E-ISSN: 3062-0961
International Journal Of Physical Activity, Nutrition and Health
URL: https://ijpanh.com/index.php/pub

Review

DOI: 10.5281/zenodo.18071252

Received: 06.07.2025 Accepted: 27.12.2025 Online Published: 28.12.2025

Differentiating Physical Activity, Exercise, and Physical Fitness: A Narrative Review on Health and Cardiopulmonary Fitness

Müberra TANRIVERDİ[1] **Sevgi PEHLİVAN**[2] **Gökhan Can TÖRPÜ**[3]

Abstract

Although the terms *physical activity*, *exercise*, and *physical fitness* are often used interchangeably, they represent distinct yet interrelated concepts that play critical roles in health and cardiopulmonary function. This narrative review aims to differentiate and clarify the definitions and interrelationships of these concepts. Literature was searched in PubMed, Cochrane Library, Web of Science, and Google Scholar using relevant keywords. Studies providing clear conceptual distinctions, discussing cardiopulmonary responses to exercise, and examining the health outcomes of physical activity and fitness were included. Physical activity refers to any bodily movement that increases energy expenditure and contributes to overall health and disease prevention, whereas exercise is a structured and repetitive form of physical activity designed to enhance specific components of physical fitness. Physical fitness encompasses both health- and skill-related attributes that individuals possess or develop, and its cardiopulmonary component reflects the efficiency of the cardiovascular and respiratory systems in oxygen transport and utilization. Understanding the distinctions and interrelationships among these concepts provides a comprehensive framework for optimizing exercise prescription, promoting health, and interpreting physiological adaptations that improve cardiopulmonary performance.

Keywords: Cardiopulmonary Fitness, Cardiorespiratory System, Exercise, Physical Activity, Physical Fitness.

INTRODUCTION

The importance of maintaining an active lifestyle has been extensively recognized in recent years due to its significant contributions to overall health and well-being. Physical activity, exercise, and physical fitness are considered fundamental constructs in the preservation and enhancement of health and quality of life (Patel & Zwibel, 2019). However, the terms physical activity (PA) and exercise, as well as physical fitness and cardiopulmonary fitness (CPF), are frequently used interchangeably in both scientific literature and lay discourse, leading to conceptual ambiguities and misinterpretations.

Physical activity refers to any bodily movement produced by the skeletal muscles that results in energy expenditure. Such activities encompass occupational, recreational, sporting, household, or other daily tasks. Examples of physical activity include walking, gardening, or routine household chores. In contrast, exercise constitutes a planned, structured, and repetitive subset of physical activity aimed explicitly at improving or maintaining physical fitness. Exercise programs are typically tailored to target specific components such as aerobic endurance, muscular strength, flexibility, or balance.

Physical fitness comprises multiple components, among which cardiopulmonary fitness emerges as a critical subdomain, reflecting the efficiency of the cardiovascular and respiratory systems and its close association with health outcomes. Cardiopulmonary fitness is distinct from other components of physical fitness in that it primarily focuses on the capacity of the cardiovascular and respiratory systems

[1] Bezmialem Vakıf University, Istanbul-Türkiye. muberratanrverdi@gmail.com
[2] Corresponding Author: Istanbul Aydın University, Istanbul-Türkiye. sevgipehlivan98@gmail.com
[3] Bezmialem Vakıf University, Istanbul-Türkiye. gokhantrp@yahoo.com

to deliver oxygen to the working muscles, thereby determining aerobic capacity and endurance performance (Myers et al., 2015). Although these components collectively contribute to overall fitness, existing literature often treats physical activity, exercise, and fitness as interchangeable terms, leading to conceptual ambiguity and inconsistency in both research and clinical practice. This gap limits the ability to interpret cardiopulmonary adaptations accurately and to design effective exercise prescriptions.

This narrative review aims to define and differentiate the three key concepts of physical activity, exercise, and physical fitness, clarify their interrelationships, and examine the cardiopulmonary system's physiological responses to exercise. By establishing a clear theoretical foundation and exploring the mechanisms underlying movement and fitness, this review seeks to resolve terminological confusion and support more coherent communication in clinical practice, public health initiatives, and health education. Relevant literature was identified through searches in PubMed, Web of Science, Google Scholar, and the Cochrane Library using the keywords "physical activity," "exercise," "physical fitness," "cardiopulmonary fitness," "cardiorespiratory fitness," and "health outcomes." Within the scope of this review, the concepts of physical activity, exercise, and physical fitness are first defined and differentiated; their physiological and cardiopulmonary bases are then discussed, followed by an evaluation of their health implications and interconnections. Finally, the review presents a conceptual framework that integrates these domains and emphasizes their collective role in promoting health and functional capacity.

