Review

Determinants of exercise adherence and maintenance among patients with hypertension: a narrative review

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Treatment options for hypertension have been evolving over time. However, prevalence rates keep increasing and perpetuate hypertension as a major cardiovascular risk factor. Exercise training is effective in reducing blood pressure, cardiovascular disease risk factors and mortality, besides improving quality of life. However, participation rates for hypertensive patients remain shockingly low and adherence to exercise training tends to decline following exercise programs. These trends emphasize the need to deepen our knowledge of modifiable intrapersonal, interpersonal, and socioeconomic and environmental factors that help explain exercise adherence among people with hypertension. The present review focuses on the determinants of adherence and long-term maintenance of a physically active lifestyle in hypertensive individuals.

Keywords

Hypertension; Exercise training; Determinants for adherence

1. Introduction

Hypertension is the main modifiable cardiovascular risk factor, as well as the most common condition in primary care [1]. In 2025 it is projected 1.56 billion patients with hypertension, while in 2000 there were 981 million [2], mostly explained by the increase of prevalence of hypertension in low-middle-income countries. High blood pressure has been related to a negative impact in health-related quality of life, and increased risk of mortality and morbidity from coronary heart disease, stroke, end-stage renal disease and congestive heart failure [3–5]. Successful prevention and control of hypertension are key to reduce disease burden and promote healthy longevity in the world's population.

Exercise training has emerged as an effective therapeutic intervention to reduce blood pressure [6]. Data from meta-analysis report that aerobic exercise training lowers systolic blood pressure (compared with control) by endurance (–8.69, 95% Credible interval (CrI) –10.13 to –7.25), dynamic resistance (–7.23, 95% CrI –10.58 to –3.87) and their combination (–13.51, 5–7 mm Hg) among adults with hypertension (systolic blood pressure $\geq$140 mm Hg) [7]. Furthermore, the beneficial effects of exercise in reducing systolic blood pressure are comparable to antihypertensive medications [7]. There is extensive literature on the benefits of regular exercise particularly blood pressure lowering and cardioprotective effects [8]. In patients with hypertension these benefits include the reduction of blood pressure, low-grade vascular wall inflammation, endothelial dysfunction and improved baroreflex sensitivity and autonomic function, with an extremely low risk of adverse effects [9, 10]. Also, age-related increases in arterial stiffness seem to be prevented or delayed with regular exercise training [10, 11]. Some of the exercise training benefits are presented in Fig. 1. In brief, mechanisms related to these effects are enhanced vascular homeostasis, increased nitric oxide bioavailability, insulin sensitivity and antioxidant capacity. Also, structural changes in blood vessels, muscles and fat cells [10, 12].

Structured exercise training programs are recommended for adults with elevated blood pressure or hypertension, with class I, level of evidence A [13]. However, such as pharmacologic therapy, exercise training must also be done uninterruptedly. The benefits regress when exercise training is discontinued. Therefore, adherence and exercise maintenance are crucial.

Despite the irrefutable positive benefits of exercise on the prevention and control of hypertension, exercise prescription for these patients is surprisingly low, such as adherence to exercise training programs and maintenance rates. In patients with hypertension little is known about the determinants of exercise adherence and maintenance. The identifi-

