Continuous and interval training programs using deep water running improves functional fitness and blood pressure in the older adults

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Abstract This study aimed to investigate the effects of two periodized training programs of deep water running on functional fitness and blood pressure in the older adults. Thirty-six individuals were divided into continuous group (CONT) and interval group (INT). Both groups were trained for 28 weeks (twice weekly). Measures were performed before the training period, after 12 weeks and training period. Two-way ANOVA and post hoc of Bonferroni were used ($\alpha = 0.05$). There were no differences between groups in functional tests, with the exception of the flexibility of the upper limbs, in which the INT group showed the highest values. There was a significant improvement in both groups of foot up-and-go test (CONT 6.45 to 5.67; INT 6.59 to 5.78, in seconds), flexibility of lower limbs (CONT -4.76 to -0.61 ; INT 0.54 to 4.63 , in centimeters), strength of upper (CONT 18.76 to 27.69 ; INT 18.66 to 26.58 , in repetitions) and lower limbs (CONT 14.46 to 21.23 ; INT 14.40 to 21.58 , in repetitions), and 6-min walk (CONT 567.50 to 591.16 ; INT 521.41 to

582.77 , in meters). No differences were shown between groups for systolic blood pressure; however, diastolic blood pressure remained higher in CONT during all training. The blood pressure decreased significantly in both groups after the training (CONT $142 \pm 16/88 \pm 3$ to $125 \pm 14/77 \pm 7$ mmHg; INT $133 \pm 15/75 \pm 7$ to 123 ± 17 and 69 ± 11 mmHg). Both programs of deep water running training promoted improvements of similar magnitude in all parameters of functional fitness, with the exception of flexibility of upper limbs, and decreased blood pressure in the older individuals.

Keywords Aquatic exercise · Continuous training · Interval training · Aging

Introduction

The aging process involves a series of changes, including the reduction of the physical fitness (Wilmore et al. 2010; Janssen et al. 1985; Holland et al. 2002), mainly of aerobic endurance, strength, and balance. These changes impact the everyday life of older adults, limiting their capacity to accomplish normal activities in a comfortable manner and increasing the risk of falls, which affects their functional independence and quality of life (Power and Howley 2000). Another important change due to aging is the increase in blood pressure (BP), and its serious associated complications (Kelley and Sharpe 2001). Excessive increases in BP raise concerns about hypertension, a disorder that has a high prevalence in the older population, generating large expenditure for its treatment, and which is

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associated with the incidence of mortality from cardiovascular disease (Pescatello et al. 2004). The increase in life expectancy means an increase in the older population, which makes it important to search for measures that soften the harmful effects of advancing age.

It is known that physical exercise is able to attenuate some effects of the aging process (Chodzko-Zajko et al. 2004). It is thus important to identify the best training model to promote improvements in health in this population. The American College of Sports Medicine recommends an exercise program that is primarily aerobic-based in order to reduce BP (Pescatello et al. 2004). Continuous and interval are the most commonly used aerobic trainings (Bækkerud et al. 2015). Continuous training (CT) is characterized by a high volume of work without any interruption, and interval training (IT) involves bursts of vigorous exercise separated by periods of rest or recovery (Bompa 2002). Most guidelines recommend the practice of CT, but recent reviews and meta-analysis suggest the superiority of IT to improve aerobic capacity, as measured in individuals by maximal oxygen consumption (Peri-Okonny et al. 2015; Milanović et al. 2015) and vascular function (Ramos et al. 2015). Of 12 studies included in a recent review, two found no difference in BP after training, five found a greater effect from CT and five from IT, demonstrating that there is still no consensus on the best method of training to promote improvements in BP (Peri-Okonny et al. 2015). All studies discussed in these reviews include training on land environment, however.

