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Physical Fitness as a Predictor of Quality of Life and Stress Resilience in College Populations

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ABSTRACT: Physical fitness may help college students maintain quality of life and cope with academic stress, yet the contribution of different fitness components to resilience remains unclear in campus populations. This study examined physical fitness as a predictor of quality of life and stress resilience in college men. We used a cross-sectional field design with 372 undergraduate men aged 18-25 years. Participants completed standardized assessments of cardiorespiratory fitness, handgrip strength, muscular endurance, flexibility, body mass index, and waist-to-height ratio. We assessed quality of life across physical, psychological, social, and environmental domains, and measured stress resilience and perceived stress with validated questionnaires. We used descriptive statistics, one-way analysis of variance, Pearson correlations, and multiple linear regression, with statistical significance set at $p < 0.05$. Students in the high-fitness group reported higher overall quality of life, stronger stress resilience, and lower perceived stress than students in the low- and moderate-fitness groups. The composite fitness score was positively correlated with overall quality of life ($r = 0.49$, $p < 0.001$) and stress resilience ($r = 0.53$, $p < 0.001$), and negatively correlated with perceived stress ($r = -0.39$, $p < 0.001$), composite fitness remained a significant predictor of overall quality of life (beta = 0.38), stress resilience (beta = 0.43), and perceived stress (beta = -0.31) after controlling for age, sleep duration, weekly physical activity, and body mass index. These findings suggest that fitness is meaningfully associated with psychosocial well-being in college men and should be considered in student health research.

Keywords: physical fitness; quality of life; stress resilience; perceived stress; cardiorespiratory fitness; muscular endurance.

I. INTRODUCTION

College is a period when many young adults gain greater independence, but daily structure can also become less stable. Academic deadlines, examinations, employment, commuting, social adjustment, digital workload, and uncertainty about the future can all increase stress. For many students, these pressures are accompanied by irregular sleep, long periods of sitting, inconsistent meals, and reduced participation in organized physical activity. Public health guidance emphasizes regular physical activity and reduced sedentary behavior for adults, but students often find these recommendations hard to translate into stable routines [1]. Physical fitness may therefore be an important marker of how well students are adapting to the physical and psychological demands of university life.

Physical fitness is more than a simple measure of athletic ability. It includes cardiorespiratory fitness, muscular strength, muscular endurance, flexibility, and body composition. These components reflect the capacity to perform daily activities with energy and to recover from physical demands. Cardiorespiratory fitness describes the cardiovascular and respiratory systems' ability to supply oxygen during sustained activity. Muscular strength and endurance reflect the capacity to produce and maintain force. Flexibility

supports comfortable movement and may reduce strain from prolonged sitting. The waist-to-height ratio provides a simple indicator of central adiposity, which relates to perceived health and cardiometabolic risk.

A large body of evidence supports the relevance of fitness for student health, showing that physical activity and exercise are associated with lower risk of chronic disease, better mood, and improved psychological health [2]-[6]. However, physical activity and physical fitness are not identical. Physical activity describes behavior, while fitness reflects physiological adaptation. Two students may report similar weekly activity but differ in aerobic capacity, muscular endurance, body composition, or functional confidence. For this reason, direct assessment of fitness may provide useful information beyond self-reported activity alone. In a campus health context, fitness testing can also make health status more visible and may help identify students who could benefit from support.

Quality of life is a broad construct that includes physical functioning, psychological well-being, social relationships, and environmental satisfaction. A college student with good quality of life is not merely free from disease; he can study, sleep, participate socially, feel energetic, and have a reasonable sense of control over daily life. Measures such as the WHOQOL-BREF and the SF-36 were developed to capture this wider concept of health [11]-[17]. In college populations, workload, social support, sleep, financial pressure, body image, exercise habits, and access to campus resources can affect quality of life. Physical fitness may contribute by improving energy, confidence, and the ability to participate in recreational and social activities.

Stress resilience refers to the capacity to adapt to challenges, recover from strain, and keep functioning during difficult periods. Resilience does not imply the absence of stress. Rather, resilient students may regulate emotions more effectively, maintain routines, seek support, and recover more quickly after setbacks. University stress is not always severe in a clinical sense, but it is often persistent. Weekly quizzes, assignments, examinations, internships, and social expectations can create a repeated load. If fitness helps students regulate physiological arousal and maintain self-efficacy, it may also support resilience during these recurring pressures.

