HUMAN MOVEMENT (ISSN 1899-1955)
2024; 25(4): 138–146

Acute effects of a dog sport on fitness parameters in young adults: a randomised controlled crossover study

original paper
DOI: https://doi.org/10.5114/hm/196835

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ABSTRACT
Purpose. Previous studies have shown that dog walking could be an effective strategy for increasing physical activity (PA). However, no studies have investigated the impact of dog sports on fitness parameters. This pilot study aimed (a) to evaluate the acute effects of a dog agility course on fitness parameters in young adults and (b) to determine any acute differences after the execution of the dog agility course with and without the dog.
Methods. In this randomised crossover study, ten physically active young women performed a dog agility course in two different conditions (i.e., with and without the dog). Fitness parameters were recorded using a smartwatch before the dog agility course (T_0), immediately after (T_1), and 10 minutes after the cool-down phase (T_2). Moreover, the subjective level of perceived exertion during exercise was assessed using the Borg category-ratio scale (Borg CR-10).
Results. Results showed significant differences in the number of steps (p = 0.011), walking time (p = 0.006), average heart rate (HR) (p = 0.004), maximum HR (p = 0.003), and perceived exertion (p = 0.007) between the two conditions at T_1. Furthermore, significant differences were found for both the average HR and the perceived exertion parameters for both conditions in the three time points (T_0, T_1, T_2).
Conclusions. Our preliminary results suggest that practising a dog sport could be as effective as other sports and induce several health benefits.
Key words: health promotion, walking, green exercise, outdoor exercise, dog walking, dog agility

Introduction

The scientific literature has amply demonstrated the beneficial effects of physical activity (PA) on health-related physical fitness parameters in all ages [1–3]. In this line, to increase participation in PA for psycho-physical well-being, the prevention of pathologies, and the reduction of sedentary behaviours, it has been suggested that governments adopt various strategies and also promote alternative and feasible programs [4]. These include green exercise and the use of technological and digital tools [5, 6]. Among the types of PA, walking is the most common and easiest form, accessible to the general population, and does not require equip-

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Received: July 05, 2024
Accepted for publication: December 04, 2024

Citation: Giustino V, Leale I, Cicero L, Petrigna L, Nigro ML, Fontana V, Mignosi E, Cataldo P, Macaluso A, Gómez-López M, Cassata G, Battaglia G. Acute effects of a dog sport on fitness parameters in young adults: a randomised controlled crossover study. Hum Mov. 2024;25(4):138–146; doi: https://doi.org/10.5114/hm/196835.

ment, economic investments, and pre-existing sports skills [7, 8]. From this perspective, several research groups have long investigated the effectiveness of walking on physical health [9–12]. Although walking can differ widely in terms of frequency, intensity, and volume, evidence suggests that even recreational walking can induce health benefits on cardiovascular function, body mass index, and body balance [13–16].

In turn, considering the large number of families who own a dog, encouraging walks with the dog (i.e., dog walking) could be an effective strategy for increasing the level of PA in the general population [17]. As a matter of fact, there is a growing body of evidence suggesting that dog walking is a practice that induces dog owners to have higher levels of PA and lower measures of sedentary behaviour than non-dog owners [18–20]. In a seminal work on this topic, Coleman et al. [21] reported that dog walking is associated with a higher level of moderate to vigorous PA (MVPA) compared to both dog owners who do not walk their dogs and non-dog owners. This can be attributed, in part, to the fact that owning a dog provides the motivation to walk with them [22, 23]. Moreover, participating in PA with the dog seems to positively affect many psychophysical and social domains as body weight, cardiovascular function, social interactions, and emotional health [17, 22].

Although previous studies have shown that owning a dog, as well as walking a dog, increases the level of PA and improves health-related physical fitness compared to non-dog owners [24–26]. Very few studies have investigated the impact of dog sports on people [27]. Dog sports have increasingly been practised in the world over the years and include all those disciplines that dog owners (specifically referred to as dog handlers) practice with their dogs. Among these, dog agility is a sport that consists of an obstacle course that includes jumps and tunnels that the dog, guided by the handler, must perform in a specific order, in the shortest possible time, and with the least number of penalties. Although studies have investigated the effects of dog walking on humans, as far as we are aware, few research groups have studied the aspects of dog handlers who practice dog agility [27, 28], and no studies have investigated the impact of dog agility on a dog handler's fitness parameters.