Exercise performed in the aquatic environment has been especially recommended for older people because it has advantages compared to exercise on land. Physical properties of the water, such as buoyancy and hydrostatic pressure, provide important biomechanical and physiological alterations, such as a lower ground reaction force, when compared to the land environment (Brito-Fontana et al. 2012; Alberton et al. 2013a, 2013b), lower sympathetic and adrenergic activation, and suppression of the rennin angiotensin system, with a consequent reduction in heart rate and BP (Epstein 1992). Among the modalities of aquatic exercises, deep water running (DWR) has been highlighted for its benefits (Kanitz et al. 2015). DWR is performed with the aid of a floatation vest, which serves to keep the body in an upright position and helps to prevent contact between the feet and the bottom (Kanitz et al. 2015). Individuals simulate a run on land, with a slight flexion of trunk. These particularities make this modality an interesting alternative, especially for those older adults who have

difficulty supporting their own body mass (Meredith-Jones et al. 2011) and have altered blood pressure levels, because they are able to exercise with a lower heart rate and lower BP (Alberton et al. 2009), without any impact on the lower limbs (Dowzer and Reilly 1998), reducing the risk of injuries. We found two studies that investigated the effects of the practice of DWR in the older adults.

After 8 weeks of DWR using IT, Broman et al. (2006) noted improvements in maximal oxygen uptake in older women. Kanitz et al. (2015) also found improvements in maximum strength and in the resistance strength of the lower limbs after an IT of 12 weeks. The practice of this modality, in addition to promoting improved cardiorespiratory capacity, may also generate improvements in strength, variable that is very important to the maintenance of functional independence. In this studies, however, only IT was investigated, and for a relatively short period. Only one study, with obese adult women, compared CT and IT in DWR (Pasetti et al. 2012). It was observed that cardiorespiratory fitness showed a significant increase in both groups, but the interval group showed greater increments. These studies did not measure functional fitness, however, a parameter which reflects the ability of the individual to accomplish their daily activities, or BP, a variable that is related to the incidence of mortality and causes concern, especially in the elderly population. There is thus a need to determine whether there are advantages in the DWR training model to older people.

The aim of the present study was thus to compare the effects of differently periodized training models of DWR, CT, and IT, on the responses of arterial blood pressure and physical fitness related to the health of older adults.

Methods

Experimental design and approach to the problem

In order to identify the model of DWR that promotes the best results in physical fitness and BP in older adults, subjects performed two different types of training: one group performed CT and the other IT. The post-12- and 28-week measurements began 48 h after the last training session, and the participants completed all evaluations in 1 day. Testing was overseen by the same investigator.

Participants

The sample was composed of 36 men and women, aged from 60 to 75 years old, who had not practiced physical exercise for at least 3 months and had no history of neuromuscular, metabolic, hormonal, or cardiovascular diseases, except for hypertension. They were familiarized with the technique of deep water running and with the Borg Scale of Perceived Exertion (6–20). The individuals were advised to maintain their normal dietary intake and to inform the researcher of any change in medication. The participants were randomized into two groups: a group that performed the CT ($n = 18$; eight women and 10 men) and a group that performed the IT ($n = 18$; 10 women and eight men). All the subjects received instructions about the procedures of the research and signed an informed consent form which had been previously approved by the ethics in research committee of the Federal University of the Rio Grande of Sul (UFRGS – n° 675.861). The study was conducted in accordance with the Declaration of Helsinki.

After the training period, data from samples that did not obtain at least 80 % frequency in the sessions were excluded. The continuous group lost six subjects: one due to allergy, one because surgery was required, one for excessive absence, two who discontinued the study, and one who refused to participate in the assessments. Five subjects were lost in the interval group: two for excessive absence and three who abandoned the study. Twelve individuals from the continuous group and 13 individuals from the interval group, thus, finished the training.

