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Letter to Editor

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 VO_2 and HR were measured and VO_2peak and HRmax were assessed using a metabolic cart (Moxus AEI Technologies, Interface Box, Pittsburgh, PA) during an incremental ramp exercise test ($25W \cdot min^{-1}$) to volitional fatigue on a cycle ergometer (Monark, Vansbro, Sweden).

HR data from game play was analyzed to determine average relative intensity (%HRmax). Exercise VO_2 was estimated from HR reserve using the resting and peak VO_2 and HR values obtained in the lab with previously developed equations (Strath et al., 2000). METs were calculated by dividing average relative VO_2 ($mL \cdot kg^{-1} \cdot min^{-1}$) by 3.5 ($mL \cdot kg^{-1} \cdot min^{-1}$ per MET). Total kcal was calculated by multiplying the total O_2 consumed by 5, assuming a relationship of ~5 kcal per L of O_2. Two-way ANOVAs and Tukey's post hoc tests were used to determine the effects of sport and sex while linear regressions were used to determine the relationship between fitness and exercise intensity. Data are expressed as Means ± SD.

No differences were observed between sex or sport for 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 ($kcal \cdot min^{-1}$ 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 VO_2peak and average HR (slope = 0.02, y-intercept = 160, r^2 = 0.004), or VO_2peak and relative HR (%HRmax; Figure 1B). Conversely, VO_2peak was positively correlated with estimates of absolute exercise intensity (METs; Figure 1D), total energy expenditure (kcal; slope = 0.23, y-intercept = -190, r^2 = 0.41) and the estimated rate of energy expenditure ($kcal \cdot min^{-1}$; slope = 0.002, y-intercept = -0.15, r^2 = 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 VO_2peak below

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

	Men		Women	
	Soccer (n = 16)	Frisbee (n = 11)	Soccer (n = 13)	Frisbee (n = 9)
Age	23.9 (3.1)	22.7 (2.5)	24.8 (2.4)	22.6 (2.7)
Height (m)	1.80 (.07)	1.80 (.06)	1.64 (.10)	1.67 (.04)
Weight (kg)	76.6 (9.1)	77.85 (10.3)	60.6 (9.6)	65.12 (9.50)
Sum of skin folds (mm)	63.4 (18.1)	72.2 (26.7)	102.9 (20.5)	100.85 (30.40)
VO_2peak ($mL \cdot kg^{-1} \cdot min^{-1}$)	54.3 (6.6)	52.4 (9.2)	43.5 (4.9)	45.4 (7.7)
HRmax (bpm)	194 (7.5)	193 (13.1)	189 (12.2)	194 (10.1)
BMI ($kg \cdot m^{-2}$)	23.6 (2.7)	23.6 (2.5)	22.3 (1.6)	23.1 (2.5)
Waist circumference (cm)	82.8 (7.5)	82.6 (7.5)	74.4 (5.7)	76.5 (7.2)

BMI, body mass index; bpm, beats per minute; cm, centimetres; HRmax, maximal heart rate; kg, kilograms; m, meters; mm, millimeters; VO_2peak ($mL \cdot kg^{-1} \cdot min^{-1}$), peak oxygen uptake per kilogram body weight

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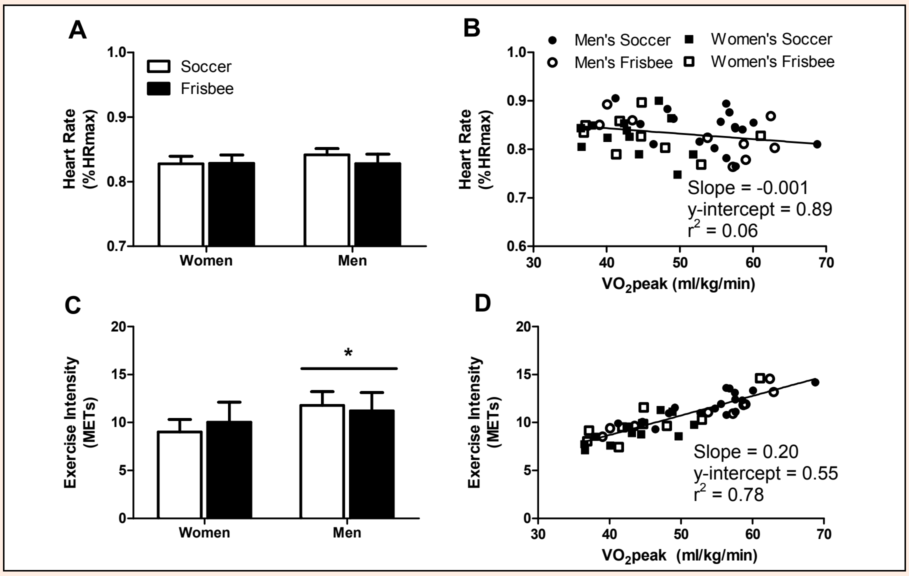

Figure 1. Average relative HR (%HRmax) for women and men participating in soccer and frisbee (A) and the relationship between aerobic fitness (VO_2peak) and average HR for all participants studied (B). Estimated exercise intensity in METs for women and men in both soccer and frisbee (C) and the relationship between aerobic fitness (VO_2peak) and estimated METs for all participants studied (D). * Significantly ($p < 0.05$) different than women.

~27 $mL \cdot kg^{-1} \cdot min^{-1}$ (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 VO_2peak and energy expenditure ($kcal \cdot min^{-1}$), 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.

J. Colin Boyd [1], Norah J. MacMillan [1], Alex E. Green [1], Jon E.D. Ross [1], David B. Thorp [2] and Brendon J. Gurd [1]✉

[1] School of Kinesiology and Health Studies, Queen's University, Kingston, Ontario, K7L 3N6, Canada

[2] Department of Human Physiology, Gonzaga University, Spokane, Washington, 99258, USA

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✉ **Brendon Gurd, PhD**

Assistant Professor, School of Kinesiology and Health Studies, Queen's University, Kingston, Canada K7L 3N6

E-mail: gurdb@queensu.ca