Physical Activity

The pivotal role of physical activity in maintaining and promoting health has been recognized since antiquity, with historical records dating back to 3000 BCE emphasizing its importance as a fundamental element of daily living (Gupta & Vaqar, 2023). The World Health Organization defines physical activity as any bodily movement produced by skeletal muscles that results in energy expenditure, encompassing all movements performed as part of daily life, whether purposeful or not (World Health Organization [WHO], 2010). Such activities include walking, running, cycling, stair climbing, gardening, shopping, and cleaning, which can be performed at various skill levels and are accessible and enjoyable for most individuals.

Comprehensive reviews and meta-analyses based on large epidemiological cohorts have consistently demonstrated a dose–response relationship between physical activity and reduced premature mortality, as well as the prevention of chronic diseases (Warburton & Bredin, 2017). Even low-intensity activities such as walking or cycling can improve aerobic capacity and overall health, while higher-intensity activities further enhance muscular strength and metabolic efficiency. Regular engagement in physical activity preserves both physical and mental well-being, reducing the risk of non-communicable diseases and lowering premature mortality by approximately 20–30%.

Moreover, physical activity supports cognitive and emotional health by reducing the risk of cognitive decline, depression, and anxiety, while also improving academic performance (Mandolesi et al., 2018). Consistent participation helps prevent chronic conditions such as obesity, cardiovascular disease, and diabetes, strengthens the immune system, and fosters overall well-being (He & Kang, 2024; Warburton & Bredin, 2016).

Exercise

Exercise encompasses planned, structured, repetitive, and purposeful physical activities designed to enhance or maintain specific components of physical fitness. Its primary objectives include improving or sustaining health, strength, endurance, and flexibility (Siedentop & Van der Mars, 2022). The biological implications of exercise are complex, involving adaptive responses across multiple organ systems. Human movement provides an evolutionary advantage, transforming skeletal muscle into a systemic regulator that meets energy demands (Hawley et al., 2014). Both aerobic exercises (e.g., walking, running, cycling, swimming) and resistance training induce beneficial adaptations across the body, strengthening muscles and improving cardiovascular efficiency. Exercise is an energy-demanding activity that influences not only the cardiovascular, respiratory, and musculoskeletal systems but also the immune and endocrine systems (Qiu et al., 2023).

Regular participation in exercise provides extensive health benefits by eliciting favorable physiological responses in numerous organ systems. The effects of both acute and chronic exercise have been well documented within exercise science, a field with a long tradition of defining performance thresholds in health and disease. Exercise physiologists examine how the body responds to movement, sports, and physical training, while clinical exercise physiologists apply these principles to prevent and rehabilitate various conditions (Booth et al., 2012). Compared to rest, exercise triggers major physiological adjustments. At rest, parasympathetic activity regulates respiration, cardiac output, and metabolism; during exercise, the sympathetic nervous system activates, increasing heart rate, ventilation, and metabolic rate to maintain homeostasis under greater physical demand (Travers et al., 2022).

The mechanisms underlying the cardioprotective effects of regular exercise involve numerous molecular and physiological adaptations. Some effects appear immediately after a single exercise session, such as reduced anxiety, lower blood pressure, improved sleep, and enhanced insulin sensitivity. Long-term exercise training, however, is required to sustain cardiopulmonary fitness, muscular strength, and cardiovascular remodeling. Regular exercise is associated with better psychological well-being and exerts anti-atherosclerotic, anti-arrhythmic, anti-ischemic, and anti-thrombotic effects. These adaptations—such as improved coronary flow reserve, heart rate variability, endothelial function, capillary density, and nitric oxide bioavailability—collectively reduce the risk of hypertension, diabetes mellitus, dyslipidemia, cancer, depression, dementia, musculoskeletal disorders, and cardiovascular mortality (Franklin et al., 2022).

Physical Fitness

Distinguishing itself from the mere engagement in physical activity, the concept of physical fitness encapsulates a range of characteristics inherent to individuals or developed over time. It signifies the capacity to undertake daily tasks with vitality and mental acumen, devoid of undue exhaustion, while possessing sufficient reserves of energy to engage in recreational activities and effectively handle unforeseen challenges (Conrad, 1981).

