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Short communication

Is dog walking suitable for physical activity promotion? Investigating the exercise intensity of on-leash dog walking

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ABSTRACT

Background: Approximately a quarter of the global population is physically inactive, increasing the prevalence of chronic health conditions such as cardiovascular disease. Clearly, a population shift is needed to increase physical activity participation. Given almost half of American and Australian households have at least one dog, dog walking has the potential to increase physical activity. The objective of this study was to characterize the exercise intensity of dog walking using physiological measures to determine whether it achieved a threshold for health-enhancement.

Method: From February 2020 to September 2022, dog owners (aged > 18 years, without impediment to walking) who resided in metropolitan Sydney participated in an on-leash dog walk for a minimum of 20 minutes, while wearing a heart rate monitor and carrying a phone to track cadence, route and duration.

Results: Forty-three participants were recruited (aged 34.26 ± 16 years). Data from measures of %heart rate reserve (38 ± 10.8 %HRR), %heart rate max (61 ± 7.2 %HRmax) and average cadence (45 ± 8.4steps/min) classified dog-walking as light intensity. However, when using average walking speed (4.29 ± 0.8 km/hr) and metabolic equivalents (3.53 ± 0.6METs), the walk was classified as moderate intensity.

Conclusion: Overall, depending on the intensity measure used, dog walking was positioned in the upper range of light intensity and the lower range of moderate intensity. Although dog walking at a certain intensity may be difficult to prescribe as strategy for meeting current moderate-to-vigorous focused physical activity recommendations, it should be recognised as a beneficial activity that may reach moderate intensity on some occasions.

1. Introduction

Physical inactivity is an urgent global health concern which has not improved in decades. Currently, 28 % of the adult population and 37 % of adults in high-income countries are physically inactive (Guthold et al., 2018). The World Health Organization recommends all adults complete 150–300 min of moderate- or 75–150 min of vigorous-intensity physical activity (PA) per week to reduce the risk of premature mortality, cancer, cardiovascular disease, diabetes and mental illness (Bull et al., 2020). Higher PA intensity to reach moderate or vigorous exertion has been associated with additional health benefits (Bull et al., 2020; Stamatakis et al., 2022).

Given the rising popularity of dog ownership, especially in developed countries (American Veterinary Medical Association, 2022), and the unique nature of the human–dog bond, dog walking has been proposed as an intervention to increase population PA (Christian et al., 2018). However, estimating the power of dog walking as a health promotion tool has been hindered by our poor understanding of the

Abbreviations: HR, heart rate; HRR, heart rate reserve; METs, metabolic equivalents; GPAQ, global physical activity questionnaire; PA, physical activity.

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intensity of dog walking. One study to date has investigated the physiological intensity of dog walking using owners' heart rate (HR), finding 63 % of dog walking was very light intensity and 27 % was light intensity (Hielscher, Ganslosser and Froboese, 2020). Two other studies, using accelerometry and self-reported data (Dall et al., 2017; Richards, Troped and Lim, 2014), classified dog walking as moderate-intensity PA. For example, a pilot study in the United States found dog owners (N = 65) accumulated an average of 23 min of moderate-to-vigorous intensity PA during daily dog walks (Richards, Troped and Lim, 2014). The goal of this study was to characterize the exercise intensity of dog walking using absolute and relative physiological measures.

2. Methods

2.1. Study sample

This cross-sectional, observational study was conducted between February 2020 and September 2022 in Sydney, Australia. A convenience sample of participants was recruited through social media, printed advertisements and word of mouth. To be eligible, dog owners had to be ≥ 18 years old, walk their dog on-leash ≥ 4 times per week, have no physical limitations affecting their walking ability, reside in metropolitan Sydney, and speak English fluently. Dog owners who owned multiple dogs were asked to walk only one dog. Dogs had to be ≥ 1 year old, weigh between 5 and 32kgs, have an absence of physical limitations that could impact walking ability, and not be part of a brachycephalic breed given the increased risk of exercise intolerance (Fawcett et al., 2018). The study was approved by the University of Sydney Human Research Ethics Committee (2019/988). All participants provided written informed consent.

