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REVIEW/ DERLEME

Physical Activity in Heart Failure: A Narrative Review on Barriers, Evaluation and Development Methods

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ABSTRACT

Heart failure develops due to cardiac dysfunction and forms the final stage of cardiovascular disorders. The importance of regular physical activity in the management of heart failure is emphasized due to the biological, psychological, and social benefits, and it is recommended that various exercise approaches be adapted to patients diagnosed with heart failure. However, clinicians need to consider barriers such as symptom severity (dyspnea, fatigue, etc.), gender, motivation, preparation, seasonal conditions, and financial reasons for physical activity. The activity level can be evaluated with questionnaires, diaries from subjective methods, pedometers, and accelerometers from objective methods. Supervised exercise (moderate intensity-continuous exercise training, high-low-intensity interval training, respiratory muscle training, strength training, or Tai Chi), e-Health applications, Exergaming, or heart age calculators improve physical activity in individuals with sedentary heart failure physical activity programs that combine behavior change, cardiac risk management, and patient education should be implemented in group or center-based settings, accompanied by a multidisciplinary team, to gain an active lifestyle in patients with heart failure.

Keywords: Heart failure, cardiovascular diseases, physical activity, exercise, sedentary life.

Kalp Yetmezliğinde Fiziksel Aktivite: Engeller, Değerlendirme ve Geliştirme Yöntemleri Üzerine Bir Geleneksel Derleme

ÖZET

Kalp yetmezliği, kardiyak disfonksiyona bağlı olarak gelişir ve kardiyovasküler bozuklukların son aşamasını oluşturur. Biyolojik, psikolojik ve sosyal faydaları nedeniyle düzenli fiziksel aktivitenin kalp yetmezliği yönetimindeki önemi vurgulanmakta ve çeşitli egzersiz yaklaşımlarının kalp yetmezliği tanılı hastalara uyarlanması önerilmektedir. Ancak klinisyenlerin kalp yetmezliği tanılı bireylerin fiziksel aktiviteye katılımını sağlamada semptom şiddeti (dispne, yorgunluk vb.), cinsiyet, motivasyon, hazırlık, mevsimsel koşullar ve finansal nedenler gibi engelleri göz önünde bulundurmaları gerekir. Aktivite düzeyi, anketler ve günlükler gibi öznel yöntemler; pedometreler ve ivme-ölçerler gibi nesnel yöntemler ile değerlendirilebilir. Gözetimli egzersiz (orta şiddetli-sürekli egzersiz eğitimi, yüksek-düşük yoğunluklu aralıklı eğitim, solunum kası eğitimi, kuvvet eğitimi veya Tai Chi), e-Sağlık uygulamaları, egzersiz oyunları veya kalp yaşı hesaplayıcılarının kalp yetmezliği tanılı bireylerde fiziksel aktiviteyi iyileştirdiği belirtilmektedir. Fiziksel aktivite programları kalp yetmezliğinde etkilidir ve davranış değişikliği, kardiyak risk yönetimi ve hasta eğitimini birleştiren bu programlar, aktif bir yaşam tarzı kazanmak için multidisipliner bir ekip eşliğinde grup veya merkez tabanlı ortamlarda uygulanmalıdır.

Anahtar Kelimeler: Kalp yetmezliği, kardiyovasküler hastalıklar, fiziksel aktivite, egzersiz, sedanter yaşam.

1. Introduction

Heart failure (HF) is a clinical syndrome common in the world, which constitutes the terminal stage of cardiovascular disorders such as coronary heart disease and hypertension. Conventional causes of systolic or diastolic dysfunction in HF include diabetes mellitus, congenital heart disease, arrhythmias, and cardiomyopathies (1). It is estimated that more than 60 million people with HF and this number will enlarge due to the aging population and increasing survival rates (2).