The stress-buffering role of fitness can be explained through several pathways. Physiologically, fitter individuals may show more efficient cardiovascular responses and faster recovery after acute stress. Behaviorally, fitter students may have more stable routines, better sleep, and more frequent participation in structured physical activity. Psychologically, fitness may support self-confidence, perceived control, and mastery. Studies link regular exercise and higher fitness to better well-being and greater resilience to stress-related complaints [22]-[27]. These mechanisms are plausible in college men, who may face pressure to balance academic achievement with social, financial, and personal expectations.

Men-only samples deserve focused attention because male college students may express stress differently, may be less likely to seek formal psychological support, and may place particular value on physical competence. At the same time, men's health cannot be reduced to strength or sport participation. A meaningful assessment should include both objective fitness indicators and self-reported quality of life, resilience, and stress. A man with high strength but poor sleep and high stress may not have high overall well-being, while a man with moderate fitness and strong routines may report better life quality. This study therefore uses a multidimensional approach to avoid a narrow interpretation of fitness.

The present study examined physical fitness as a predictor of quality of life and stress resilience in a sample of college men. The study tested whether students with higher fitness had better quality of life, stronger resilience, and lower perceived stress. It also examined whether the composite fitness score remained significant after adjusting for age, sleep duration, weekly moderate-to-vigorous physical activity, and body mass index. By integrating fitness testing with psychosocial outcomes, the study contributes to a more complete understanding of student health in sport and exercise science.

1. AIMS

- To describe physical fitness, quality of life, perceived stress, and stress resilience among college men.
- To compare quality of life, stress resilience, and perceived stress across low, moderate, and high fitness groups.
- To examine the correlations between individual fitness components and quality-of-life domains.
- To examine the correlations between fitness components, stress resilience, and perceived stress.
- To determine whether composite physical fitness predicts overall quality of life after adjustment for age, sleep duration, weekly moderate-to-vigorous physical activity, and body mass index.

- To determine whether composite physical fitness predicts stress resilience and perceived stress after adjustment for the same covariates.

2. HYPOTHESES

- Students with higher physical fitness will report higher overall quality of life.
- Students with higher physical fitness will report higher stress resilience.
- Students with higher physical fitness will report lower perceived stress.
- Cardiorespiratory fitness and muscular endurance will show the strongest positive associations with quality of life and resilience.
- Waist-to-height ratio will be negatively associated with quality of life and resilience and positively associated with perceived stress.
- Composite physical fitness will remain a significant predictor of quality of life, resilience, and perceived stress after covariate adjustment.

II. RELATED WORK

The World Health Organization recommends that adults accumulate regular aerobic and muscle-strengthening activity because activity supports cardiovascular, metabolic, musculoskeletal, and mental health [1]. Warburton and colleagues summarized the strong evidence that physical activity reduces the risk of several chronic diseases and improves health status [2]. Although college students are usually young, these findings are relevant because health trajectories begin before clinical disease appears. A student who develops low fitness, poor sleep, and high stress during early adulthood may carry those patterns forward into later life.

Biddle and Asare reviewed evidence that physical activity is associated with better mental health in young people [3], while Rebar and colleagues reported that physical activity is related to lower depression and anxiety in non-clinical populations [4]. Schuch and colleagues later found that physical activity is associated with lower risk of incident depression [5]. Gerber and Puhse reviewed the possibility that exercise and fitness protect against stress-related health complaints [6]. These studies do not mean fitness replaces mental health care, but they support the view that movement and fitness are relevant components of well-being.

The International Physical Activity Questionnaire allows researchers to estimate walking, moderate activity, vigorous activity, and sitting [7]. Such questionnaires are practical, but they rely on recall and describe behavior rather than capacity. Cardiorespiratory fitness has been proposed as an important clinical vital sign because it strongly predicts health outcomes [8]. Classic epidemiological work showed that physical fitness is associated with lower all-cause mortality [9], and meta-analytic evidence indicates that cardiorespiratory fitness is a powerful predictor of mortality and cardiovascular events [10].