2.2. Procedure

Data were collected during a single visit to the participant's home, plus self-recording of the number and duration of dog walks over the subsequent seven days to describe habitual dog walking patterns (Appendix A). During a seated, resting baseline, participants completed the dog walking questionnaire, which reflects typical dog walking patterns (Appendix B), and the Global Physical Activity Questionnaire (GPAQ) which enquires about PA in a typical week (Armstrong and Bull, 2006). After 10 min of seated rest, blood pressure was measured twice with a one-minute interval between measures and averaged for descriptive purposes (OMROM HEM-8712). HR was recorded continuously (WAHOO TICKR X) throughout baseline and the recorded dog walk. Resting HR was the average taken from minute 10 of rest. The HR monitor was connected to the WAHOO Fitness app on a study mobile device (LG K42) for data collection. Participants self-reported height and weight.

After baseline measurements, participants completed a dog walk ≥ 20 min along a typical route without the researcher. During the walk, participants carried the study mobile device in a trouser pocket (LG K42) to record the total distance, speed, moving time, elapsed time (via the WAHOO Fitness app), cadence and elevation change (through the STRAVA app) using GPS and accelerometry. Participants were instructed not to use the study phone whilst walking.

2.3. Data analysis

PA volume (metabolic equivalent (MET) minutes/week) were calculated for each participant using the GPAQ data. These values were then classified as achieving or not achieving the recommended PA guidelines of > 600 MET minutes/week (World Health Organisation, 2002). We calculated %heart rate reserve (HRR), %HRmax, mean walking speed (km/hr), mean walking cadence (steps/min) and METs from relative VO_2 as indicators of exercise intensity. Participant's HRmax was predicted using the equation, HRmax = 207-(0.7xage) (Gellish et al., 2007). Absolute HRR was calculated using the formula HRmax-restingHR and %HRR was calculated using [(meanHRofwalk-restingHR)/HRR]x100. %HRR was then categorised into light (20 < 40 %HRR), moderate (40 < 60 %HRR) and vigorous intensity (60 < 85 %HRR) (American College of Sports Medicine et al., 2018). %HRmax was also categorised into light (57 < 63 %HRmax), moderate (64–76 % HRmax) and vigorous intensity (77–95 %HRmax) (American College of Sports Medicine et al., 2018). The maximum HR value achieved during the walk was also noted for each participant. Cadence values were categorised into light (<100 steps/min), moderate (≥100 steps/min) and vigorous (≥130 steps/min) (Tudor-Locke et al., 2019). We identified two physiologically impossible cadence values which were removed based on a standard deviation greater than three from the mean. Relative VO_2 of the observed walk was calculated as $VO_{2total} = 7.15 + 5.97x (V^2/Ht)$ (Ludlow and Weyand, 2016), whereby V is walking speed in meters/second and Ht is the participant's height. METs were subsequently calculated using $VO_{2total}/3.5$. We calculated stops as ≥ 3 s at absolute 0 km/hr as 3 s captured most stops that participants experienced. As the dog walks differed in length, we calculated the number of stops as a relative average (per 30 min) and raw number in the first 20 min of the walk (i.e., the minimum walk duration). An independent samples T-test was used to compare the number of stops between female and male dogs. Descriptive analyses were used to summarise all variables. Data are presented as mean(SD) unless indicated otherwise. Statistical analyses were conducted in IBM SPSS Statistics Version 27. P values < 0.05 were considered statistically significant.

3. Results

Of the 43 participants, approximately 2/3 were female (n = 27) with an average age of 34.26 years (±16.22, range 18–66) and an average body mass index of 24.56 (±3.86) kg/m^2. Average systolic blood pressure was 123 (±8.75) mmHg, diastolic blood pressure was 78 (±7.35) mmHg and average habitual reported MET minutes was 1450.47 (±1277.95) minutes. The self-reported dog walking questionnaire, which reflects habitual dog walking patterns, showed dog owners walked their dogs on leash 1.36 (±1.11) times for 38.72 (±24.15) minutes per day. However, the dog walking log showed participants walked their dogs less often in the seven days after the recorded walk (5.26 ± 3.59 times/week for 35.75 ± 13.30 min/walk).