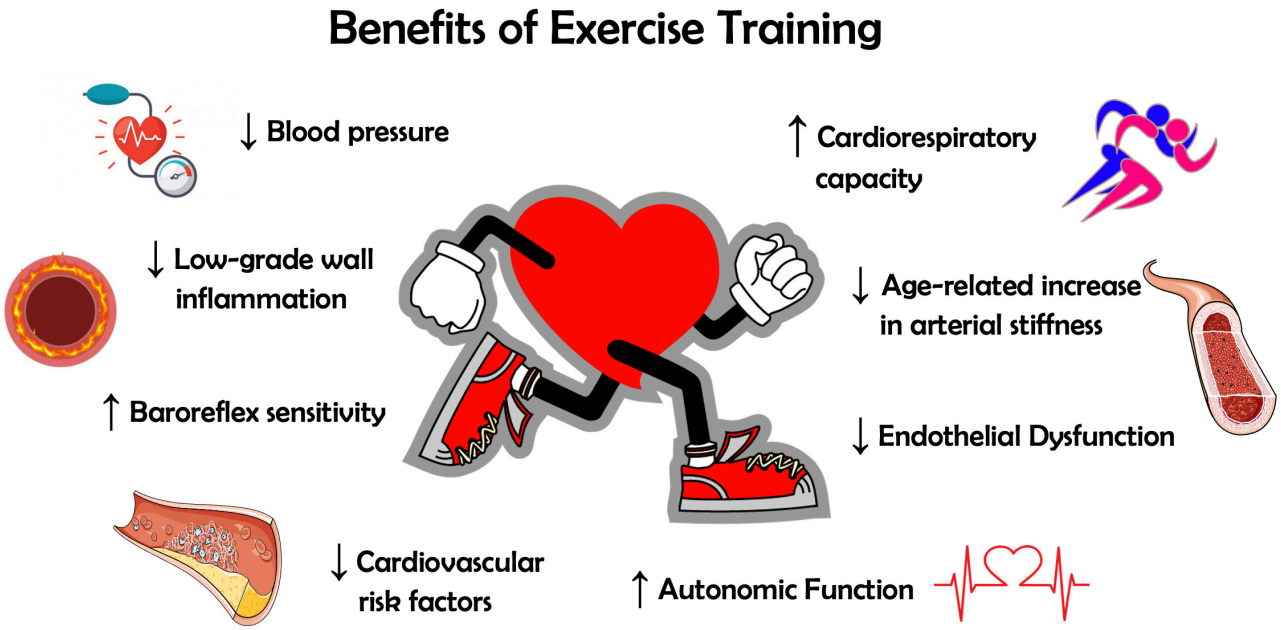

Fig. 1. Benefits of exercise training. Mechanisms mediating the beneficial effects of exercise.

cation and contextualization of these determinants pave the way to optimize strategies to increase adherence to exercise and lifestyle interventions aiming to control blood pressure. It may also help clinicians to (i) identify specific groups of patients who benefit from additional support (e.g., social support) and (ii) to develop tailored interventions adjusted to the patients' needs. Therefore, this review aims to identify determinants of exercise adherence and exercise maintenance among patients with hypertension.

2. Adherence to hypertension treatment/management

Hypertension prevalence rates keep increasing and perpetuate hypertension as a major cardiovascular risk factor mostly due to lack of patient adherence to treatment, either pharmacological or lifestyle modifications, namely physical activity, and exercise training [14–17]. Recent estimates suggest that nearly 40 million hypertension-related deaths can be avoided over the next 25 years by scaling up hypertension treatment to 70% [18]. Adherence is the degree to which a person's behavior meets the recommendations agreed with the healthcare provider and takes responsibility for their health [19, 20]. Many factors influence adherence, such as patient's beliefs, health concepts, lifestyles and cultural habits [21]. Adequate blood pressure control is only achieved by one-third of treated patients with hypertension [22]. A major cause is poor medication adherence [14, 15]. Within the first year of antihypertensive medication, up to 50% of patients discontinue treatment [20, 23, 24]. This is a major concern because uncontrolled blood pressure leads to increased end organ damage, cardiovascular events, dementia, loss of quality of life, disability and death [25]. Thus, to effectively control blood pressure, proper adherence to long-term antihypertensive treatment should be monitored [15]. Causes of non-adherence are related to the symptomless nature of hypertension, complicated drug regimens and adverse drug reactions, the economic burden of medication, a lack of understanding about the condition and its management, and a lack of patient motivation [14, 25, 26]. Adherence to a healthy lifestyle in patients with hypertension is also poor, despite the well-known benefits. In the National Health and Nutrition Examination, only 19.4% of hypertensive participants adhered to Dietary Approaches to Stop Hypertension dietary guidelines [27]. In a sample of nearly 9000 participants with hypertension from the European Investigation into Cancer and Nutrition cohort, patients aware of their condition adhered more to dietary guidelines compared with unaware hypertensives [28]. Contrarily, Kim and Andrade [29], 2016 reported that individuals diagnosed with hypertension showed less adherence to the Dietary Approaches to Stop Hypertension diet than those not diagnosed with hypertension. So in this study, a diagnosis of hypertension did not seem to provide an incentive to engage in healthy dietary behavior. Factors associated to low adherence to a healthy diet are difficulty in changing old dietary habits, the thought that dietary change is impossible, a lower self-efficacy for following diet guidelines and lower dietary education [30].

