The Relationship Between Cardiac Function and Body Composition in Basketball Coaches

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Abstract

Background: It is widely believed today that the role of a coach has evolved beyond merely directing training sessions. Coaches are now expected to possess diverse skills in tactical, technical, psychological, physical fitness, and interpersonal, social, and personality domains. The aim of the present study was to examine the relationship between cardiac function and body composition in basketball coaches.

Methods: In this causal-comparative study, 60 basketball coaches participating in the national high school championships (for both girls and boys) in 2023 (1402 Iranian calendar) were selected as the statistical sample. On the first day of the competition, following the opening session, the study procedures, benefits, and strengths were explained in a pre-scheduled meeting, and volunteers were registered. The next day, demographic questionnaires were distributed among the volunteer coaches and collected after completion. Then, cardiac waves and body composition were measured using an electrocardiogram (ECG) and a body composition analyzer, respectively. Pearson correlation coefficient was used for inferential data analysis ($P \leq 0.05$).

Results: Significant correlations were found between heart rate and protein mass (P=0.04), between QRS wave and fat mass (P=0.04), and between PQ interval and both protein mass (P=0.01) and lean body mass (P=0.01).

Conclusion: It appears that cardiac performance in basketball coaches is influenced by body composition.

Keywords: Cardiac function, body composition, basketball

Introduction

Today, many believe that the role of a coach has gone beyond conducting training sessions and must include a variety of skills in areas such as tactics, techniques, psychology, physical conditioning, and interpersonal, social, and personality competencies (1). Cardiovascular disease is one of the most serious and fundamental health concerns in Iran and across the world. In industrialized nations, cardiovascular disease is considered the second leading cause of death. Similarly, in developing countries, cardiovascular issues are among the major public health problems and are on the rise (2). Recent research increasingly confirms the influence of psych-osocial factors on the onset and progression of cardiovascular disease. The stressful and tense conditions of modern societies have led to cardiovascular diseases becoming the leading cause of premature death, claiming millions of lives annually and resulting in billions of dollars in healthcare costs and lost productivity (3). Research shows that psychological and social stress is an independent risk factor—regardless of age, gender, and traditional physical risk factors—contributing to cardiovascular disease. These stressors act through psychoneuro-physiological mechanisms and stimulate the autonomic nervous system, particularly the sympathetic division, thereby increasing cardiovascular responses and promoting the onset or continuation of heart disease. One key psychological factor in cardiovascular disease is personality type. Individuals with stress-prone and anxious personality types are more susceptible to heart disease (4). Considering the stress and challenges that coaches face in various sporting events, maintaining cardiovascular health is essential for coping with the specific demands of these events. Currently, numerous problems such as heart attacks, high blood pressure, weight gain, obesity, and physical inactivity are observed among coaches, potentially impacting their overall health. Health is one of the most important topics of interest to researchers and is defined by the World Health Organization as an optimal state of overall well-being. Obesity is a serious public health issue in both developed and developing countries. According to WHO statistics, in 2004, overweight and obesity ranked fifth among the most dangerous risk factors for death (5). Due to its rapid rise in recent years and associated health complications such as cardiovascular disease, diabetes, specific types of cancer, musculoskeletal disorders, and gallbladder disease, obesity is considered a major public health concern (6). A healthy body requires a minimum amount of fat for proper hormonal function, reproduction, and immune response. Fat is essential not only as an energy source but also for synthesizing cell membranes and facilitating intra-cellular communication. However, excess fat can lead to a

metabolic disorder known as metabolic syndrome. Physical activity and fitness are crucial elements in maintaining human health. Experts recommend exercise and physical activity as the best treatments for these diseases. Previous studies have confirmed that regular physical activity improves individual health and helps prevent many deadly diseases (7,8).Therefore, given the importance of physical health, the present study aims to investigate the relationship between cardiac function and body composition in basketball coaches.

Materials and Methods

The study population consisted of all coaches participating in the 2023 (1402) national high school basketball championships for boys and girls. Based on Morgan's table, 60 volunteer coaches were selected as the statistical sample. To carry out the study, the researchers first visited the Shiraz Department of Education and fully explained the research process to the director of physical education. After receiving approval and obtaining an official introduction letter from Islamic Azad University of Shiraz, initial coordination was made with the competition organizers. On the first day of the competition, after the opening session, all coaches were briefed on the research process, its advantages, and its strengths. Volunteers were registered during the same session. The following day, demographic questionnaires were distributed to the volunteer coaches and collected after completion. Then, their cardiac waves and body composition were measured using an electrocardiogram (ECG) and a body composition analyzer, respectively. Pearson correlation coefficient was used for inferential statistical analysis. The significance level was set at $P \leq 0.05$.

Results

Table 1 reports the mean and standard deviation of the participants' age, height, and weight. Moreover, table 2 presents the mean and standard deviation of cardiac performance indicators (heart rate, QRS wave, PQ interval, QT interval) and body composition indicators (protein mass, mineral mass, lean body mass, and fat mass). Results of Pearson's correlation test shown in Table 3 indicate significant correlations between: Heart rate and protein mass ($r = -0.25$, $P = 0.04$), QRS wave and fat mass ($r = -0.25$, $P = 0.04$), PQ interval and protein mass ($r = 0.30$, $P = 0.01$), PQ interval and lean body mass ($r = 0.32$, $P = 0.01$).