Based on %HHR (<40 %HRR) and %HRmax (<65 %HRmax), the recorded dog walk was classified as light intensity (Table 1). We were unable to retrieve 10 participants' cadence data as researchers used a different STRAVA account and cadence could not be extracted. However, using the mean cadence from participants with valid data (n = 33), approximately 1/3 (29 %) of the walk was classified as stopped/incidental moving and 2/3 (71 %) was purposeful slow walking. No participants walked at a moderate intensity (>100 steps/min). Using the mean walking speed including and excluding stops > 3 s, the recorded dog walk was moderate intensity based on the 2011 Compendium of Physical Activities (>4.0 km/hr) (Ainsworth et al., 2011). The average calculated METs, derived from the calculated relative VO_2, were 3.53 METs (±0.61), classifying it as moderate intensity.

In the first 20 min of the dog walk, owners of male dogs (n = 24, 56 %) stopped 10 (±5.77) times compared with owners of female dogs who stopped 11 (±5.67) times (p = 0.754). Similarly, when analysing > 3 s stops per 30 min, there was no difference (p = 0.649) between the owners of male and female dogs. Owners of male dogs stopped 15 (±8.62) times and owners of female dogs stopped 16 (±8.22) times.

4. Discussion

Dog walking is a rapidly growing area of research, particularly in the context of an increasingly inactive population and the need to find cost effective strategies to increase PA (Christian et al., 2018). The current findings reveal that, among adult dog owners in the Sydney

Table 1
Descriptive characteristics of the recorded dog walks among adult dog owners in Sydney, Australia between February 2020 and September 2022.

Dog Walk Characteristics		Mean (SD)	Exercise Intensity Boundaries
Distance (km)		2.34 (0.84)	
Total time (min:sec)		34:44 (10:15)	
Elevation gain (m)		26.67 (17.38)	
No. of > 3 s stops in the first 20 min of recorded dog walk		11 (5.67)	
No. of > 3 s stops per 30 min		16 (8.36)	
Calculated relative VO_2 (ml/kg/min)		12.37 (2.13)	
Mean HR recorded (bpm)		108 (13.28)	
Mean maximum HR recorded (bpm)		137 (16.10)	
Mean %HRR	Mean HR during dog walk	38.11 (10.81)	Light (20 < 40 %HRR) Moderate (40 < 60 % HRR)
	Max HR during dog walk	60.55 (12.83)	
Mean % HRmax	Mean HR during dog walk	60.96 (7.18)	Light (57 < 63 %HRmax) Moderate (64 < 76 % HRmax)
	Max HR during dog walk	75.07 (8.35)	
Mean walking speed including stops (km/hr)		4.29 (0.82)	Light (<4.0 km/hr) Moderate (≥4.0 km/hr)
Mean walking speed excluding stops (km/hr)		4.61 (0.73)	Light (<4.0 km/hr) Moderate (≥4.0 km/hr)
Mean walking cadence (steps/min)		45.34 (8.40)	Light (<100 steps/min) Moderate (≥100 steps/min)
Calculated METs from relative VO_2		3.53 (0.61)	Light (1.6 < 3 METs) Moderate (3 < 6 METs)

HR (heart rate), HRR (heart rate reserve), METs (Metabolic Equivalents)

metropolitan area, on-leash dog walking fell in the upper end of light- and lower end of moderate-intensity PA. On-leash dog walking may not be appropriate as a sole form of PA to achieve recommended PA intensity guidelines (Bull et al., 2020).