Concerning exercise training, regardless of the mounting evidence about the benefits of exercise in the management of hypertension, it is presently underutilized [31]. Surprisingly, only a third of primary care physicians recommend exercise training as lifestyle therapy to their patients [32]. In addition, regular exercise tends to decline over time following exercise training programs. More than 50% of patients dis-

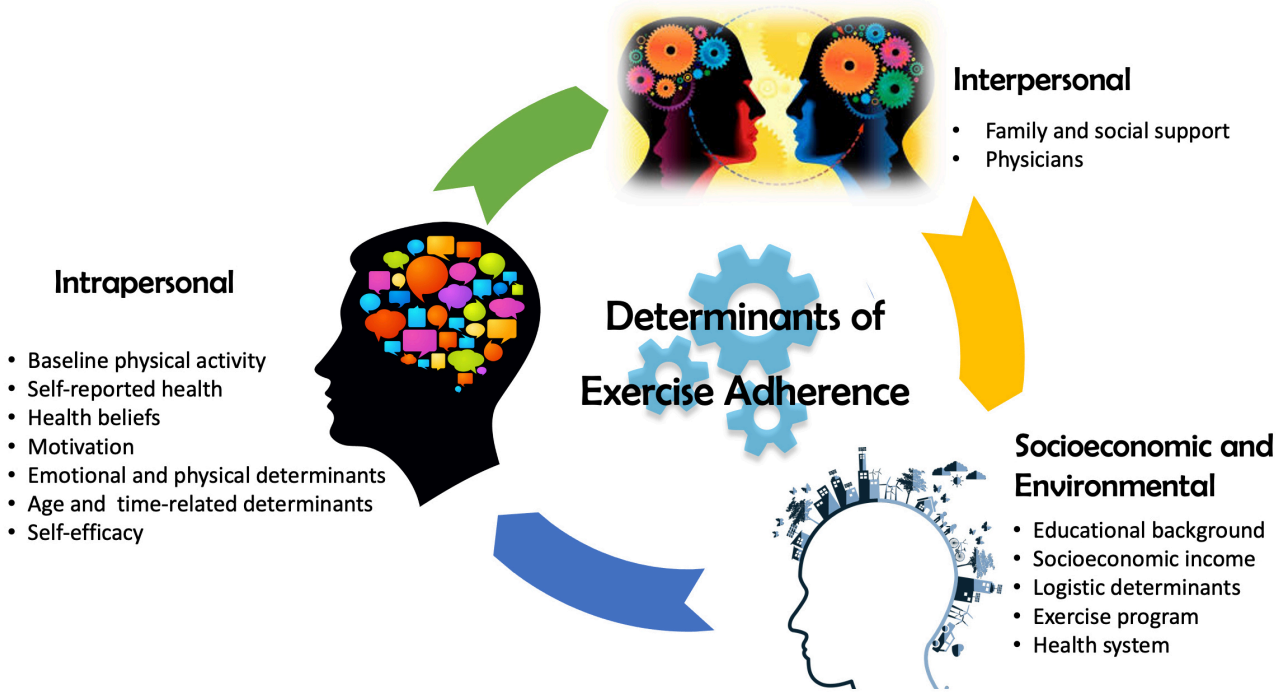

Fig. 2. Determinants of exercise adherence. Intrapersonal, interpersonal and socioeconomic and environmental determinants of exercise adherence.

continue regular exercise within the first year following the program [33, 34]. These rates emphasize the need to deepen our knowledge on modifiable personal, social, psychological, and environmental factors that help explain exercise participation among people with hypertension [35, 36].

Following an ecological health model [33], adherence determinants were grouped into 3 large categories: (a) intrapersonal determinants — including baseline physical activity, self-reported health, health beliefs, motivation, emotional and physical determinants, age and time-related determinants, and self-efficacy; (b) interpersonal determinants — lack of family and social support, and physicians; (c) socioeconomic and environmental determinants — educational background and socioeconomic income, logistic, exercise program, and health system determinants (Fig. 2). In the next section, some of the major determinants will be explored. Some of the papers included in this review are presented in Table 1 (Ref. [19, 34, 37–42]).

3. Intrapersonal determinants for adherence

3.1 Baseline physical activity

A positive association between baseline physical activity level and adherence to exercise programs has been found [16, 34, 42–44]. Participation in sports activities at baseline surfaced as a major predictor of long-term exercise adherence [43]. A lower drop-out rate was also found in participants who participated in home-based activities [44] and with higher baseline physical activity levels [34]. Participation in exercise programs increased physical activity level after program cessation [42]. Roessler and Ibsen 2009 [42] found that, at baseline, only about 25% of the patients in their study complied with the daily moderate physical activity recommendations. However, after the intervention, participants were, in general, more physically active. Furthermore, exercise training in later life was more frequent in individuals who exercised during youth and middle age [45].