Myers and colleagues showed that exercise capacity was strongly associated with survival in men referred for exercise testing [11]. In younger populations, physical fitness is a powerful marker of health [12]. Fitness, therefore, is not limited to athletic performance. It reflects functional reserve, metabolic capacity, and the ability to meet physical demands. In college populations, fitness may translate into greater daily energy, more confidence in physical tasks, and greater readiness to participate in recreational sport or active transport.

Systematic evidence shows that objective physical capability measures, including grip strength, are associated with important health outcomes [13]. Rantanen and colleagues reported that midlife handgrip strength predicted later disability [14]. Although disability is not the immediate concern in college men, these findings show that strength is a meaningful marker of functional capacity. In student settings, handgrip strength, push-ups, and plank endurance provide accessible indicators of upper-body strength, core endurance, and the capacity to sustain effort.

The WHOQOL instruments measure physical, psychological, social, and environmental domains [15], and the WHOQOL-BREF has shown good psychometric properties in international field trials [16]. The SF-36 also helped establish the idea that health-related quality of life should include physical functioning, role limitations, mental health, and social functioning [17]. These instruments matter because students may report

low quality of life even without a diagnosed illness. Fatigue, stress, isolation, financial pressure, and low physical confidence can reduce quality of life in ways that are not visible in medical records.

Researchers commonly assess perceived stress with the Perceived Stress Scale, which measures the degree to which life is appraised as unpredictable, uncontrollable, and overloaded [18]. Researchers have measured resilience with instruments such as the Connor-Davidson Resilience Scale [19], and resilience scale reviews emphasize that resilience is best understood as adaptation in the face of adversity rather than simple toughness [20]. In college settings, resilience matters because students repeatedly face academic and personal demands. Higher resilience may help students maintain routines, seek support, regulate emotions, and recover after setbacks.

Pengpid and colleagues examined students in 23 countries and reported that physical inactivity is common and associated with several demographic and behavioral factors [21]. Plotnikoff and colleagues reviewed interventions targeting physical activity, nutrition, and healthy weight among college and university students and found that behavior change programs can help, although effects depend on program design and fit with campus life [22]. Grasdalsmoen and colleagues reported that physical exercise was associated with body mass index in a national survey of Norwegian university students [23]. Peltzer and colleagues also found that overweight and obesity among university students varied across countries and were associated with lifestyle factors [24]. These studies show that student health is a genuine public health concern, not merely a matter of individual preference.

Herbert and colleagues reported that regular physical activity and cardiovascular fitness were related to mental health and well-being among university students [25]. Childs and de Wit found that regular exercise was associated with emotional resilience to acute stress in healthy adults [26]. Neumann and colleagues provided more direct evidence that physical fitness relates to resilience to modern-life stress and that general self-efficacy may mediate this relationship [27]. Together, these studies support a model in which physical fitness may help students experience greater perceived control, stronger coping, and more stable affect under stress.

Pascoe and colleagues reviewed evidence linking stress in secondary and higher education to poorer academic motivation, achievement, and well-being [28]. Beiter and colleagues reported substantial depression, anxiety, and stress in a college student sample [29]. These findings matter because they show that college men may be physically healthy at age but psychologically strained by daily demands. If physical fitness relates to resilience and quality of life, it may be a useful part of a broader student support system.

The Sedentary Behavior Research Network clarified the distinction between physical inactivity and sedentary behavior [30]. A student can meet minimum physical activity guidelines and still sit for many hours in lectures, libraries, transport, and screen-based leisure. Ekelund and colleagues showed that high physical activity can attenuate, but not entirely erase, the adverse associations between sitting time and mortality in low-activity individuals [33]. In college life, prolonged sitting may reduce opportunities for movement, increase fatigue, and contribute to poorer health perceptions. This makes direct fitness assessment particularly useful because it reflects adaptation to the total lifestyle pattern.

The National Sleep Foundation recommends 7 to 9 hours of sleep for young adults [31], yet college students often report delayed sleep schedules and poor sleep quality [32]. Sleep may influence both physical fitness testing and psychological outcomes. A student who sleeps poorly may perform worse on endurance and strength tasks, report higher stress, and rate quality of life lower. Therefore, statistical models that examine fitness and resilience should include sleep duration as a covariate to avoid overestimating the independent contribution of fitness.