Hence, this pilot study aimed to (a) evaluate the acute effects of a dog agility course on fitness parameters (such as number of steps, walking time, distance covered, average pace, energy expenditure, average and maximum heart rate (HR), and perceived exertion level) in physically active young adults and (b) determine any acute differences in these fitness parameters after the execution of the dog agility course with and without the dog.

We hypothesise that a dog agility course can increase all of the aforementioned parameters in dog handlers except for walking time.

Material and methods

Study design

This study used a randomised controlled crossover design. All participants performed a dog agility course in two different conditions (i.e., with and without the dog), with a washout period of one week between the two conditions [29].

Participants

Participants were recruited from a dog sports club in Palermo, Italy. The research was presented to the staff of the dog sports club and the invitation to participate was spread among the members of the dog sports club. The participation was on a voluntary basis by providing written informed consent.

To participate, the inclusion criteria were (1) age between 18 and 35 years, (2) normal weight, (3) level of PA sufficiently active, and (4) one year of dog agility background. Although thirteen participants were recruited, two of them were not eligible for inclusion (> 35 years), and one participant dropped out of the study. Thus, 10 young female participants (age: 24.3 ± 3.66 years; height: 1.63 ± 0.07 m; weight: 55.6 ± 7.05 kg; BMI: 20.93 ± 1.34 kg/m^2), who had been practising dog agility for at least one year, were enrolled for the study.

Eligibility assessment

Age classification

Considering the 5 following age categories: young (≤ 25 years), young adults (25 < years ≤ 35), adults (35 < years ≤ 55), senior adults (55 < years ≤ 65), and elderly (> 65 years) [30–32]; we included only young (excluding minors) and young adults in the study.

Anthropometric measures

An electronic scale (maximum recordable weight: 300 kg; resolution: 100 g; Seca; Hamburg, Germany) was used to measure body weight, and a standard stadiometer (maximum recordable height: 220 cm; resolution: 1 mm) to determine height. Body mass index

(BMI) was computed as body weight divided by height squared (kg/m^2). Based on the following standard BMI categories: underweight (BMI < 18.5), normal weight (18.5 ≤ BMI < 25), overweight (25 ≤ BMI < 30), and obesity (BMI ≥ 30) [33]; we only considered people with normal weight.

Physical activity level assessment

The International Physical Activity Questionnaire – Short Form (IPAQ-SF), an instrument to detect the level of PA during the last 7 days or a usual week, was administered to all participants [34]. Through the frequency (days) and the duration (minutes) spent for each PA intensity (i.e., vigorous activities, moderate activities, walking, and sitting), we calculated the total weekly PA as reported in the "Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) – Short and Long Forms" (http://www.ipaq.ki.se). In detail, we used the corresponding metabolic equivalent task (MET) assigned to each type of PA (i.e., 3.3 for walking, 4.0 for moderate-intensity physical activities, and 8.0 for vigorous-intensity physical activities) [35]. Hence, to calculate the total weekly energy expenditure, we multiplied the MET of each type of PA for the minutes of practice over the last seven days and then we summed the results (i.e., for walking, moderate-intensity physical activities, and vigorous-intensity physical activities). According to the abovementioned IPAQ scoring protocol, participants were classified into the 3 following categories of PA: low active, moderate active, and high active. For the study, we only considered moderately active people.

Procedure

Participants were randomised in a crossover design between two conditions for performing the dog agility course: with and without the dog. Five participants performed the dog agility course first with the dog and then, after a washout period of one week, without the dog; the other five participants performed the same dog agility course in reverse order. Figure 1 shows the flow diagram of the study.