3.2 Self-reported health

Self-reported health issues seem to interfere with hypertensive patient's participation in exercise programs [38, 42, 43]. The major predictors of long-term exercise adherence were high health-related quality of life and high self-rated health [43]. Interestingly, Roessler and Ibsen 2009 [42] reported that, at baseline, only a third of the participants rated their health status as good or very good. However, after the 1-year intervention period, more than 50% declared an improvement in "self-reported health status". One often reported aspect of being physically active was having more energy and self-control (e.g., "It is good to use my muscles and get my heart rate up"; "I feel better in controlling my daily life"). Awareness of being healthy after exercise training programs seems to be a predictor of future health status [42]. In the MOBILE study [38] patients with lower self-reported health reported more barriers to exercise and less motivation. Patients reported difficulty in escaping the vicious cycle of feeling too tired, unfit, or too fat to start exercising. Also, the coexistence of other chronic musculoskeletal problems and asthma were limiting factors for achieving the recommended dose of exercise [38]. Tailoring exercise programs to individual characteristics may help overcome these barriers.

Table 1. Overview of determinants of adherence and outcomes of included studies.

Authors	Country	Study design	Participants	Evaluation/monitoring methods	Outcomes/Determinants of adherence
Alefan *et al.* [19]	Jordan	Cross-sectional, observational study	1000 patients with hypertension (>18 years)	Patient interview	Gender, lifestyle and self-management counseling, high knowledge, and beliefs scores were found to be independent predictors of compliance.
Andjelkovic *et al.* [37]	Serbia	Cross-sectional, observational study	362 patients with hypertension (>65 years)	Self-reported questionnaire of adherence	Received counseling on healthy lifestyle behaviors by physicians and lack of education predicted high adherence to healthy lifestyle behavior.
Duclos *et al.* [38]	France	Cross-sectional, observational study	1766 patients with T2DM and hypertension (>18 years)	IPAQ - Short version; Self-questionnaires of barriers for PA and motivations enabling regular PA	Active patients, those with fewer barriers to PA, with lower treatment burden, and with an active physician, were more likely to reach blood pressure targets. A negative self-image was the highest ranked barrier for the inactive patients, followed by lack of support and medical concerns.
Magobe, Poggenpoel & Myburgh [39]	South Africa	Qualitative, exploratory, descriptive, and contextual research study	44 participants with hypertension (>20 years)	Focus group and individual interviews	Poor self-care and poor self-efficacy were associated in low levels of PA.
Mansyur *et al.* [40]	USA	Clinical Trial	185 participants with hypertension (45–65 years)	Computer-tailored telephone interviewing system; Self-Efficacy and Exercise Habits survey	Higher self-efficacy was partially helpful for increasing PA. Major barriers to increasing PA were comorbidities and time conflicts due to other responsibilities.
Nishigaki *et al.* [41]	Japan	Cross-sectional, observational study	541 Physicians (≥24 years) 881 participants with hypertension (20–89 years)	Self-administered, web-based surveys	Education and guidance on lifestyle changes and target blood pressure provided by physicians were not received by patients as much as physicians believed. Physician- provided assessment and feedback about lifestyle modifications and patient motivation for maintaining their target blood pressure were key for the lack of major lifestyle modification.
Roessler & Ibsen [42]	Denmark	Clinical Trial with 1-year follow-up	1156 participants with hypertension, T2DM or dyslipidemia	Focus group and individual interviews	Female gender and higher education were associated with program participation. Weight loss was the main motivation for participation, and weight gain a reason for dropping out. Physical, emotional, motivational, and time-related barriers were reported.
Saida, Sorensen & Langberg [34]	Denmark	Observational study with 1-year follow-up	214 adults (62% with hypertension (>18 Years)	Self-reported exercise and adherence surveys; Quality of life rated on a visual analog scale and self-rated health survey	The main predictors of long-term exercise adherence were participation in sports activities at baseline, self-rated health, and quality of life. Long-term adherence was associated with low education (<10 years) and lower age (<50 years).

T2DM, Diabetes Mellitus type 2; IPAQ, International Physical Activity Questionnaire; PA, Physical Activity.

3.3 Health beliefs

Some reports defend that health beliefs can have both a negative [34, 46] or positive [42] effect in hypertensive patients. Hypertension causes no physical symptoms and patients, generally, do not feel limited in their daily life activities [14]. Therefore, usually these patients do not acknowledge the need to be physically active. Besides, some believe that exercise may be deleterious for hypertension and that exercising is hard work [46].