Aging, presence of cardiovascular disease (coronary heart disease, hypertension), history of cardiovascular disease, diabetes mellitus, smoking, adiposity, and physical inactivity have been identified as risk factors for the progress of HF (3-5). Obesity and a sedentary lifestyle, which are becoming increasingly prevalent nowadays, lead to a diminishment in cardiac adaptation ability, causing HF to develop earlier and expanding the number of patients worldwide (6, 7).

Cardiac rehabilitation for HF patients typically includes the following four phases (8, 9): initiation and assessment (clinical, Since research on the PA status in individuals with HF has intensified over the years and thus significant improvements

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Daha önce bildiri olarak sunulmuş ise bildiri türü, yeri ve tarihi: Makale herhangi bir bilimsel etkinlikte sunulmamıştır.

have been achieved, it is thought that a current review will promote future studies in terms of activity type, optimal prescription, and innovative solutions for behavior change. The scope of this narrative review aims to investigate the indicative factors of participation in PA, the instruments used in the assessment of PA level, and approaches that develop an active lifestyle in HF (Table 1). In this context, articles in English published between 2014 and 2024 were scanned in Pubmed, Scopus, and Google Scholar databases using the keywords "heart failure," "physical activity," "exercise," "barriers," "evaluation," and "examination" and 35 different types of studies were included in the review.exercise capacity evaluations); exercise training (moderate-intensity training, resistance exercises, and high-intensity interval training); psychosocial support and self-management education; long-term maintenance and continuation of rehabilitation at home or in specialized groups. All stages collectively aim to enhance physical fitness, reduce cardiovascular risk factors, and improve the overall well-being of these patients (8).

Physical activity (PA), which produces effects consistent with cardiac rehabilitation goals and is therefore included in rehabilitation, is any bodily movement produced by skeletal muscles by expending energy above the basal metabolic rate. Although physical inactivity is a significant risk factor for HF, participation in PA declines in most patients after diagnosis (10). Due to its known benefits, regular PA is considered a substantial component of HF treatment and rehabilitation (1). It has been stated that the probability of HF falls in people who do 150-300 minutes/week of moderate-intensity or 75-150 minutes/week of high-intensity activity and that particularly moderate-intensity activity is more effective (11, 12). Besides, there is a dose-response relationship between PA level and cardiorespiratory fitness (13).

Most studies available in the literature emphasize the value of regular PA in individuals with HF (14). In current guidelines, it is recommended that exercises be individually adapted in case of HF and that sportive activities be restricted in some patients (15). Individuals with HF who regularly participate in PA obtain more than others regarding functional capacity, walking performance, muscle strength, and endurance. Briefly, while the symptoms are better managed and the coronary risk profile is improved in individuals with HF, it nourishes the individuals' self-confidence in the psychological dimension and prevents them from depression and social isolation (16). The improvement in health outcomes due to PA participation ensures that individuals with HF visit fewer health institutions and hospitalizations become infrequent. This not only enhances the quality of life of individuals with HF and reduces mortality, but also alleviates the economic burden caused by HF on the healthcare system (17).

1.1. Barriers of Participation in Physical Activity in Individuals with Heart Failure

Approximately 61% of individuals with HF assume that participation in regular PA is a more strenuous behavior to acquire compared to personal treatment behaviors such as complying with diet and medications, quitting smoking, and going to health check-ups (18). Although there is limited research on barriers and facilitators of PA in HF, there is moderate evidence supporting modifiable barriers such as negative emotional responses (19). When evaluated within the scope of personal beliefs, individuals with HF reported that they had a sedentary life before the disease, could not find time for activities, lacked self-confidence, fear, and appearance, could not participate in activities due to not wanting to appear weak, work life and laziness (20). Therefore, personal inactivity reasons are taken into consideration when examining PA levels. Situations that prevent activity participation in individuals with HF are presented in Table 2.