Physical characteristics

Body mass and height were measured using an Asimed analog scale (resolution of 0.1 kg) and Asimed stadiometer (resolution of 1 mm), respectively. Body density was estimated using the skinfold protocol proposed by Petroski (Petroski and Pires-Neto 1995, 1996). We opted for this protocol because it was developed with men and women from southern Brazil. The following skinfolds were measured in the form of a circuit: subscapular, triceps, supra iliaca, and leg for men and middle armpit, supra iliaca, thigh, and leg for women, using a plicometer Cescorf (resolution of 1 mm). Body fat was subsequently calculated using the Siri equation (Siri 1993).

Blood pressure

Assessments of resting BP were made at the same time of day. The subjects remained seated for 20 min, with their arms relaxed at the sides of the body, in a noiseless environment and with the temperature between 24 and 26 °C (Wilmore et al. 2010). BP was measured during the last minute of resting (MAPA, MEDITECH, Brasilia, Brazil).

Physical fitness related to health

After the assessment of resting BP, the individuals performed the test battery of Rikli and Jones (1999). The battery is composed of six tests, with the aim of assessing agility/dynamic balance (foot up-and-go), strength of the upper and lower limbs (arm curl and 30-s chair stand, respectively), flexibility of upper and lower limbs (back scratch and chair sit-and-reach, respectively), and aerobic endurance (6-min walk). The tests were performed in this order with 1 min of rest between them. Before each test, the evaluator demonstrated the exercise and the participant carried out an attempt for familiarization, except for the walking test, which the subjects performed only once. The result of the second attempt was used in the data analysis.

DWR training programs

The training lasted for 28 weeks, with a frequency of twice-weekly sessions, at a total duration of 45 min each session. Each session was composed of warm-up period (5 min), the main part, and stretching (time of stretching varied during training in order to complete the 45-min session). The warm-up was comprised of walking in deep water with an intensity corresponding to the rating 11 (light) of the Borg Scale of Perceived Exertion (6–20), and the final stretching was performed for the quadriceps, hamstrings, ankle plantar flexors, chest, and elbow flexors and extensors muscles. The main part involved DWR along with exercises for the upper limbs. The intensity of both training sessions was periodized through the Borg Scale of Perceived Exertion (6–20) and can be seen in Table 1. CT was always conducted at a fixed intensity throughout the session, while IT was performed in blocks of stimulus periods at high intensity alternating with active recovery periods at low intensity. Initially, participants performed three mesocycles, each composed of 4 weeks with a progressive increase in

Table 1 Periodization of the DWR training programs

Mesocycle	Weeks	Continuous training		Interval training	
		Intensity (Borg 6–20)	Duration	Intensity (Borg 6–20)	Duration
Adaptation	1–4	13	30 min	10× (2 min sti 15 + 1 min rec 11)	30 min
Acquisition	5–8	15	30 min	6× (4 min sti 17 + 1 min rec 11)	30 min
Peak	9–12	16	31 min 30 s	7× (4 min sti 17 + 30 s rec 11)	31 min
Regenerative	12–16	13	30 min	10× (2 min sti 15 + 1 min rec 11)	30 min
Acquisition	17–20	15	30 min	6× (4 min sti 17 + 1 min rec 11)	30 min
Acquisition	21–24	16	31 min 30 s	7× (4 min sti 17 + 30 s rec 11)	31 min
Peak	25–28	17	36 min	12× (2 min sti 18 + 1 min rec 15)	36 min

min minutes, *s* seconds, *sti* stimulus, *rec* recovery

intensity; then 4 weeks where they carried out a regenerative mesocycle, with a consequent reduction of intensity, and, finally, three more mesocycles, also composed of 4 weeks with a progressively increasing intensity. The sessions took place at the swimming center of the EsEF-UFRGS, in a pool 25 m long, 16 m wide, and 1.95 m deep. The water temperature was maintained between 31 and 32 °C. The sessions were given by the instructors of a university extension project developed at the center, who had at least 1 year's experience with this modality.

Statistical analysis

The sample size calculation was performed using the GPower version 3.1 program in which we used $\alpha = 0.05$, power of 80 %, and the variances of the previous studies that assessed variables similar (strength and aerobic endurance) to those of the present study (Kanitz et al. 2015; Rica et al. 2013). We used descriptive statistics, through means and standard deviation for the analysis of the collected data. We used Shapiro–Wilk and Levene tests for analysis of the normality and homogeneity of the data, respectively. For the comparison between groups and between different times, we used two-way ANOVA (group $\times$ time) and post hoc test of Bonferroni. The adopted level of significance was $\alpha = 0.05$. All statistical tests were performed using SPSS version 20.0 software. The retrospective statistical power provided by SPSS (partial eta squared) after the data analysis varied from 0.700 to 0.999 in all outcomes in which we observed a significant difference in the time factor and from 0.541 to 0.955 in the group factor.

Results

The characterization data of the sample can be seen in Table 2.

The results of the functional tests can be seen in Table 3. Only in the flexibility test of the upper limbs did we find a significant difference in the group factor, as the interval group showed greater values throughout the intervention period. There was no significant difference in the time factor in the same test. We also noted a significant improvement, in both groups, from week 0 to week 12 and a maintenance of these values until the end of the intervention in agility/dynamic balance and the strength of the upper limbs. A significant increase in the flexibility of the lower limbs and in aerobic endurance was seen from pre- to post-training, without any difference between groups. Finally, strength of the lower limbs exhibited a significant improvement from week 0 to week 12 and from week 12 to post-training.

Table 4 shows the systolic and diastolic blood pressure results of the interval and continuous groups. We verified a significant reduction in systolic blood pressure (SBP) from pre- to post-training in both groups, without any difference between them. Diastolic blood pressure (DBP) showed a significant decrease from pre- to post-training in both groups, although the continuous group showed greater values during the intervention period in comparison to the interval group. Table 5 presents the prevalence of subjects in the different BP classes according to BP levels, based on the values defined by the Brazilian Society of Cardiology (SBP <130 mmHg or DBP <85 mmHg: normotensive, SBP

Table 2 Baseline characteristics

Variables	Continuous group (<i>n</i> = 12)		Interval group (<i>n</i> = 13)		<i>p</i>
	Mean	±SD	Mean	±SD	
Age (years)	67.20	6.74	68.60	4.21	0.852
Height (m)	1.67	0.07	1.59	0.06	0.034*
Body mass (kg)	84.00	16.58	69.83	12.37	0.025*
BMI (kg/m ²)	26.44	9.36	27.38	4.72	0.769
Body fat percentage (%)	35.89	7.01	31.81	7.78	0.211

*Significant difference between groups for *p* < 0.05

130–139 mmHg or DBP 85–89 mmHg: pre-hypertensive, SBP > 139 mmHg or DBP > 89 mmHg: hypertensive). In the continuous group, eight subjects were hypertensive and seven were receiving drug treatment. In the interval group, seven individuals were hypertensive and six were taking medication. During the training period, one subject in the interval group altered their BP medication (hydrochlorothiazide from 25 to 50 mg).

Discussion

The results of the present study showed that DWR performed as continuous and interval training promotes an improvement in agility and dynamic balance, in the strength of upper and lower limbs, in the flexibility of

lower limbs, and of cardiovascular fitness. We also verified a significant decrease in both SBP and DBP, with the continuous group showing greater values for DBP throughout the intervention period.