On the other hand, when patients have a positive attitude toward exercise ("exercise is beneficial"), the effects on adherence are also positive [34]. In addition, at exercise program completion, most patients reported a better attitude towards physical activity, enjoying it more than before the program [42].

3.4 Motivation

Groups with higher motivation levels seem to have a greater probability of maintaining healthy behavior, namely exercise training [47]. Training under supervision or in a structured environment and feeling engaged in a group were also related to higher motivation levels [42]. The main reported motives to complete an exercise program were better health status and weight loss. Contrarily, weight gain was related to higher program dropout [42]. Lack of energy (e.g., "I haven't got energy" and "I'm too tired after my job") and an interest in other physical activities also had a negative effect on motivation to exercise [42, 48].

3.5 Emotional and physical determinants

Patients' experiences and emotions towards exercise were found to influence their adherence to exercise programs and maintenance after program cessation [34, 42, 48]. Saida *et al.* 2017 [34], noticed that participants with a positive attitude ("exercise is fun") presented a higher adherence (80%) than participants with a negative emotion ("exercise is boring") towards exercise (24%). Roessler and Ibsen 2009 [42] also stated that negative emotions (e.g., "I'm too lazy") were related with less adherence. Contrarily, Hu *et al.* [49] in 2015 found no association between depression and anxiety and exercise adherence. Physical issues, like injuries, physical disabilities and movement limitations were found to act as barriers for participation in exercise training programs and were related to low physical activity levels [42, 43, 50].

3.6 Age and time-related determinants

Interestingly, Leijon *et al.* 2011 [16] reported that higher age at baseline was related to increased 12-month exercise adherence. However, older participants reported that environmental factors (e.g., seasonal issues) were a determinant for non-adherence and/or maintenance in exercise training programs [43, 48]. Perceived lack of time is a major determinant for non-adherence to exercise training programs [42, 43, 46, 48, 50]. This determinant was more frequently reported by participants with lower age than higher-aged participants [16].

3.7 Self-efficacy

Self-efficacy seems to positively influence and predict many health behaviors. Patients with more family support frequently present more self-care behaviors such as exercise adherence [49, 51, 52]. Self-efficacy seems to be a prerequisite of effective self-care for chronic disease [46, 52, 53]. In face of existing barriers, participants with higher self-efficacy are more likely to start or maintain a specific task [52]. Among patients with hypertension, some studies have demonstrated a positive association between self-efficacy and exercise adherence, however, these patients seem to have a tendency for low self-efficacy [46, 49, 52, 54]. Hu *et al.* 2015 [49], found that a 10-unit increase in self-efficacy increased the adjusted odds ratio for adhering to exercise to 1.25 (95% Confidence interval (CI) 1.04–1.49). The authors related these results to the possibility of self-efficacy being behavior specific. They suggested that patients might have felt more self-efficacy about exercising. Mansyur *et al.* 2013 [40], reported that higher self-efficacy seemed to be partially helpful for increasing physical activity in participants with hypertension. Furthermore, the authors reported that different barriers were more associated with behaviour change than were associated with self-efficacy, for example, being "too busy" directly interfered with physical activity.

4. Interpersonal determinants

4.1 Family and social support

Self-care management may be a struggle for many patients, needing the support of family, friends, and professional organizations to successfully manage their disease. Social support has been shown to positively influence independent exercise maintenance in the community [42, 49, 55]. Professional and friend support within the patient community offers positive experiences and social interaction. These have been shown to be important in behavioral change by adding to a non-intimidating atmosphere and encouraging patients to exercise [42, 43, 46]. Participants report that exercising among people with similar health problems is important for positive exercise and help overcome barriers [38, 42, 43]. Interestingly, patients also considered how their activity level influenced their social environment and family (e.g., "I feel I would be a better role model for others if I exercised regularly", "I realize that I might be able to influence others to be healthier if I would exercise more" and "Some of my close friends might exercise more if I would") [46].

4.2 Physician

In older patients with hypertension, received counseling on healthy lifestyle behaviors by physicians seems to predict higher adherence to these healthy lifestyle behaviors [19, 37]. Good communication and relationship between patient and physician are paramount for good adherence. Letting the patient talk without interruptions, using a language the patient understands and paying attention to the patient seem to be the most important aspects for patients [56]. Alefan *et al.* 2019 [19], reported that lifestyle and self-management coun-

selling was found to be an independent predictor of patients' compliance with lifestyle recommendations such as physical activity. The MOBILE study [38], reported that controlled blood pressure rates were four times higher in patients with an active physician compared to patients with an inactive physician. The reason for this could be related to fewer perceived exercise barriers for active physicians, positively influencing their patients to exercise. For active participants, the physician also motivated them to exercise by showing interest and monitoring the patient's exercise training program, along with providing reassurance on potential health issues [38].