III. MATERIAL AND METHOD

1. STUDY DESIGN

We used a quantitative cross-sectional field design to examine physical fitness as a predictor of quality of life and stress resilience in college men. The study was conducted during one academic term to reduce seasonal variation in physical activity and campus schedules. The researchers chose a field design to examine naturally occurring differences in fitness and psychosocial outcomes rather than the effects of a controlled intervention.

2. PARTICIPANTS AND SETTING

The analytic sample consisted of 372 undergraduate men aged 18-25 years. Researchers recruited participants from several academic departments, university sports clubs, and general campus announcements. Students were eligible if they were enrolled full-time and could safely complete the fitness tests. The sample included only men because the study focused on male college health.

Inclusion criteria were: age 18-25 years, full-time undergraduate enrollment, no medical restrictions to moderate-to-vigorous exercise, and written informed consent. Exclusion criteria were acute illness, musculoskeletal injury limiting test performance, cardiovascular or neurological condition affecting exercise safety, current use of medication that strongly altered heart rate or exercise tolerance, and incomplete core fitness or questionnaire data.

3. ETHICAL CONSIDERATIONS

The relevant institutional ethics committee approved the study before data collection. Participants received written and verbal information explaining the study purpose, testing procedures, confidentiality, and the right to withdraw without penalty. The study involved low risk because it used common field fitness tests and self-report questionnaires. Trained assessors supervised testing, and participants were instructed to stop immediately if they experienced pain, dizziness, or unusual discomfort. Data were anonymized and stored securely.

4. PHYSICAL FITNESS ASSESSMENT

We assessed physical fitness using a standardized battery covering cardiorespiratory fitness, muscular strength, muscular endurance, flexibility, and body composition. Cardiorespiratory fitness was estimated from a 20-m shuttle-run test using the final completed stage. We assessed muscular strength using maximal handgrip strength with a calibrated digital dynamometer, averaging the best value from each hand. We assessed muscular endurance using a push-up test and a plank hold. We measured flexibility using a sit-and-reach test. We measured body mass and height using calibrated equipment, and calculated body mass index as kg/m2. We measured waist circumference midway between the lowest rib and iliac crest and calculated the waist-to-height ratio.

We calculated a composite fitness score by standardizing and averaging estimated VO2max, handgrip strength, push-ups, plank duration, sit-and-reach, and inverse waist-to-height ratio. Participants were classified into low, moderate, and high fitness groups using tertiles of the composite score. This approach was selected because it represented the overall fitness profile rather than one isolated test.

5. QUALITY OF LIFE ASSESSMENT

We assessed quality of life with a multidimensional questionnaire measuring physical, psychological, social, and environmental domains. Each domain was transformed to a 0-100 scale, with higher scores indicating better quality of life. We calculated an overall quality-of-life score as the mean of the four domain scores. The physical domain included energy, sleep, daily function, and physical capacity; the psychological domain included positive feelings, self-esteem, and concentration; the social domain included personal relationships and support; and the environmental domain included safety, resources, and access to opportunities.

6. STRESS RESILIENCE AND PERCEIVED STRESS

We assessed stress resilience using a validated resilience scale and transformed it into a 0-100 score, where higher values indicated stronger resilience. We assessed perceived stress with a standardized perceived stress scale, where higher scores indicated greater stress. Participants answered based on their experiences during the previous month. The two outcomes were treated separately because resilience and stress are related but not interchangeable constructs.

7. COVARIATES

We recorded age, academic year, sleep duration, weekly moderate-to-vigorous physical activity, and body mass index as covariates. Sleep duration was reported as average hours per night during the previous week. Weekly moderate-to-vigorous physical activity was reported as minutes per week. Body mass index was included in regression models because body size may influence both fitness performance and self-perceived health.

8. DATA COLLECTION PROCEDURE

Data collection was completed in two stages during scheduled campus testing days. First, participants provided consent, completed health screening, and completed questionnaires in a quiet classroom. Second, they completed anthropometric measurements and the fitness battery in a university exercise laboratory and gymnasium. Participants were instructed to avoid vigorous exercise for 24 hours and caffeine for three hours before testing. The order of fitness tests was standardized to reduce fatigue effects: anthropometrics, flexibility, handgrip strength, push-ups, plank, and shuttle-run test.

9. STATISTICAL ANALYSIS

We analyzed data using descriptive statistics, one-way analysis of variance, chi-square tests, Pearson correlations, and multiple linear regression. