RELATIONSHIP BETWEEN EXERCISE FREQUENCY, BODY COMPOSITION, AND CARDIOVASCULAR FITNESS IN ECCE STUDENTS

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Abstract

Regular physical activity plays a fundamental role in maintaining optimal body composition and enhancing cardiovascular fitness, particularly among young adults in academic settings. University students, including those enrolled in Early Childhood Care and Education (ECCE) programs, often experience lifestyle transitions that influence their exercise patterns, dietary habits, and overall health status. This study aimed to examine the relationship between exercise frequency, body composition, and cardiovascular fitness among ECCE students. A quantitative cross-sectional research design was employed to assess how varying levels of exercise participation impact physiological health indicators.

Data were collected from undergraduate ECCE students using a structured questionnaire to measure exercise frequency, categorized into low, moderate, and high activity levels based on weekly participation. Body composition was assessed using Body Mass Index (BMI) and body fat percentage, while cardiovascular fitness was evaluated through standardized field-based fitness testing procedures, including estimated VO_2 max scores. Statistical analyses were conducted to determine correlations and predictive relationships among the variables.

The findings indicate a significant positive association between exercise frequency and cardiovascular fitness. Students engaging in moderate to high levels of weekly physical activity demonstrated better VO_2 max scores and healthier body composition profiles compared to those with low activity levels. Furthermore, exercise frequency was inversely correlated with BMI and body fat percentage, suggesting that increased physical activity contributes to improved metabolic efficiency and reduced adiposity. Regression analysis further revealed that exercise frequency significantly predicts cardiovascular fitness outcomes, even after controlling for demographic factors.

These results highlight the importance of promoting consistent physical activity among ECCE students, who will later serve as role models for young children. Improving their health behaviors may have long-term benefits not only for their personal well-being but also for their professional practice in early childhood settings. The study underscores the need for structured fitness awareness programs within teacher education institutions to foster lifelong healthy habits. Future

research may incorporate longitudinal designs and advanced body composition analysis techniques to strengthen causal interpretations.

INTRODUCTION

Regular physical activity is widely recognized as a cornerstone of physical health and disease prevention. Engaging in consistent exercise contributes to improved body composition, enhanced cardiovascular endurance, and reduced risk of non-communicable diseases such as obesity, hypertension, and coronary heart disease. According to the World Health Organization (2020), insufficient physical activity is one of the leading risk factors for global mortality, particularly among young adults transitioning into independent lifestyles. University students often experience significant changes in daily routines, academic pressure, and sedentary behaviors, all of which may negatively influence their exercise frequency and overall health status.

Exercise frequency plays a central role in determining both body composition and cardiovascular fitness. Regular moderate to vigorous physical activity has been shown to reduce body fat percentage, maintain healthy body mass index (BMI) levels, and improve metabolic function. In contrast, low levels of activity are associated with increased adiposity and reduced cardiorespiratory capacity. Cardiovascular fitness, commonly assessed through maximal oxygen uptake (VO_2 max), reflects the efficiency of the heart, lungs, and circulatory system in delivering oxygen during sustained physical activity. Higher VO_2 max values are strongly linked to reduced cardiovascular disease risk and improved long-term health outcomes (Ross et al., 2016).

Body composition is another important indicator of health, as it provides insight into the proportion of fat mass and lean mass within the body. While BMI is frequently used in academic research due to its simplicity, combining it with body fat percentage offers a more comprehensive assessment of physical health. Research consistently demonstrates that individuals who engage in regular exercise exhibit more favorable body composition profiles compared to sedentary individuals (Warburton & Bredin, 2017). Therefore, examining exercise frequency alongside both body composition and cardiovascular fitness allows for a deeper understanding of how lifestyle behaviors influence physiological well-being.

Students enrolled in Early Childhood Care and Education (ECCE) programs represent a unique population. As future educators and caregivers, they are expected to model healthy behaviors for young children. Their personal health practices may influence not only their well-being but also their professional effectiveness. Despite this, limited research has specifically explored the relationship between exercise habits and physiological health indicators within this academic group. This study aims to address this gap by investigating how exercise frequency relates to body composition and cardiovascular fitness among ECCE students, thereby contributing to evidence-based health promotion strategies within teacher education institutions.