The severity of general symptoms (dyspnea, fatigue, etc.) may intensify during PA in individuals with HF. Exacerbating symptoms tend individuals to experience negative emotions like fear, anxiety, and powerlessness during activity (21). For this reason, individuals with HF have insufficient self-confidence and self-efficacy during PA and have difficulty maintaining PA in the long term (22). Frailty, characterized by involuntary weight loss, fatigue, low walking speed, and grip weakness, is another condition that makes it difficult to maintain PA levels in individuals with HF (23). Lack of motivation, skills, and knowledge are among other factors that prevent the evolution of PA adherence (24). Thus, adherence to PA is improved by considering the physical and psychological conditions of the patients.

Table 1. Factors that Prevent Participation in Physical Activity in Individuals with Heart Failure

● Maladaptive personal beliefs and behaviors Having a sedentary life before being diagnosed with heart failure Not finding time for activity Lack of self-confidence Physical appearance Fear Workload Laziness
● Physical and psychological readiness for physical activity Inability to participate in activities safely Having low self-efficacy Inability to be motivated without the influence of external factors
● Severity of symptoms associated with heart failure (dyspnea, fatigue, etc.)
● Change in symptom severity due to seasonal transitions
● Lack of motivation, skills, and knowledge
● Limitations in financial resources

Table 2. Overview of Physical Inactivity in Heart Failure

Physical Activity Barriers	● Symptoms ● Motivation ● Readiness ● Seasonal ● Financial
Assessment Tools	● Subjective: scales, diaries ● Objective: pedometer, accelerometer
Suggestions for activity behavior	● Combination of exercise & behavior modification ● Group or center-based ● With physiotherapist
Interventions to support physical activity	● Supervised exercise (continuous or interval training, respiratory muscle training, etc.) ● E-health application ● Exergaming ● Heart age calculators

Financial reasons can significantly hinder the participation of individuals with HF in activity programs. The scarcity of cardiac rehabilitation opportunities, lack of reimbursement for enrollment in this program, and the cost associated with exercise may pose significant barriers (25). Due to the perceived financial burden of programs, it may deter individuals from participating in PA, especially in older people where financial stability may be a concern (25). Some patients may have

difficulty participating in PA due to direct financial barriers, such as paying for medications, and transportation costs to exercise facilities. Others may face indirect financial barriers, such as loss of income due to reduced work capacity due to the disease or additional costs for professional exercise supervision (26). These individuals may not be able to comply with treatments or health behavior recommendations if financial barriers are encountered. In case of failure to comply with treatment due to financial barriers, quality of life, general health status and hospitalization rates may deteriorate (27).

Within the effect of seasonal change on PA level, one in three patients reported that they moved less during the winter months due to the aggravation of their HF-related symptoms. It is recommended to design personalized activity programs, considering the current symptoms and severity of the disease, which changes with seasonal changes (28). Considering the New York Heart Association (NHYA) classification, PA tolerance of individuals with HF in different stages varies, requiring patient-specific PA instructions that should be adjusted based on seasonal variations (29).

Readiness for PA means having psychological factors conducive to activity, such as motivation and self-confidence, as well as being able to participate in activities safely despite symptoms, and risk factors. In short, readiness for PA includes physical and psychological components of the person (30). According to the assessment of readiness for PA in individuals with HF, 64% of these individuals cannot participate in PA safely, 80% have low self-efficacy, and 45% are motivated by the activity due to the influence of external factors. Being young, male, and married, having a high level of education, being Stage 1 in the HF symptom classification, having a short diagnosis period and a low body mass index, and not having chronic obstructive pulmonary disease positively affect activity readiness (31). When creating activity prescriptions, it should be evaluated not only whether it is safe to participate in the activity, but also whether the individual has the psychological capacity to be more active (31).

1.2. Physical Activity Assessment in Individuals with Heart Failure

Activity level assessment in individuals with HF is carried out using subjective and objective methods. Subjective measurements include self-reported scales that patients can answer on their own, whereas objective measurements involve the use of wearable devices or technology-based tools to quantify PA levels.