The dog agility course was 56.87 m long and consisted of 12 obstacles: 10 jumps and 2 tunnels. The course was designed with a minimum and maximum distance between obstacles of 5 and 8 m, respectively (Figure 2). For the jumps, the bar was 50 cm high and 120 cm wide; for the tunnels, the diameter was 60 cm and the length was 525 cm.

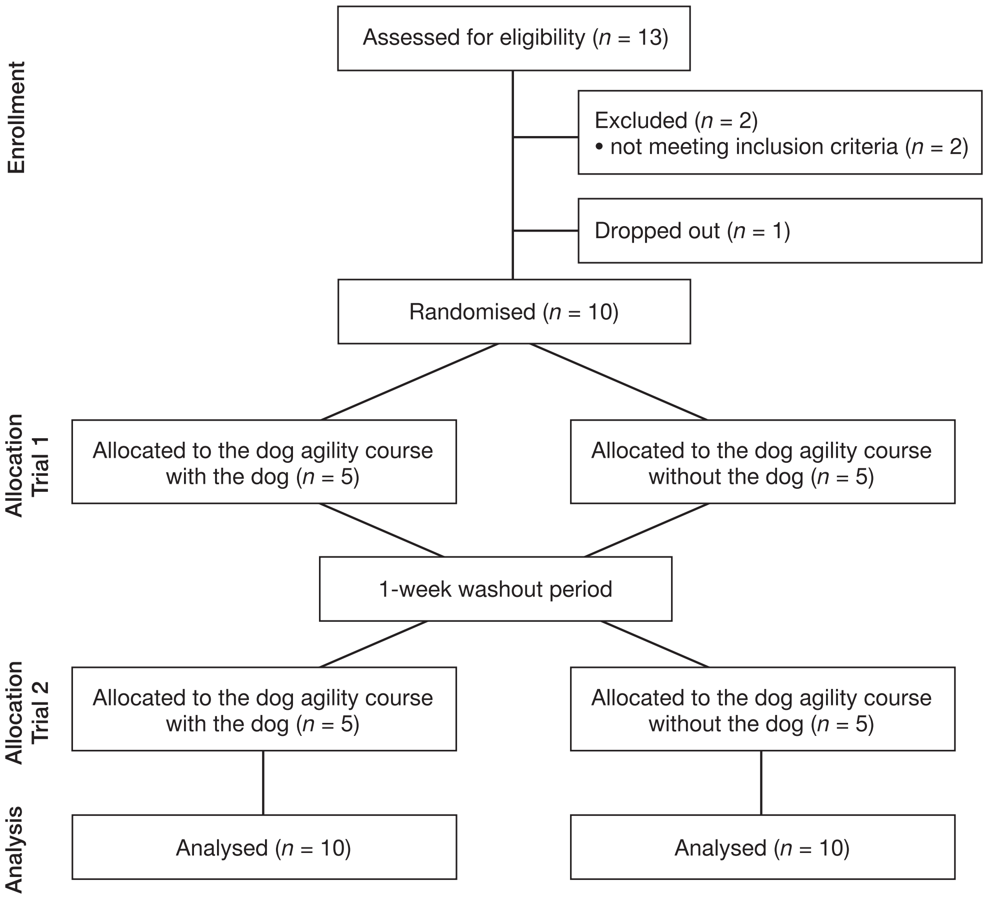

Figure 1. Flow diagram

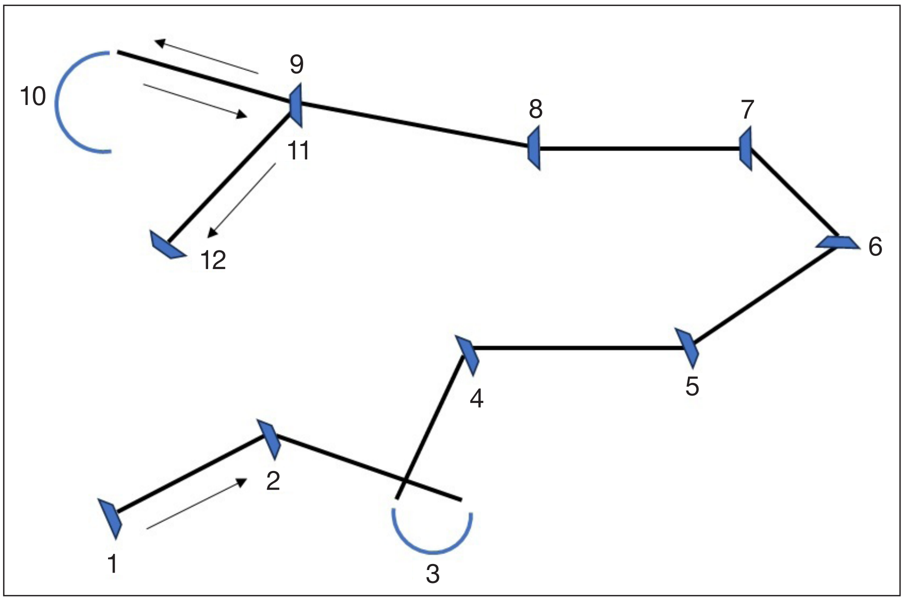

Figure 2. Dog agility course

Prior to the dog agility course, a 10-minute warm-up phase consisting of exercises aimed at improving joint mobility and engaging the major muscle groups was conducted. Following the dog agility course, a 10-minute cool-down phase, which included leisure exercises and walking, was carried out. Three time points of measurement were included: before the dog agility course (T0), immediately after the dog agility course (T1), and 10 minutes after the end of the cool-down phase (T2). At T_0 and $T_{2,}$ the average HR (bpm) and the perceived exertion level were measured; whereas at $T_{1,}$ the number of steps, walking time (s), distance covered (km), average pace (min/km), energy expenditure (cal), average and maximum HR (bpm), and perceived exertion were assessed.

Parameters were recorded using a fitness smartwatch (Fitbit Blaze, San Francisco, CA, USA) selected based on the validity and reliability of the device [36, 37]. Participants were asked to wear the instrument on the non-dominant wrist at all three time points (i.e., T_0, T_1, and T_2) for both conditions (i.e., with and without the dog).

The subjective level of perceived exertion during exercise was assessed using the Borg category-ratio scale (Borg CR10) [38]. This scale from 0 (no perceived exertion) to 10 (maximum perceived exertion) allows individuals to report the internal intensity of the exercise [38].