Physical fitness is underpinned by discernible components, which can broadly be categorized into those pertaining to health and skill related with physical prowess. The most mentioned components are divided into two groups: one related to health and the other more associated with physical fitness abilities (Raimkulov & Artikov, 2023). Within the realm of health-related components, we find cardiorespiratory endurance, muscular endurance, muscular strength, body composition, and flexibility as the primary constituents. It is important to note that these components may not uniformly progress; an individual may excel in one aspect while lagging in another. For instance, one may possess significant muscular strength yet lack the flexibility required for certain movements. This non-uniform progression underscores the multifaceted nature of physical fitness, wherein different attributes may develop at varying rates. Moreover, physical fitness is not a static state but rather a dynamic process influenced by various factors such as lifestyle, genetics, and environmental conditions. Thus, individuals may find themselves at different points along the continuum of physical fitness, with room for improvement always present. In essence, physical fitness serves as a cornerstone for overall health and well-being, offering a pathway towards vitality and resilience in the face of life's challenges. It is through structured activities such as exercise that individuals can actively enhance or maintain their physical fitness levels, thereby optimizing their quality of life and longevity (Sharma et al., 2023).

Cardiopulmonary Fitness

Cardiopulmonary fitness is a critical aspect of overall physical fitness, encompassing both aerobic and anaerobic capacities. Cardiopulmonary system involves the efficient functioning of the circulatory and respiratory systems to supply energy to the body during prolonged physical activity and to eliminate metabolic byproducts post-exertion. Aerobic capacity refers to the body's ability to utilize oxygen effectively, facilitating sustained muscle activity through the integrated efforts of the pulmonary and cardiovascular systems. Conversely, anaerobic capacity is associated with short-term, high-intensity efforts, providing energy through glycolytic and phosphagen pathways without relying on oxygen. Together, these components ensure optimal performance and recovery in various physical activities (Kokkinos et al., 2018; Shiraki et al., 2020).

Aerobic capacity, measured as maximum oxygen uptake (VO_{2max}) or peak oxygen uptake (VO_{2peak}), is a robust predictor of cardiovascular mortality and morbidity. The inverse relationship between cardiopulmonary fitness and health outcomes is evident across a diverse range of individuals, from the general population to those with cardiovascular risk factors and both with and without cardiovascular disease. Given that the inclusion of cardiopulmonary fitness alongside traditional cardiovascular risk factors improves the accuracy of risk stratification for adverse outcomes, it has been proposed that fitness levels and regular physical activity be regarded as clinical vital signs (Lee & Zhang, 2021).

Every component of physical fitness contributes to overall health; however, the relationship between specific fitness elements and health outcomes is particularly strong for certain domains, such as cardiopulmonary fitness. Higher levels of cardiorespiratory and muscular fitness are consistently associated with a lower risk of adverse health outcomes (Kaminsky et al., 2019).

The relationship between cardiopulmonary fitness and various biological risk factors, as well as clinical assessments, parallels that of physical activity. Among healthy middle-aged and older adults, those with superior cardiopulmonary fitness or those who improve their fitness levels over time show a lower risk of all-cause and cardiovascular disease mortality and morbidity. Furthermore, higher cardiopulmonary fitness in individuals with existing health conditions may result in fewer clinical incidents (Kokkinos et al., 2022).

The necessary minimum level of cardiopulmonary fitness for maintaining health can differ between men and women and among different age groups. These differences are due to variations in cardiopulmonary fitness distributions among healthy individuals of different genders and the nonlinear decline in cardiopulmonary fitness with aging, particularly in the absence of regular exercise (Garber et al., 2011).

Physical Activity and Exercise

Although closely related, physical activity encompasses all movement that expends energy, while exercise refers specifically to planned and structured efforts aimed at improving fitness. Both contribute significantly to overall health, yet structured exercise programs are particularly effective in eliciting targeted physiological adaptations, such as improved cardiovascular efficiency, enhanced muscular strength, and better metabolic control (Pedersen & Saltin, 2015).

Emerging evidence highlights that even modest increases in exercise—especially among previously sedentary individuals—result in substantial reductions in morbidity and all-cause mortality, underscoring a steep early dose-response benefit (Ekelund et al., 2019). These physiological improvements are complemented by mental health benefits, including reduced symptoms of anxiety and depression, improved sleep quality, and cognitive enhancement (Piercy et al., 2018).