The improvement in body balance can be explained by the instability created by the aquatic environment, mainly in the DWR modality, in which the subjects do not have contact with the bottom of the pool (Melzer et al. 2008; Avelar et al. 2010). The results of the present study are in accordance with the findings of other studies in the literature on older adults: Kaneda et al. (2008) reported a reduction of 14 % in the execution time of the tandem gait. Comparison between the studies is difficult due to the different methods of assessment used; however, the improvement in balance that was noted in the present study may suggest a lower risk of falling in this

Table 3 Functional fitness before training and after 12 and 28 weeks of training: interval training (IT) and continuous training (CT)

	Group	<i>n</i>	Week 0		Week 12		Week 28		Δ	Time	Group	Time* group
			Mean	±SD	Mean	±SD	Mean	±SD				
Foot up-and-go (s)	IT	13	6.59	0.85	6.02	0.77	5.78	0.58	−12.27 %	<0.001*	0.840	0.824
	CT	12	6.45	1.20	6.09	1.24	5.67	0.84	−12.13 %			
Flex UL (cm)	IT	13	0.08	9.02	1.25	6.92	1.5	7.46	1.42 cm	0.677	0.042*	0.406
	CT	12	−6.76	11.35	−7.96	11.63	−6.84	−1.04	−0.08 cm			
Flex LL (cm)	IT	13	0.54	3.44	1.72	7.82	4.63	8.47	4.09 cm	0.007*	0.281	0.270
	CT	12	−4.76	10.67	−0.42	12.45	−0.61	12.10	4.15 cm			
Strength UL (repetitions)	IT	13	18.66	4.16	23.50	3.39	26.58	7.20	42.44 %	<0.001*	0.508	0.590
	CT	12	18.76	4.78	26.07	5.76	27.69	8.08	47.60 %			
Strength LL (repetitions)	IT	13	14.40	2.46	17.25	3.59	21.58	3.65	49.86 %	<0.001*	0.720	0.050
	CT	12	14.46	5.44	19.23	5.34	21.23	5.43	46.82 %			
6-min test (m)	IT	13	521.41	89.51	530.38	109.43	583.77	90.32	11.96 %	0.021*	0.315	0.398
	CT	12	567.50	89.38	574.01	93.73	591.16	52.58	4.17 %			

Flex UL flexibility of the upper limbs, *Flex LL* flexibility of the lower limbs, *strength UL* strength of the upper limbs, *strength LL* strength of the lower limbs, Δ delta

*Statistically significant difference for *p* < 0.05

Table 4 Systolic and diastolic blood pressure before training and after 12 and 28 weeks of training: interval training (IT) and continuous training (CT)

	Group	<i>n</i>	Week 0		Week 12		Week 28		$\Delta\%$	Time	Group	Time* group
			Mean	$\pm$ SD	Mean	$\pm$ SD	Mean	$\pm$ SD				
SBP	IT	13	133	15	132	11	123	17	-7.80	<0.001*	0.312	0.379
	CT	12	142	16	139	20	125	14	-12.03			
DBP	IT	11	75	7	74	9	69	11	-7.91	<0.001*	<0.001*	0.403
	CT	12	88	3	85	5	77	7	-12.29			

$\Delta\%$ delta percentage, *SBP* systolic blood pressure, *DBP* diastolic blood pressure

*Statistically significant difference for $p < 0.05$

population (Alves and Scheicher 2011). Falls are frequent phenomena and of extreme concern in this age group, because they can lead to incapacity, injury, and death (Alves and Scheicher 2011).

Another variable associated to the risk of falling is strength. A decrease of strength and body mass are considered the main factors contributing to the loss of functional mobility (DoHerty 2003) and independence in older adults (Power and Howley 2000). This data demonstrates the importance of the increase of strength observed in the present study, allowing the older adults to accomplish their daily activities in a more efficient and independent way. However, it is highlighted that the increase in strength occurred after predominantly aerobic DWR training, corroborating the findings of Kanitz et al. (2015) who found an increase of 8 % in the resistance strength of the knee extensors and of 18 % for the knee flexors. This improvement can be explained due to the characteristics of the trained modality: DWR is carried out in a cyclical manner with horizontal displacement and large knee and hip joint amplitudes, providing strong resistance during its execution, which can generate

resistance strength stimuli in the musculature involved (Kanitz et al. 2015).