Statistical analysis

Statistical analysis was conducted using R (R Core Team; Vienna, Austria) with a significance level set to < 0.05. Considering the small sample recruited, a non-parametric analysis was performed. For ordinal data, a Wilcoxon matched-pairs signed ranks test was used to compare medians between each set of matched pairs (i.e., with and without the dog) for all the parameters (i.e., number of steps, walking time, distance covered, average pace, energy expenditure, average and maximum HR, and perceived exertion). The Friedman test for randomised complete block designs was adopted to detect any differences between the variables considered (i.e., average HR and perceived exertion) in the two conditions (i.e., with and without the dog) measured at the different time points (T_0, T_1, T_2).

Results

The Wilcoxon matched-pairs signed ranks test revealed significant differences in the number of steps (p = 0.011), walking time (p = 0.006), average HR (p = 0.004), maximum HR (p = 0.003), and perceived exertion (p = 0.007) between the two conditions immediately after (T_1) the dog agility course. In particular, for all these parameters, higher values were found in the execution of the dog agility course with the dog. No significant differences were found in distances covered (p = 0.104), average pace (p = 0.348), and energy expenditure (p = 0.102), between the two conditions, as reported in Table 1.

Furthermore, among the parameters considered, the comparison of both the average HR and the perceived exertion (which were measured at T_0, T_1, and T_2) showed significant increases in all three measurement times (T_0, T_1, T_2) in the condition with the dog compared to without the dog.