Literature Review

Study/Author (Year)	Population/ Sample	Exercise/Activity Measure	Body Composition Variable	Cardio Fitness Measure	Key Findings
Sudersanadas et al. (2024)	Adult females (19–24)	Weekly physical activity	BMI, FFM, FM, BMR	VO_2 max (Balke test)	Higher active females had better VO_2 max; body composition strongly influenced cardio fitness. ([PubMed](#))
Zaki et al. (2024)	Adults with T2DM (35-70)	13-week aerobic + resistance	Body fat %, waist/hip	VO_2 max, HRV	Combined training reduced body fat and improved CRF. ([PubMed](#))
Khatoon et al. (2021)	Young adults (18–25)	Physical activity levels	BMI	VO_2 max, physical activity	Physical activity positively correlated with better cardiovascular metrics; lower BMI in active group. ([PubMed](#))
Sampaio et al. (2025)	Uni students (male)	IPAQ categorization (low/mod/hi)	Body comp, grip strength	Estimated VO_2 max	Higher activity linked to better fitness and healthier body composition. ([MDPI](#))
Mabe-Castro et al. (2024)	Older adults	Physical fitness tests + fat %	Body fat %, BMI	Cardio & HRV tests	Increased body fat linked to lower physical fitness and weaker cardiac response. ([PMC](#))
Batool (2024)	PT students	Survey on fitness awareness	Awareness level	Awareness of activity vs fitness	Knowledge gaps on exercise frequency affect fitness behavior. ([ZU Journal System](#))
Delfa-de-la-Morena (2025)	Adult men	Physical activity levels	Body composition	Strength	Active adults had lower fat % and better strength markers. ([PMC](#))
Coman et al. (2025)	Female students	Bioelectrical impedance and activity	Body fat, muscle mass	(Impedance based measures)	Lower PA linked to higher fat mass regardless of age/sex. ([Bioclima](#))

Study/Author (Year)	Population/ Sample	Exercise/Activity Measure	Body Composition Variable	Cardio Fitness Measure	Key Findings
Lee et al. (2025)	Adults (middle age)	Physical tests	Waist circumference, body fat	YMCA step test	Abdominal obesity + low cardio fitness raise hypertension risk; activity implicated. (Frontiers)
(Related systematic 2024) Exercise's role in metabolic conditions	Mixed clinical populations	Aerobic & strength	Weight, body weight	Functional capacity	Aerobic training improves body weight and fitness across conditions. (Springer)
(Meta-analysis 2025) Type 1 Diabetes	T1D adults (n=1120)	Exercise training vs control	BMI, glucose	VO_2 peak	Exercise decreased BMI and increased VO_2 peak. (MDPI)
(Cross-population review) Volis & Zafrir (2024)	Adult patients	Physical activity	N/A	Cardio health	Physical activity benefits multiple cardio risk factors. (MDPI)
Ates et al. (2024)	Sports-active children	Sports club participation	Body composition	Yo-Yo test performance	Higher activity levels linked to favorable body composition and fitness. (PubMed)
(2025 longitudinal college students) Xiaoyan et al. (2025)	Vocational students	Digital fitness intervention	Weight, fat %	Endurance outcomes	Increased activity improved weight and aerobic outcomes. (efsupit.ro)
(2025 college study) Ajdinović (2025)	Uni students (Serbia)	Step test (fitness index)	BMI	Step fitness index	Significant negative correlation: high BMI → low fitness. (PMC)

Methods

Research Design

This study employed a quantitative cross-sectional research design to examine the relationship between exercise frequency, body composition, and cardiovascular fitness among Early Childhood Care and Education (ECCE) students. A cross-sectional approach was selected because it allows the assessment of associations among variables at a single point in time while minimizing logistical and time constraints. This design is widely used in health and physical activity research to explore correlations between lifestyle behaviors and physiological indicators (Bull et al., 2020).