In addition to strength gains in the lower limbs, we also saw an increase in the strength of the upper limbs. Simultaneously with the DWR, participants performed exercises for the upper limbs and, because the individuals were previously untrained, this may have generated a sufficient stimulus for the increase of strength of this musculature in the first weeks of training.

We also verified maintenance of the flexibility of the upper limbs and a significant improvement in the lower limbs from pre- to post-training in both groups, without any difference between them. Pasetti et al. (2006) also observed a significant increase in this outcome for the lower limbs (pre-training 23.42 ± 6.66 cm, post-training 25.77 ± 6.59 cm) after deep water running training. In both studies, specific flexibility exercises were not performed, and, thus, this increase may be attributed to the large hip joint amplitude needed for the practice of DWR.

In the present study, aerobic endurance showed a significant improvement after training in both groups. In addition to this, even though there was no significant difference between groups, the interval group exhibited greater percentage increases in comparison to the continuous group (11.9 and 4.1 %, respectively). The findings of Krueel et al. (2009) demonstrated that exercise performed in the interval model provides greater values of heart rate and oxygen consumption, even during the recovery period, when compared to continuous exercise. In the present study, the interval group performed the stimuli of the periods of the training at higher intensities than the continuous group throughout the intervention period. In this way, the greater increase of aerobic endurance registered in the interval group can be explained by the higher intensities proposed for this

Table 5 Prevalence of subjects in the different BP class before training and after 12 and 28 weeks of training: interval training (IT) and continuous training (CT)

Group	Classification	Week 0	Week 12	Week 28
IT	Normotensive	4	5	7
	Pre-hypertensive	3	3	2
	Hypertensive	5	4	3
CT	Normotensive	3	3	8
	Pre-hypertensive	1	4	3
	Hypertensive	9	6	2

group. In accordance with the findings of the present study, Pasetti et al. (2012) observed a significant increment of aerobic endurance after interval and continuous DWR trainings (45.1 and 42.5 %, respectively) and the interval group showed greater increments.

The increases seen in the functional tests reflect an improvement in the ability of the older adults to perform the activities required for daily living. They are, thus, able to climb stairs, to walk, and to stand up from a chair more easily, for example, contributing to the maintenance of their functional independence.

In the present study, we also saw a significant reduction in both SBP and DBP. We noticed that the decline of the pressure levels was more marked from week 12 to week 28, which highlights the importance of long-term interventions, because we did not find a significant decrease in BP values post-12-week training, period commonly used in interventions with physical exercise. This can be attributed to the greater intensity and volume of the training performed in the second half of the intervention, when the individuals had already adapted to the proposed models of training, and it was safer to progress the training loads to higher levels. We also clearly saw that, previous to the training, the interval group was in the high normal BP classification, whereas the continuous group was in the first stage of the hypertension; however, after the 28 weeks of training, both groups were classified as having normal BP. Analyzing the results for the prevalence of subjects in each classification of BP, we can see that before training, there was a greater prevalence of hypertensive individuals, while after 28 weeks of training, there was a higher prevalence of normotensive individuals.

Hypertension treatment includes pharmacological and non-pharmacological measures, yet, it has been observed that of the individuals who begin treatment with drugs, 16 to 50 % of them discontinue the hypertensive medication in the first year of use. A significant number of those who continue the treatment do not do so appropriately (Dusing et al. 1998; Caro et al. 1999). This data demonstrates a low adherence to the use of medication, putting their treatment for the disease at risk.