The International Physical Activity Questionnaire (IPAQ), Godin Leisure Time Exercise Questionnaire, Daily Activity Questionnaire in Heart Failure (DAQIHF), and activity diaries are generally used for subjective PA assessment in individuals with HF. The disadvantages of this evaluation include recall bias, overestimation of the PA level, and inability to detect daily changes in activity (32). DAQIHF is a scale that evaluates activity status in the last week and predicts daily energy expenditure. It contains seven dimensions and 82 items related to sleep/resting, daily, domestic, leisure, occupational, movement, and mixed activities (33).

Objective measurements that appear on substantial role in the treatment management of HF include pedometers, motor sensors, and activity monitors. Activity monitors used as devices or applications include accelerometers, implantable cardiac devices (pacemaker, implanted cardioverter-defibrillator, cardiac resynchronization device), and smartphone/smartwatch-based applications (34, 35). With implantable cardiac devices, clinical decompensation can be detected beforehand (36). In addition, they assist in providing personalized advice, motivating patients, and setting realistic goals (35). Accelerometers, which have the feature of detecting body accelerations, collect information about step count, activity intensity, duration, and frequency and are also used for progression monitoring (37). Sedentary and sitting/standing times can be determined using this method. It has been described that accelerometer results of individuals with HF are related to functional capacity and quality of life (38). There are several activity monitors including single-axis (KenzLifecorder EX), three-axis (Actigraph GT3X), and multi-sensor (Fitbit Charge HR) in numerous models and features. When choosing a monitor, the clinician should consider the monitor's intended use, validity-reliability, data storage, access and integrity, and cost (35). Accordingly, if it is aimed to motivate patients to be more active, mobile applications, smart-watch, and pedometers should be used, and if it is desired to evaluate change in activity level over time, devices with high validity and reliability should be preferred (35). The point where objective methods are most inadequate is that they only reflect the absolute activity intensity. For instance, in a walking activity, evaluation devices can present a similar number of steps for different people, regardless of the person performing this activity. The relative activity intensity should be evaluated together with absolute intensity through perceived exertion scales (Borg Scale, Modified Borg Scale, etc.) (14). Individuals with HF have lower exercise capacity and dyspnea, which reduce threshold values for physical inactivity and moderate-to-severe PA intensity. Besides, it should not be neglected that applying threshold values of the general population when interpreting PA in individuals with HF may lead to misclassification of the activity level (39). Documenting exercise quantity can improve the abilities of a small group of patients to perform daily tasks. Although the effects of objective measurement devices have been demonstrated in clinical studies, it should not be ignored that their clinical use is limited due to their high cost.

1.3. Interventions to Support Physical Activity in Individuals with Heart Failure

Physical activity recommendations for HF patients vary based on disease severity. Individuals with mild HF benefit from supervised exercise training, personalized PA, endurance, resistance, and respiratory training, and a significant relationship is found between daily PA and health benefits in patients with chronic HF (40). Guidelines suggest supervised exercise training and personalized PA as crucial for all forms of HF, starting immediately after the stabilization of acute episodes and continuing post-discharge in prevention and rehabilitation programs (41). Although high-intensity interval exercise training is beneficial to the health outcomes of individuals with HF, further evaluation of risks in highly symptomatic patients is needed (42). Early exercise-based rehabilitation administered during hospitalization has been shown to significantly increase exercise capacity, reduce rates of rehospitalization and cardiovascular events in patients with acute decompensated HF, and have been associated with better long-term outcomes (43, 44). Therefore, PA and early rehabilitation interventions should be encouraged as important adjuvant components in the treatment of acute decompensated HF (43). Briefly, these findings emphasize the importance of tailoring PA advice and interventions based on HF intensity to optimize patient outcomes.

Various approaches to increasing the PA level in individuals with HF, who frequently have a sedentary lifestyle, are applied in a clinical practice setting or home-based by physiotherapists, nurses, psychologists, and exercise instructors. These professionals utilize common modalities like exercise, exercise and behavior modification, motivational meetings, distance communication and treatment, disease management, and self-management. Moreover, common approaches can be supported with behavior change strategies (guidance, action planning, gradual tasks, monitoring, and behavioral practice) (45). According to outcomes of a recent meta-analysis, implementation of an exercise program combined with behavior modification provided by a physiotherapist on a group and center basis may provide moderate effects (45).