However, no significant correlations were observed between: Heart rate and mineral mass ($r = -0.19$, $P = 0.12$), Heart rate and lean body mass ($r = -0.24$, $P = 0.06$), Heart rate and fat mass ($r = -0.01$, $P = 0.9$), QRS wave and protein mass ($r = 0.19$, $P = 0.13$), QRS wave and mineral mass ($r = 0.18$, $P = 0.14$), QRS wave and lean body mass ($r = 0.17$, $P = 0.17$), PQ interval and mineral mass ($r = 0.16$, $P = 0.21$), PQ interval and fat mass ($r = 0.17$, $P = 0.19$),

QT interval and protein mass (r = 0.08, P = 0.51), QT interval and mineral mass (r = 0.07, P = 0.58), QT interval and lean body mass (r = 0.07, P = 0.55), QT interval and fat mass (r = -0.09, P = 0.48).

Table 1. Mean and Standard Deviation of Participants' Demographic Characteristics

Variable	Mean	Standard Deviation
Age (years)	43.37	8.28
Height (cm)	169.26	24.74
Weight (kg)	74.88	17.16

Table 2. Mean and Standard Deviation of Heart Rate, QRS Wave, PQ Interval, QT Interval, and Body Composition Components

Variable	Mean	Standard Deviation
Heart Rate (beats/min)	75.98	11.08
QRS Wave (ms)	96.95	9.91
PQ Interval (ms)	140.10	23.92
QT Interval (ms)	374.61	21.84
Protein Mass (kg)	13.61	3.07
Mineral Mass (kg)	3.07	0.48
Lean Body Mass (kg)	51.77	10.94
Fat Mass (kg)	22.08	6.95

Table 3. Pearson Correlation Coefficients Between Cardiac Function Indicators and Body Composition Variables

Variable	**Protein Mass**	**Mineral Mass**	**Lean Body Mass**	**Fat Mass**
Heart Rate	r = -0.25, P = 0.04	r = -0.19, P = 0.12	r = -0.24, P = 0.06	r = -0.01, P = 0.90
QRS Wave	r = 0.19, P = 0.13	r = 0.18, P = 0.14	r = 0.17, P = 0.17	r = -0.25, P = 0.04
PQ Interval	r = 0.30, P = 0.01	r = 0.16, P = 0.21	r = 0.32, P = 0.01	r = 0.17, P = 0.19
QT Interval	r = 0.08, P = 0.51	r = 0.07, P = 0.58	r = 0.07, P = 0.55	r = -0.09, P = 0.48

Discussion

The results of the present study indicated that an increase in protein mass is associated with a decrease in heart rate, a reduction in fat mass corresponds to an increase in the QRS wave, and an increase in both protein mass and lean body mass leads to an increase in PQ interval. These findings suggest that improvements in body composition (i.e., increased lean body mass and reduced fat mass) are associated with enhanced cardiac function.

Consistent with our findings, Dabidi Roshan and Nasrollahi Boroujeni (2019) demonstrated a significant positive relationship between cardio-respiratory fitness and body composition indicators (9). Studies have shown that cardiovascular diseases are the leading cause of death in Iran. In fact, mortality data from 18 provinces reveal that 46% of total deaths and 27.2% of years of life lost are attributable to cardiovascular diseases (10).

In Isfahan, the prevalence of cardiovascular disease among individuals aged 30 to 79 years was reported as 19.4%, with 21.9% for women and 16% for men (11). Although many researchers have introduced body mass index (BMI) as one of the most well-known indicators of obesity, recent evidence suggests that it has serious limitations, including its inability to differentiate between lean mass and fat tissue, which are better predictors of diabetes and cardiovascular disease (9).Adopting a healthy lifestyle—including proper nutrition, regular physical activity, and stress avoidance—appears to play a critical role in maintaining body composition within the normal range. While many researchers attribute the rising prevalence of obesity to factors such as physical inactivity and increasingly sedentary lifestyles (12), the impact of diet, genetics, hormonal changes, daily stress, and other factors on body composition should not be overlooked.

In relation to body composition and cardio-respiratory fitness, Bararpour and Dabidiroshan (2021) reported significant positive relationships between cardiovascular fitness and lean body mass, muscle mass, waist-to-hip ratio, and BMI. This means that improvements in cardio-respiratory fitness are associated with better anthropometric and body composition indicators (13).

Nowadays, cardio-respiratory fitness is considered one of the strongest indicators of health, even more so than traditional markers such as body weight, blood pressure, and cholesterol. The World Health Organization recommends at least 150 minutes of moderate-intensity physical activity per week to maintain health and well-being (14). Moreover, in 2016, the American College of Sports Medicine and the American Heart Association released updated exercise guidelines, promoting walking as an enjoyable form of exercise to help combat sedentary lifestyles and improve health (15, 16). The mechanism linking anthropometric indices and physical fitness remains unclear. However, the relationship between BMI and fat mass with physical performance has been confirmed in previous studies (17, 18). It has also been reported that increased body weight

and fat negatively impact physical performance in two ways: (1) they are associated with lower relative maximal oxygen consumption, and (2) greater body weight leads to increased energy expenditure at any level of physical activity.

Conclusion

Therefore, heavier (and more obese) individuals require a higher percentage of their maximal oxygen consumption during physical activity due to elevated energy demands and lower VO_2max (19). One of the limitations of the present study was the inability to assess cardio-respiratory function using laboratory tests such as the Bruce protocol. Future studies are recommended to explore the relationship between body composition indices and cardio-respiratory performance using standardized laboratory tests. Based on the findings of the present study, it appears that cardiac performance in basketball coaches is influenced by body composition.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Resources

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