Among the non-pharmacological measures, physical exercise, mainly aerobic in character, has been indicated as an essential component in the prevention, treatment, and control of elevated BP (Pescatello et al. 2004). According to the American College of Sports Medicine, the practice of physical exercise reduces, on

average, 7 mmHg of the BP, and a reduction of 2 mmHg of the SBP and of the DBP represents a reduced risk of 14 and 17 %, respectively, of the occurrence of a cerebral vascular accident, as well as a reduction of 9 and 6 %, respectively, of the development of coronary artery disease. The clinical importance of the reduction of BP values has been reported in large studies investigating the outcomes of morbidity and mortality, and even reductions of small magnitude in SBP and DBP levels are associated with a reduction in the occurrence of cardiovascular events and mortality (Lewington et al. 2002). Even though an accurate threshold for the relationship between BP and the risk of cardiovascular outcomes does not exist, even small reductions (within the normal range) can be clinically significant, especially in older adults (Lewington et al. 2002). This is of great clinical relevance to the findings of the present study, since a minimum reduction of 10 mmHg of the SBP and of the DBP was observed in both groups, except in the DBP of the interval group, which exhibited a reduction of 6 mmHg. The dropout rate for physical exercise, excluding for reasons of poor health, was lower than that for drug treatment (13 %). It is thus suggested that the practice of DWR is an efficient non-pharmacological alternative treatment in the reduction of blood pressure levels and ensures good adherence by the patient.

We found only one other study that evaluated the effect of DWR in BP; however, this study was conducted with middle-aged adults (Piotrowska-Calka 2010). After 24 weeks of training, twice a week, no significant differences were seen in BP (pre-training $124.2 \pm 15.3/80.0 \pm 5.6$ mmHg, post-training $119.5 \pm 6.7/80.0 \pm 0.0$ mmHg). This result can be explained by the lower BP levels already found in the pre-training, which reduces the range for improvement. On the other hand, the subjects of our study began training with higher levels of BP, giving them greater range for improvement and making them more sensitive to the effects of physical exercise.

We speculate that there was no difference between the effects of the types of training because, although we used two different methods of training, the physiological load of this training was similar, because the intensity of CT was intermediate in relation to the intensity of the stimulus period and the recovery period of interval training. There was also an increase of intensity during training, and the continuous group also trained at high intensity, close to the anaerobic threshold, as intensity

17 of the Borg scale correlates with the second ventilatory threshold (Alberton et al. 2013a, b). Finally, both types of training were predominantly aerobic, even during the stimulus period of interval training, because they were performed below or at an intensity 17 on the Borg scale, with the exception of the last mesocycle (Alberton et al. 2013a, b). Our results do not corroborate those of other studies that reported a greater effect of interval training on oxygen consumption and BP in the elderly (Nemoto et al. 2007; Mitranun et al. 2014). This difference may be explained because in these studies, the intensity of the continuous group was fixed at light to moderate throughout the training, while the intensity of stimulus period of interval training was very intense and predominantly anaerobic.

Finally, it is notable that the significant improvement in physical fitness, and the reduction of BP, which is of great clinical importance, occurred with a training period of only two weekly sessions (90 min per week). In this way, we demonstrated that DWR can be a time-efficient training method for the promotion of benefits to the health of older adults.

Possible limitations to the present study were the absence of a control group, absence of laboratory test, and the small sample size. The difference between the groups in body mass, lack of nutritional and daily physical activity, and including both men and women in the sample may have influenced the results. We emphasize, however, that to the best of our knowledge, this study evaluates the effects of DWR over the longest intervention period. This also appears to be the first study to investigate the effects of DWR, a modality that has many advantages for older people, on BP, a variable that is of great concern in this age group, and on physical fitness, which better represents an individual's ability to conduct their daily activities than laboratory tests. Finally, evaluating men and women is a plus point for the external validity.

Based on the results of this study, the practice of DWR, as both continuous and interval training, promotes improvements in body balance, in the flexibility of lower limbs, in the strength of upper and lower limbs, and in aerobic endurance. Continuous and interval DWR also promotes a significant reduction of SBP and DBP in older adults. Based on these results, an individual can choose their preferred training in order to improve physical fitness and BP.

These are very important results for older individuals, as they promote improvements in their capacity to

accomplish the activities of daily living, maintain their functional independence, and result in a lower risk of mortality due to cardiovascular disease.

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