., 2000), the absolute intensity of exercise associated with these sports demonstrated considerable variability (ranging from ~7-15 METs; Figure 1D). Further, the current data set predicts that individuals with a VO2peak below

Table 1. Summary of participant characteristics for recreational soccer and frisbee. Values are means ± SD.

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participant</strong></td>
<td>Soccer</td>
<td>Frisbee</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>23.9 (3.1)</td>
<td>22.7 (2.5)</td>
</tr>
<tr>
<td><strong>Height (m)</strong></td>
<td>1.80 (0.7)</td>
<td>1.80 (0.6)</td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
<td>76.6 (9.1)</td>
<td>77.85 (10.3)</td>
</tr>
<tr>
<td><strong>Sum of skin folds (mm)</strong></td>
<td>63.4 (18.1)</td>
<td>72.2 (26.7)</td>
</tr>
<tr>
<td><strong>VO2peak (mL·kg⁻¹·min⁻¹)</strong></td>
<td>54.3 (6.6)</td>
<td>52.4 (9.2)</td>
</tr>
<tr>
<td><strong>HRmax (bpm)</strong></td>
<td>194 (7.5)</td>
<td>193 (13.1)</td>
</tr>
<tr>
<td><strong>BMI (kg·m⁻²)</strong></td>
<td>23.6 (2.7)</td>
<td>23.6 (2.5)</td>
</tr>
<tr>
<td><strong>Waist circumference (cm)</strong></td>
<td>82.8 (7.5)</td>
<td>82.6 (7.5)</td>
</tr>
</tbody>
</table>

BMI, body mass index; bpm, beats per minute; cm, centimetres; HRmax, maximal heart rate; kg, kilograms; m, meters; mm, millimeters; VO2peak (mL·kg⁻¹·min⁻¹), peak oxygen uptake per kilogram body weight

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~27 mL·kg⁻¹·min⁻¹ (for example sedentary or clinical populations) may not achieve an exercise intensity of > 6 METS during recreational sport (Figure 1D). This finding, combined with the positive association observed between VO₂peak and energy expenditure (kcal·min⁻¹), raises the possibility that not all participants in recreational sport may experience equal health benefits.

In summary, both soccer and frisbee appear to elicit a high relative intensity of exercise that is independent of sex and fitness. However, absolute exercise intensity (METs) and energy expenditure (kcal) are impacted by both sex and aerobic fitness suggesting that participation in sport by some populations (sedentary, overweight, clinical, or female populations for example) may not be associated with significant health benefit. While these results suggest caution when promoting recreational sport as a means of improving health there is a need for further research examining the intensity of participation in a wide range of sport, specifically in populations other than athletes and young healthy adults.

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References

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