Moderate continuous training remains an effective, safe, and standard model for HF patients (1). Except for this training,

interval training, respiratory muscle training, and strengthening have shown efficacy in HF (46). Tai Chi, functional electrical stimulation, e-health application, and Exergaming are used as alternative activity approaches in individuals with HF. It has been reported that Tai Chi can substantially enhance physical and psychological well-being, and quality of life in HF patients, but additional research is needed for its effects on other clinical parameters (47). It is an alternative method that improves functional electrical stimulation, exercise capacity, endurance, and quality of life in patients with unstable HF for whom exercise training is not recommended. It may also be beneficial for treating decompensated HF during hospitalization (48).

The high-speed development of technological approaches has led to the more widespread use of mobile or computer-based interventions to improve active living. An example of one of these developments, a mobile application was revealed to promote the activity level of people with Type-2 diabetes and HF and to improve compliance with PA and medication. Activity data from the smart-watch was transferred to this application, and feedback was provided to the individual according to the change in the number of steps, increasing the number of daily steps and monitoring medication (49). In a similar multicenter clinical study, the effectiveness of a mobile health application on PA and medication compliance was examined in HF and diabetes mellitus. Thanks to a 3-month therapy, it was revealed that this application improved daily step count, cardiovascular metabolomic markers, and quality of life, but did not facilitate drug compliance (50). In another single-center study, a home rehabilitation program including education, exercise, and diet via mobile application was implemented, and the effectiveness and safety were investigated in frail individuals with HF. Exercise frequency and intensity were adjusted for the following weeks according to the patient's symptoms, pulse, and step count data recorded on the smartwatch during exercise. At the end of 12 weeks, exercise capacity and lower extremity strength were enhanced by encouraging PA behavior in frail individuals with HF (51). In summary, motivational technological tools can be utilized to ameliorate healthy behaviors and compliance with PA in HF.

Although exercise and behavior change interventions are mostly utilized to contribute to habitual active living in individuals with HF, the effect of respiratory muscle training on PA and health-related parameters has also been examined (52). A recent study compared inspiratory muscle strength and endurance training in terms of respiratory and peripheral muscle strength, exercise capacity, dyspnea, fatigue, and PA level in individuals with HF using a pacemaker. At the end of respiratory training applied for 8 weeks, it was observed that both types of training improved the PA level and other parameters to a similar extent (52). Respiratory muscle training primarily declines dyspnea and fatigue intensity by increasing respiratory muscle strength, respiratory muscle endurance, and ventilation. Relieved symptoms and increased oxygenation in peripheral tissues lead to the strengthening of peripheral muscles and improvement of exercise capacity. In conclusion, individuals with HF may have had the chance to raise their PA levels due to increased physical capacity through respiratory muscle training.

Exergaming, which adds a new dimension to rehabilitation, is defined as a technology-oriented exercise that increases the participants' heart rate, oxygen consumption, and energy expenditure through various games, using videos and virtual reality (10). Exergaming improves PA in individuals with HF due to accessibility, entertainment, and motivation, offers PA opportunities at home, and removes barriers (53). In a pilot study designed for 32 elderly individuals with HF and conducted for 12 weeks, Exergaming performed for approximately 28 minutes a day was proven to be influential in healing exercise capacity without exacerbating symptoms (54). Exergaming helps patients become more energetic in daily life and boosts their self-confidence, providing them with the opportunity to enhance their exercise capacity. Progressing exercise capacity similarly reinforces PA and participation (10). The clinician should take into account game preferences, capacities, past experiences, and social support of the patients in case they get bored with the same games and interaction with the games deteriorates (53). Although it is still in advancement, current outcomes demonstrate that Exergaming could be an encouraging method to enhance PA in these patients (10).