Dog walking was light intensity using %HRR, %HRmax and mean walking cadence, but moderate intensity using calculated METS and average walking speed (including and excluding stops). The intensity classification also differed across individualized and non-individualized indicators. Of three outcome measures that were individualized according to the participant's age and height (%HRR, %HRmax and calculated METs), two indicated dog walking was light intensity (%HRR and %HRmax) and one indicated moderate intensity (calculated METs). Among non-individualized indicators, mean cadence was light intensity and mean speed (including and excluding stops) was moderate intensity. Non-individualized measures provide intensity estimates for most healthy adults, but variations in age and fitness levels add known error to these estimates. Although individualized, calculated METs also fail to account for variations in fitness levels. Given the eligibility criteria required owners to walk their dog at least 4 times per week, we may have selected a sample who are more active than the general population, perhaps explaining the discrepancy between HR, calculated METs and walking speed. Cadence showed the greatest discrepancy from other measures, including a disconnect from walking speed. Cadance has been questioned as an indicator of intensity by previous studies comparing laboratory and field walking with error due to varying step lengths (Schantz et al., 2022). Here, there is also the possibility of measurement error from the mobile device.

Our findings are similar to those of Hielscher, Ganslosser and Froboese (2020) who concluded dog walking was light intensity, based on HR, but differ from Richards, Troped and Lim (2014) and Dall et al. (2017) who classified it as moderate intensity, based on cadence from accelerometry data. The inconsistency among studies may stem from differing measures of exercise intensity, highlighting the need for measures of relative intensity in future studies. That said, Dall et al. (2017) focused on older adults who may have particular dog walking patterns and motivations that affect intensity and duration (Westgarth et al., 2021).

Recent research shows brief bouts of high intensity PA may elicit health benefits (Stamatakis et al., 2022). In the current study, 90 % of participants had a highest recorded HR above the moderate threshold indicating that at least some of the walk was within moderate-vigorous intensity brackets. The health impacts of brief bouts of higher intensity dog walking warrant future consideration.

We found great variability in the number of times that dog owners stopped during the walk (3 to 48 times), although the mean walking speed did not significantly differ when including or excluding stops. Walking at oscillating speed, with accelerations and deceleration, typically requires greater energy expenditure than travelling at constant speed, especially with wider oscillations such as stopping and starting (Minetti et al., 2001). Repeated stopping and starting during dog walking may magnify the intensity of the exercise; a prospect that could be unpacked using direct measures of VO_2. Feral dog studies show that male dogs stop more frequently than females to mark their territory (Pal, 2003), although we found no association between the number of stops and dog sex. The difference in stops across the sample suggests other canine characteristics may affect dog walking patterns. We did not investigate dog breed, size, age, behaviour, health status, or density of urbanisation, all of which could also affect the number of stops and exercise intensity. Further research is needed to understand when and for whom dog walking may promote health. Breed may be a particularly salient factor, given the rising popularity of brachycephalic dogs whose compromised airways regularly decrease their walking ability (Fawcett et al., 2018).

This study focused solely on on-leash dog walking. Other dog-related physical activities, such as running in the park, may reach moderate-to-vigorous intensity which could increase health benefits and provides an opportunity for future research. The sample may not be representative of the general dog-owning population given the eligibility criteria required owners to walk their dog at least 4 times per week. The study is also limited by the small sample size and the use of convenience sampling. The canine weight limitation may have excluded very small or very large dogs, so further research is needed to confirm our findings are generalizable across diverse canine populations.

Overall, our data suggest on-leash dog walking lies within the upper end of light intensity and the lower end of moderate intensity, depending on which intensity indicator is used. Although prescribing dog walking to achieve moderate-intensity PA recommendations may be an uncertain strategy, it is important to recognise that any type, intensity and volume of activity is beneficial (Bull et al., 2020). Dog walking should be seen as a component of health promotion in combination with other, higher-intensity activities.

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CRediT authorship contribution statement

Crystal Li: Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Data curation. **Lauren Powell:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization. **Emmanuel Stamatakis:** Writing – review & editing, Methodology, Conceptualization. **Paul McGreevy:** Writing – review & editing, Methodology, Conceptualization. **Anthony Podberscek:** Writing – review & editing, Methodology, Conceptualization. **Adrian Bauman:** Writing – review & editing, Methodology, Conceptualization. **Kate Edwards:** Writing – review & editing, Supervision, Software, Resources, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2024.102715.

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