As reported in Table 2, the Friedman test for randomised complete block design analysis showed sig-

Table 1. Statistical analysis of parameters considered using the Wilcoxon matched-pairs signed ranks test

Parameter	Condition	Mean	*SD*	*p*-value (Wilcoxon)
Number of steps	dog condition no-dog condition	62.8 41.5	27.93 10.27	0.011
Walking time (s)	dog condition no-dog condition	36.5 21.3	16.35 2.76	0.006
Distance covered (km)	dog condition no-dog condition	0.03 0.02	0.02 0.01	n.s.
Average pace (min/km)	dog condition no-dog condition	15.61 14.33	4.15 5.25	n.s.
Energy expenditure (cal)	dog condition no-dog condition	3 1.3	3.07 1.62	n.s.
Average HR (bpm)	dog condition no-dog condition	99.7 79.8	10.31 10.18	0.004
Maximum HR (bpm)	dog condition no-dog condition	107.6 85.7	10.22 9.65	0.003
Perceived exertion	dog condition no-dog condition	4.1 2.2	1.04 1.17	0.007

n.s. – not significant

Table 2. Statistical analysis of parameters considered using the Friedman test

Parameter	Condition		T_0	T_1	T_2	*p*-value (Friedman)
Average HR (bpm)	no-dog condition	mean SD	65.1 3.81	79.8 10.18	68.5 8.66	0.0001
Average HR (bpm)	dog condition	mean SD	72.8 6.37	99.7 10.31	81.7 12.28	0.0004
Average perceived exertion	dog condition	mean SD	1 1	4.1 1.04	1.2 0.75	0.0003
Average perceived exertion	no-dog condition	mean SD	0.6 1.02	2.2 1.17	0.7 0.78	0.0001

nificant differences for the average HR and the perceived exertion parameters for both conditions in the three time points (T_0, T_1, T_2). In detail, the values found for the average HR in the condition with (p = 0.0004) and without a dog (p = 0.0001) and for the perceived exertion in the condition with (p = 0.0003) and without a dog (p = 0.0001) at T_0, T_1, and T_2 were not equivalent to each other.

Discussion

The purpose of this study was to examine the acute effects on fitness parameters such as number of steps, walking time, distance covered, average pace, energy expenditure, average and maximum HR, and perceived exertion level in young adults who performed the same dog agility course in two different conditions, i.e., with and without the dog.

Our hypothesis was to detect, after the execution of the course with a dog, an increase in the number of steps, distance covered, average pace, energy expenditure, average and maximum HR, and perceived exertion level, and a decrease in walking time. Our hypothesis was based on the fact that the dog could have increased the intensity of the physical exercise because (1) the participants were pushed to motivate the dogs to perform the course in the shortest possible time; (2) the participants could have indicated the course to the dogs and given indications on overcoming obstacles.

Results showed a significant increase in the number of steps (p = 0.011), walking time (p = 0.006), average HR (p = 0.004), maximum HR (p = 0.003), and perceived exertion (p = 0.007) during the execution of the course with a dog. In contrast with our hypothesis, we found a significant increase in walking time and no significant difference in distance covered, average pace, and energy expenditure.

Although a growing body of evidence suggests that dog walking has positive effects on several physical characteristics in dog handlers [18–20], no studies have focused on the benefits of dog sports on dog handlers.