Incorporating both structured exercise and lifestyle-based physical activity into daily routines not only improves adherence but also sustains long-term functional capacity, especially when supported by policy-level and environmental facilitators (Bull et al., 2020). Therefore, the integration of varied movement strategies into modern life stands as a powerful, low-cost intervention for preventing disease and promoting holistic well-being.

Physical Activity and Physical Fitness

There is a close relationship between physical activity and physical fitness; physical fitness is primarily, though not entirely, determined by physical activity patterns over recent weeks or months. Physical fitness is similar to PA but is more predictive of health outcomes. Physical fitness is comprised of cardiovascular, musculoskeletal, body composition, and metabolic components (Miller et al., 2016). While genetic contributions to fitness are significant, the portion of observed variation in fitness attributable to environmental factors, particularly physical activity, is likely greater than that due to genetics. For most individuals, increases in physical activity lead to improvements in physical fitness, although the magnitude of fitness adaptation to a standardized exercise dose varies widely and is under genetic control (Blair et al., 2001).

Physical activity is a modifiable behavioral factor, whereas physical fitness represents an acquired physiological state influenced by both habitual activity patterns and genetic predispositions. These two

constructs independently affect longevity, yet they interact bidirectionally; physical fitness mediates and moderates the relationship between physical activity and mortality risk. Regular physical activity enhances physiological fitness over time, while baseline fitness levels determine an individual's capacity and tolerance for physical activity. Consequently, physical activity and fitness maintain an integrated, reciprocal relationship that collectively contributes to overall health outcomes (Lee et al., 1997).

In general, health-related behaviors (such as diet, physical activity, smoking, etc.) and health-related fitness components (including cardiorespiratory, motor, and metabolic factors) constitute an integrated system functioning as an inseparable cycle with reciprocal influences on health outcomes. Consistent with this integrative framework, epidemiological evidence reviewed by Lee et al. (1997) consistently demonstrated that both physical activity and physical fitness exert independent and synergistic effects on all-cause mortality, further underscoring the concept of a holistic behavior-fitness-health continuum.

In general, health-related behaviors (such as diet, physical activity, smoking, etc.) and health-related fitness components (including cardiorespiratory, motor, and metabolic factors) constitute an integrated system functioning as an inseparable cycle with reciprocal influences on health outcomes (Bouchard et al., 2012).

Physical Activity and Cardiopulmonary Fitness

Exercise and physical activity constitute fundamental components of a healthy lifestyle and are associated with a significant reduction in the risk of developing chronic diseases. Cardiopulmonary fitness is widely recognized as a proxy measure reflecting habitual physical activity levels (Bahls et al., 2021).

A published meta-analysis demonstrated the independent and beneficial effects of high levels of physical activity and cardiopulmonary fitness on health (Williams, 2001), these findings have been further corroborated by a large-scale analysis utilizing data from the UK Biobank (Steell et al., 2019).

Despite the well-established benefits of an active lifestyle on health, levels of physical activity and cardiopulmonary fitness tend to decline progressively throughout the lifespan. Nonetheless, PA and CPF are recognized as both independent and interrelated risk factors for cardiovascular disease (Bahls et al., 2021). A substantial body of evidence demonstrates that higher levels of physical activity and cardiopulmonary fitness are significantly associated with reduced incidence of various diseases and lower all-cause mortality rates. However, the association between cardiopulmonary fitness and coronary heart disease appears to be stronger compared to that of physical activity (Dyrstad et al., 2016).

VO_{2peak} declines by approximately 5 mL/min/kg per decade, and this reduction may be more pronounced in individuals with high levels of baseline spontaneous physical activity (SPA). However, increases in lifelong leisure-time physical activity (LTPA) and SPA may attenuate the age-related decline in cardiopulmonary fitness (Ward, 2024) On the other hand, CPF is largely determined by genetic factors, and it has been suggested that individuals with high CPF may be more likely to engage in physical activity (Karvinen et al., 2015). Therefore, the causal relationship between physical activity and cardiopulmonary fitness remains unclear.

Table 1. Comparison of physical activity, exercise, physical fitness, and cardiopulmonary fitness: definitions, characteristics, health benefits and examples.