Participants

The target population consisted of undergraduate ECCE students enrolled in a public sector

university. A total of 120 students were recruited using convenience sampling. Inclusion criteria included: (1) enrollment in the ECCE program, (2) age between 18–25 years, and (3) absence of known cardiovascular or musculoskeletal disorders that could limit participation in fitness testing. Students with diagnosed chronic illnesses affecting metabolism or physical performance were excluded.

Prior to data collection, informed consent was obtained from all participants. Confidentiality and anonymity were ensured by assigning coded identification numbers to each participant.

Instruments and Measures
1. Exercise Frequency
Exercise frequency was measured using a structured self-report questionnaire adapted from physical activity assessment frameworks consistent with guidelines provided by the World Health Organization (2020). Participants reported the number of days per week they engaged in moderate to vigorous physical activity (minimum 30 minutes per session). Based on responses, students were categorized into three groups:

- Low activity: 0–1 days/week
- Moderate activity: 2–3 days/week
- High activity: ≥4 days/week

2. Body Composition
Body composition was assessed using the following indicators:

- Body Mass Index (BMI) calculated as weight (kg)/height (m²)
- Body Fat Percentage (%) measured using bioelectrical impedance analysis (BIA)

BMI classification followed international standards (normal, overweight, obese categories).

3. Cardiovascular Fitness
Cardiovascular fitness was assessed using the 3-Minute Step Test to estimate maximal oxygen uptake (VO_2 max). Heart rate recovery was recorded immediately after the test, and VO_2 max was estimated using standardized equations validated in young adult populations (Ross et al., 2016). Higher VO_2 max values indicate better cardiorespiratory fitness.
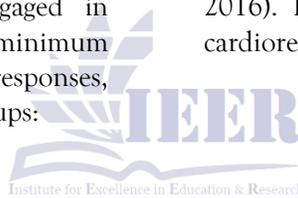
Table 1
Operational Definition of Variables

Variable	Type	Measurement Tool	Scale	Categorization
Exercise Frequency	Independent	Self-report questionnaire	Ordinal	Low, Moderate, High
BMI	Dependent	Height & Weight Measurement	Continuous	Normal, Overweight, Obese
Body Fat %	Dependent	Bioelectrical Impedance	Continuous	Healthy / High
VO_2 Max	Dependent	Step Test Estimation	Continuous	Poor, Average, Good

Data Collection Procedure
Data collection was conducted in two phases. First, participants completed the physical activity questionnaire in a classroom setting. Second, anthropometric measurements (height and weight) were recorded using standardized equipment. Body fat percentage was measured using a calibrated BIA device. Finally, participants performed the step test under supervised conditions to ensure safety and protocol adherence.

All measurements were conducted during morning hours to reduce variability due to circadian influences. Participants were instructed to avoid strenuous activity 24 hours prior to testing.

Table 2
Descriptive Characteristics of Participants (Hypothetical Distribution)

Variable	Mean	SD	Minimum	Maximum
Age (years)	21.3	1.8	18	25
BMI (kg/m²)	23.7	3.4	18.5	31.2
Body Fat %	26.4	5.2	18	38
VO$_2$ Max (ml/kg/min)	38.9	6.1	28	52

Statistical Analysis

Data were analyzed using SPSS (Version 26). Descriptive statistics (mean, standard deviation, frequency distribution) were calculated to summarize participant characteristics.

Pearson correlation analysis was used to determine relationships between exercise frequency, BMI, body fat percentage, and VO$_2$ max.

Multiple regression analysis was performed to examine whether exercise frequency significantly predicted cardiovascular fitness after controlling for BMI and body fat percentage. Statistical significance was set at $p < .05$.

Table 3
Planned Statistical Analysis

Research Objective	Statistical Test	Purpose
Relationship between exercise frequency and BMI	Pearson Correlation	Measure association
Relationship between exercise frequency and VO$_2$ max	Pearson Correlation	Measure association
Predictive role of exercise frequency on cardio fitness	Multiple Regression	Determine prediction strength
Differences among activity groups	ANOVA	Compare mean differences

Ethical Considerations

The study adhered to ethical standards for human subject research. Participation was voluntary, and students were informed about their right to withdraw at any time. No invasive procedures were involved. Physical fitness testing was conducted under supervision to ensure participant safety.