5. Socioeconomic and environmental determinants

5.1 Educational background and socioeconomic income

Literature regarding educational background is not consensual, with some studies reporting a positive correlation between educational status and adherence to exercise programs [34, 42, 43, 45] and others reporting no correlation [42]. However, in a study by Lee *et al.* 2006 [45], income level was the strongest predictor of exercise and physical activity suggesting its importance in reduced perceived barriers to exercise, perceived health status and blood pressure control.

5.2 Logistical determinants

Logistical determinants pointed for exercise adherence and exercise maintaining were difficulties in access, mainly inconvenience and scheduling around other important activities. Distance and existing transports were also reported as important determinants both for adhering to exercise programs and their maintenance. Patients reported that living in a walkable neighborhood and proximity to exercise facilities were common facilitators [57]. Communities with wider and better opportunities (such as community resources and availability of personal and exercise programs) are more likely to have better ranks of adherence to exercise [31, 35, 36, 41].

5.3 Exercise program determinants

Regarding exercise training programs, higher adherence and maintenance rates were related to supervised training programs, a structured environment with fixed training timetables and feeling part of a group [35]. Exercise type/mode was another determinant, with walking, cycling, and gardening the most frequently reported activities [33, 42]. Goal setting and monitoring were consistently identified as the most useful intervention features, and activity planning support tools were also noted as helpful and important [57].

5.4 Health care system determinants

The most common health care system determinants identified by patients were cost [33, 46, 57], language barriers, negative experiences towards health care system, including excessive medical appointments, and lack of physician's referral for exercise programs [32, 57]. Lack of time during medical appointments, reference services not being available and non-coverage from insurances were reported by physicians as determinants for lack of referral to exercise programs [58]. Reddeman *et al.* 2019 [57], reported that general advice to simply exercise more often or more vigorously was unhelpful for patients. Similarly, most participants were unaware of existing guidelines for exercise training or reluctant to them, perceiving them to be overly standardized. Even though patients seemed to be willing to receive exercise recommendations from various members of the health care team (e.g., physiotherapists, medical trainees, occupational therapists), many preferred to receive this information specifically from the family physician for a variety of reasons (e.g., knowledge of patient's health context, relationship or rapport).

6. Conclusions and future perspectives

Physical exercise is a widely accepted tool to control blood pressure in patients with hypertension. Despite this, adherence to exercise and maintenance rates are shockingly low. Multilevel determinants for adherence and maintenance in exercise training programs for patients with hypertension are identified. These determinants include intrapersonal, interpersonal, and socioeconomic and environmental determinants. This review supports that higher baseline physical activity level, self-efficacy, self-rated health, family and social support and the physician's physical activity level is positively associated with exercise adherence and maintenance. Further, inconsistent findings were found for educational background and health beliefs. This identification enables a more comprehensive understanding of the difficulties encountered with adherence to these programs and maintenance after program cessation. Structured training in a group improves motivation towards exercise and increases physical activity in the short term. Furthermore, motivation along with support, and encouragement could help the individuals to maintain an active healthy lifestyle. Also exploring enjoyable activity options may assist this process along with adapting exercise programs to individual characteristics. Further qualitative studies are needed to gather data on views and opinions beyond a list of options provided by a questionnaire, since understanding these determinants may be beneficial for future intervention trials. In addition, future clinical guidelines should address these determinants to improve adherence to exercise programs and actively integrate participants in the program, paying attention to individual needs to incentive long-term maintenance of a healthy and physically active lifestyle. Also, cost-effectiveness and cost-utility studies are needed to assess the effort to increase adherence and maintenance to exercise programs. Future studies are clearly needed to identify the most important determinants of exercise adherence and maintenance, and to determine whether there are differences between exercise modalities and hypertension grades. When designing a physical activity and exercise program it is important to assess these determinants to increase adherence and the long-term benefits of exercise training.

Author contributions

SL designed the research study. SL and GF performed the research. SL, DF, JMB, JO and FR contributed to the drafting of the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable.

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Conflict of interest

The authors declare no conflict of interest.

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