As for the increase in the number of steps we found, this could be partially explained because, to stay as close as possible to the dogs, participants took shorter steps or even approached the obstacle to indicate it to the dogs. This could also be related to the increase in walking time found. Powell et al. [39] showed that dog ownership is associated with a higher daily number of steps and higher weekly time spent walking, with results suggesting dog acquisition increases PA levels in a short time. Here, we also found that these parameters can increase after a single session of a dog sport performed with the dog than without. Although the number of steps increased, the distance covered, and the average pace did not change significantly, and this outcome could be related to the length of the course, which was the same in both conditions. A recent study by Machová et al. [40] showed that dog owners spent more time in PA during a week and reported higher energy expenditure levels compared with non-dog owners. However, no previous studies have investigated the impact on energy expenditure in dog handlers after a session of any dog sport. We found no difference in calories burned after a dog agility course between the conditions with and without a dog. This could be explained due to the type and intensity of the dog sport we examined. However, in contrast with our findings, Engelberg et al. [18] detected that dog owners showed 4–5 more minutes/day of MVPA than non-dog owners. Performing the course with the dog resulted in greater perceived exertion than executing the course without a dog. This finding can be explained by the increase in cardiovascular function (increase in average HR and maximum HR) found. Indeed, it is known that the perceived exertion level measured by the Borg scale is strongly correlated with the HR detected during exercise [41]. Although the cardiovascular benefits of dog walking have been reported by many research groups, no studies have so far examined the effects on the cardiovascular function of a dog sport [17, 22]. Based on our outcomes, increased HR responses to exercise seem to be associated with the presence of the dog. Among other outcomes, Sirard et al. [42] found that dog ownership increases the metabolic equivalent per minute/week, and calorie expenditure. The greater perceived exertion could also be explained by the attention that owners must pay to their dogs [43, 44]. Indeed, the owner-dog relationship of gaze average length and gaze frequency may have played a primary role as dog agility shifts the gaze to the owners more frequently than assistance dogs or untrained dogs [43]. Although no study has investigated the effectiveness of dog sports, which are increasingly practised, on owners' physical characteristics, previous studies have already reported that dog owners engage more in the practice of walking and PA, and these findings align with our results. Indeed, in recent years, the research has focused more on the beneficial effects of owning a dog on the practice of PA. A recent scoping review aimed to investigate the association between PA in young people and the presence of a dog in the family demonstrated that walking and playing with the dog increased the level of PA in dog owners [45]. The authors concluded that suggesting and promoting awareness campaigns on the importance of owning dogs to increase the practice of PA in young people, emphasising the importance of walking and playing with them daily to achieve this goal [45]. Similarly, in the scoping review by Chase et al. [46], the authors stated that walking and playing with a dog are favourable strategies for increasing the level of PA in young people by detecting this positive association in the majority of the articles included. A previous review summarized the articles that compared the level of PA of dog owners and non-dog owners, showing that dog owners reported higher walking and PA practice than non-dog owners, with effect sizes from small to moderate [47]. The above-reported findings are in agreement with our preliminary results suggesting that practising sports with the dog could be as effective as other sports. However, due to the lack of studies, more research is needed on this topic to confirm the contribution of any dog sport on fitness parameters in dog handlers. Of interest is a study by Krøger et al. [48] in which authors explored the effectiveness of agility activity with dogs to motivate less active children to participate in PA. This research highlighted that dog agility appeared to motivate less active children to engage in challenging PA [48]. The main limitation of the present pilot study is the lack of literature on this topic. However, this could also be the major strength of the study which, in this regard, intends to provide a fundamental contribution to this field of research. Moreover, a limitation of the study is the small sample size which may not be representative of the general population. Among the limitations of the study, it is necessary to mention the IPAQ as an eligibility instrument for the sample which, being self-reported, increases the risk of self-reporting bias. Moreover, it should be mentioned that this study explored the acute effects of the practice of a dog sport. Thus, longitudinal studies could be useful to provide stronger causal evidence on the relationship between PA and dog ownership.

Conclusions

Considering the already known effectiveness of all animal-assisted activities, dog sports such as dog agility, could be useful also for populations with disorders/disabilities [49–51]. Having a dog could increase the physical level of people. Doing sports with the dog could be an effective alternative strategy to increase the practice of PA and reduce sedentary behaviours with consequent beneficial effects on psychophysical health. Furthermore, since it is an outdoor exercise, it could also be recommended in particular socio-sanitary conditions, such as during the most recent pandemic [52]. As a matter of fact, in a study that investigated dog walking before and during the COVID-19 pandemic lockdown, the authors highlighted that this could be a public health strategy in cases of lockdowns/disasters/emergencies that may occur in the future [53]. Moreover, dog sports are accessible to the general population, and do not require equipment, economic investments, and pre-existing sports skills.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Bioethics Committee of the University of Palermo (approval No.: 109/2022).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Conflict of interest

The authors state no conflict of interest.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Funding

This research received no external funding.

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