Feature	Physical Activity	Exercise	Physical Fitness	Cardiopulmonary Fitness
Definition	Any bodily movement produced by skeletal muscles that results in energy expenditure.	Planned, structured, and repetitive bodily movements intended to improve or maintain physical fitness.	A set of health and skill-related attributes that individuals have or achieve.	The ability of the cardiovascular and respiratory systems to supply oxygen during sustained physical activity.
Planning and Structure	May be unplanned and unstructured.	Planned and structured.	Involves both health and skill-related components.	Involves efficient function of the circulatory and respiratory systems.
Objective	Encompasses everyday activities like walking, gardening, and household chores.	Aims to improve specific aspects of physical fitness such as cardiovascular endurance, strength, or flexibility.	Represents the ability to perform daily tasks with vigor and alertness, without undue fatigue.	Focuses on aerobic capacity and endurance capabilities.
Health Benefits	Reduces the risk of chronic diseases, improves overall quality of life, and enhances mental health.	Provides extensive health benefits, including improved metabolic equilibrium and immune system function.	Serves as a cornerstone for overall health and well-being, offering vitality and resilience.	Strong predictor of cardiovascular mortality and morbidity and improves cardiovascular risk factors.
Components	Involves all forms of movements performed as part of daily life without specific purpose.	Includes aerobic exercises (e.g., running, cycling) and resistance training.	Comprises cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition.	Includes aerobic and anaerobic capacities, measured by metrics like maximum oxygen uptake (VO_{2max}).
Adaptation and Improvement	Regular participation improves physical and mental health, reduces chronic disease risk, and enhances overall well-being.	Leads to physiological adaptations across various organ systems, enhancing physical fitness components.	Dynamic process influenced by lifestyle, genetics, and environment, with continuous room for improvement.	Improves with regular physical activity and structured exercise, enhancing overall physical fitness.
Examples	Walking, cycling, stair climbing, gardening, and cleaning.	Running, swimming, weightlifting, yoga, and sports activities.	Fitness tests, exercise programs, and physical activities tailored to improve specific fitness components.	Activities that challenge the cardiovascular and respiratory systems, such as running, swimming, and high-intensity interval training.

DISCUSSION and CONCLUSION

The comprehension of the intricate dynamics among physical activity, exercise, and physical fitness stands as a cornerstone in advancing overall health and well-being. Physical activity, encompassing the broad spectrum of bodily movements involved in daily routines and tasks, serves as the fundamental framework for health promotion and disease prevention. Its diverse forms, ranging from everyday chores to recreational activities, provide multifaceted benefits for both physiological and psychological health. Exercise, defined as a structured and purposeful subset of physical activity, plays a pivotal role in enhancing and maintaining physical fitness by targeting specific attributes such as cardiovascular endurance, muscular strength, and flexibility. The physiological adaptations induced by consistent exercise not only optimize organ system function but also offer comprehensive health benefits, including metabolic balance and immune system enhancement.

From a practical standpoint, these distinctions become evident when comparing sedentary individuals with those who engage in regular physical activity or structured exercise. Sedentary individuals typically exhibit minimal daily physical activity, leading to lower levels of physical fitness and diminished cardiopulmonary capacity. In contrast, individuals who participate in regular exercise demonstrate improved cardiovascular endurance, muscular strength, and overall physical fitness due to continuous physiological adaptation. Thus, while physical activity contributes to general health maintenance, structured and consistent exercise plays a decisive role in enhancing physical fitness and achieving optimal cardiopulmonary function (Booth et al., 2012).

This review highlighted the subtle distinctions among physical activity, exercise, and physical fitness while underscoring the profound positive effects of exercise on the human cardiopulmonary system (Table 1). Cardiopulmonary fitness, a critical component of overall physical fitness, reflects the efficiency of the cardiovascular and respiratory systems and is strongly linked to reduced risks of morbidity and mortality. Regular physical activity and exercise induce essential physiological adaptations that improve cardiopulmonary function and support overall health.

In conclusion, fostering a culture that values regular physical activity and structured exercise programs is essential for promoting health, longevity, and quality of life across all populations and age groups. Integrating physical activity into daily life, engaging in organized exercise, and understanding the body's response to exertion set individuals on a path toward enhanced well-being and vitality. Future research should focus on elucidating the underlying mechanisms of exercise's impact on the cardiopulmonary system and developing tailored interventions that address the diverse needs of individuals, ultimately advancing effective strategies for health promotion and disease prevention.

Authors' Statement of Contribution to the Article: Article design: MT, SP; Data Collection and Processing: SP, GCT; Literature review: MT, SP, GCT; Article writing: SP, GCT; Consulting: MT

Conflict of Interest: The authors have no conflict of interest to declare.

Financial support. No financial support was received for the completion of this study.

Ethics Committee Approval. This study is a review article and does not require ethics committee approval as it does not involve human or animal subjects.

Peer Review: After the blind review process, it was found suitable for publication and accepted.

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