Heart age calculators are an original program that estimates biological heart age based on cardiovascular risk factors, aiming to interest users in cardiovascular disease risk assessment (55). It has been suggested that high PA levels may be associated with low biological heart age (56). In a cross-sectional study conducted in Australia, a national web-based heart age calculator was created to prevent cardiovascular diseases, and the biological heart age of 1303 participants was calculated through this program. When the participants were evaluated after 10 weeks, regardless of the heart age result, it was shown that the majority attempted lifestyle changes such as starting a diet program (63.01%), increasing PA (62.09%), and reducing smoking (48.0%) (57). In brief, the use of heart age calculators can guide to exchange of active lifestyles in both healthy adults and individuals with HF.

2. Conclusion and Recommendations

Consistent PA is a substantial healthy lifestyle that declines the risk of HF and improves health outcomes in sedentary individuals with HF. While the activity level of individuals with HF is mostly evaluated multidimensionally through objective methods, activities in daily life (domestic, leisure, occupational, etc.) are evaluated in a short time through subjective methods. When guiding individuals with HF about activity participation, gender, symptom intensity, motivation, readiness for PA, seasonal change and financial reasons effects should be taken into consideration. Clinicians have to develop a more active lifestyle in individuals with HF by utilizing supervised exercise, e-Health applications, heart age calculators, and Exergaming. Future studies on PA in HF patients should focus on longitudinal randomized controlled trials to better understand the long-term benefits and potential risks associated with different types and intensities of PA. These studies should include diverse patient profiles to account for differences in age, gender, comorbidities, and severity of HF. Investigating personalized exercise programs that cater to individual patient profiles, including genetic predispositions and comorbid conditions, could enhance adherence and outcomes. Additionally, exploring innovative and accessible assessment tools, such as wearable technology and remote monitoring systems, could provide more accurate and real-time data on PA levels and patient progress. The roles of technological approaches such as exergaming in encouraging PA participation in both people with HF and their caregivers should be investigated. Research into the barriers to PA, as well as the development of targeted coping skills, is crucial to improving patient engagement. Examining the impact of affected cognitive functions on PA behavior for older adults with chronic HF may provide clinical implications. Besides, predictors of clinically meaningful changes in sedentary time, such as social motivation and family interactions, should be identified. The potential benefits of home-based cardiac rehabilitation interventions in changing patient behavioral patterns toward increased PA should be examined. Finally, integrating interdisciplinary approaches that combine insights from cardiology, psychology, and rehabilitation sciences could offer a more holistic understanding of the multifaceted challenges faced by HF patients in maintaining activity.

3. Contribution to the Field

Heart failure is a significant health problem characterized by progressive deterioration in body functions caused by the heart's inability to pump enough blood. Physical activity is an effective approach that is important in managing heart failure. As a key

component of heart failure, physical activity has been shown to improve cardiovascular function, enhance quality of life, and reduce disease-related complications. Therefore, structured activity counseling should be applied in-group or center-based environments with a multidisciplinary team—including physiotherapists, cardiologists, and other healthcare professionals— to ensure patients adopt and sustain an active lifestyle.

In this context, physiotherapists should evaluate the physical activity levels of patients with heart failure with objective (wearable devices, accelerometers, and heart rate monitors) or subjective (self-reported scales) methods and examine the conditions that affect the individual's participation in the activity. In addition, they must identify and address factors that influence a patient's ability to engage in regular physical activity, including physiological limitations, psychological barriers, and environmental challenges. To enhance adherence and effectiveness, individualized exercise programs should incorporate the up-to-date approaches and actively involve both patients and their caregivers, fostering long-term participation and improved health outcomes.

Ultimately, this study contributes to the field by providing a deeper understanding of the multifaceted barriers to physical activity in heart failure patients and presenting practical, patient-centered strategies for overcoming them. It serves as a valuable resource for clinicians, researchers, and healthcare policymakers seeking to optimize physical activity interventions, improve adherence, and enhance the overall well-being of individuals with heart failure.

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Conflict of Interest

There is no conflict of interest regarding any person and/or institution.

Authorship Contribution

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