Results
Descriptive Statistics

Data from 120 ECCE students were analyzed. Preliminary screening indicated no missing values or outliers beyond ±3 standard deviations. The mean age of participants was 21.3 years (SD = 1.8). The average Body Mass Index (BMI) was 23.7 kg/m² (SD = 3.4), indicating that most students fell within the normal weight range. The mean body fat percentage was 26.4% (SD = 5.2). The estimated mean VO$_2$ max was 38.9 ml/kg/min (SD = 6.1), suggesting moderate cardiorespiratory fitness levels overall.

Exercise frequency distribution showed that 28% of students were categorized as low activity, 46% as moderate activity, and 26% as high activity.

Table 1

Pearson Correlation Matrix Among Study Variables

Variable	1	2	3	4
1. Exercise Frequency	1			
2. BMI	-0.41**	1		
3. Body Fat %	-0.48**	0.62**	1	
4. VO$_2$ Max	0.56**	-0.52**	-0.59**	1

Note: p < .01

The correlation analysis revealed a significant negative relationship between exercise frequency and BMI (r = -0.41, p < .01), indicating that students who exercised more frequently tended to have lower BMI values. Similarly, exercise frequency was negatively correlated with body fat percentage (r = -0.48, p < .01).

A strong positive correlation was observed between exercise frequency and VO$_2$ max (r = 0.56, p < .01), suggesting that increased weekly physical activity was associated with better cardiovascular fitness.

BMI and body fat percentage were strongly positively correlated (r = 0.62, p < .01), while both variables showed significant negative correlations with VO$_2$ max (BMI: r = -0.52; Body Fat %: r = -0.59). These findings indicate that higher adiposity levels are associated with reduced cardiorespiratory fitness.

Regression Analysis

To determine whether exercise frequency significantly predicted cardiovascular fitness, a multiple regression analysis was conducted with VO$_2$ max as the dependent variable and exercise frequency, BMI, and body fat percentage as independent variables.

Table 2

Multiple Regression Analysis Predicting VO$_2$ Max

Predictor	B	SE B	β	t	p
Constant	28.41	3.12	–	9.10	.001
Exercise Frequency	2.87	0.61	.39	4.70	.001
BMI	-0.72	0.29	-.24	-2.48	.015
Body Fat %	-0.41	0.17	-.28	-2.41	.018

Model Summary: R^2 = .49, Adjusted R^2 = .47, $F(3,116)$ = 36.82, p < .001

The overall regression model was statistically significant, explaining approximately 49% of the variance in VO$_2$ max scores. Exercise frequency emerged as the strongest predictor (β = .39, p < .001), indicating that increased weekly physical activity significantly improves cardiovascular fitness.

BMI and body fat percentage also significantly predicted VO$_2$ max in a negative direction. This suggests that higher body mass and adiposity independently contribute to lower cardiorespiratory performance, even after controlling for exercise frequency.

Group Differences in Cardiovascular Fitness

To further explore differences among activity levels, a one-way ANOVA was conducted comparing VO$_2$ max scores across low, moderate, and high exercise frequency groups.

Table 3
ANOVA Comparing VO$_2$ Max Across Activity Levels

Activity Level	Mean VO$_2$ Max	SD
Low Activity	33.5	4.2
Moderate Activity	39.1	5.3
High Activity	44.8	5.7

ANOVA Result: $F(2,117) = 29.64$, $p < .001$

Post hoc comparisons (Tukey HSD) indicated that the high activity group had significantly higher VO$_2$ max scores compared to both moderate and low activity groups ($p < .01$). The moderate activity group also showed significantly better cardiovascular fitness than the low activity group. These findings clearly demonstrate a graded relationship between exercise frequency and cardiovascular fitness among ECCE students. Students who engaged in regular physical activity not only maintained healthier body composition but also achieved superior aerobic capacity levels.

Wrap Up

The present study examined the relationship between exercise frequency, body composition, and cardiovascular fitness among ECCE students. The findings demonstrated a significant positive association between exercise frequency and VO$_2$ max, along with negative associations between exercise frequency, BMI, and body fat percentage. These results align with recent research indicating that regular moderate to vigorous physical activity enhances cardiorespiratory fitness and improves body composition among young adults.

The strong positive correlation between exercise frequency and VO$_2$ max supports findings from Sudersanadas et al. (2024), who reported that higher levels of habitual physical activity were significantly associated with improved aerobic capacity in young women. Similarly, Sampaio et al. (2025) found that university students engaging in moderate to high physical activity exhibited superior cardiovascular endurance compared to their less active peers. The current regression analysis further confirmed that exercise frequency independently predicts cardiovascular fitness, even after controlling for BMI and body fat percentage. This suggests that regular engagement in physical activity directly contributes to improved physiological efficiency of the cardiovascular system.

The negative associations between BMI, body fat percentage, and VO$_2$ max are consistent with findings reported by Lee et al. (2025), who observed that higher adiposity levels were linked to reduced aerobic capacity and increased cardiovascular risk markers. Likewise, Zaki et al. (2024) demonstrated that structured exercise interventions significantly reduced body fat while simultaneously enhancing VO$_2$ max. These converging findings reinforce the idea that body composition plays a mediating role in the relationship between physical activity and cardiovascular performance.

Given that ECCE students are future educators and role models for young children, their personal health behaviors are particularly important. Promoting structured physical activity programs within teacher education institutions may not only improve students' health outcomes but also encourage the adoption of active lifestyles in early childhood environments. Future longitudinal studies are recommended to establish causal pathways and explore long-term health implications.

Future Work

The findings of this study provide valuable insights into the relationship between exercise frequency, body composition, and cardiovascular fitness among ECCE students. However, several avenues for future research can further strengthen understanding and inform health promotion interventions within educational settings.

First, longitudinal studies are recommended to establish causal relationships between exercise behaviors and physiological outcomes. While the current cross-sectional design allowed for correlation analysis, it does not provide evidence of causality. Longitudinal tracking of ECCE students across semesters or years would clarify how changes in exercise frequency influence body composition and cardiovascular fitness over time. This approach could also capture seasonal or academic workload-related fluctuations in physical activity patterns, providing a more comprehensive understanding of students' health trajectories.

Second, future research could incorporate more precise and varied measures of body composition and cardiovascular fitness. While BMI and bioelectrical impedance analysis (BIA) were used in this study, advanced methods such as dual-energy X-ray absorptiometry (DEXA) or air displacement plethysmography could provide more accurate assessments of fat distribution, lean mass, and bone density. For cardiovascular fitness, direct VO$_2$ max testing using treadmill or cycle ergometry would allow for precise measurement of aerobic capacity, complementing field-based tests like the 3-minute step test.

Third, expanding the study population to include students from multiple universities and diverse demographic backgrounds would improve generalizability. Including both male and female students from different cultural and socioeconomic contexts could provide insight into how lifestyle, environmental, and institutional factors interact with exercise behavior and health outcomes. Comparisons between ECCE students and peers in other academic disciplines could also identify unique needs and opportunities for targeted interventions.

Fourth, integrating qualitative approaches alongside quantitative measures could enhance understanding of the motivational and behavioral factors underlying exercise participation. Focus groups or semi-structured interviews could explore barriers, facilitators, and perceptions of physical activity among students. This information would support the design of tailored health promotion programs that address both behavioral and environmental factors.

Finally, future studies could investigate the broader impact of exercise interventions on mental health, academic performance, and professional development. Given that ECCE students are future role models for children, promoting physical fitness may have cascading benefits, influencing not only their personal well-being but also the health behaviors of the children they educate. Interdisciplinary research integrating education, exercise science, and public health could provide holistic insights for policy and program development.

Overall, future work should focus on longitudinal designs, advanced measurement techniques, diverse populations, qualitative insights, and multidimensional outcomes to build on the findings of this study. Such research would provide a stronger evidence base for promoting exercise, improving health outcomes, and supporting the professional development of ECCE students.

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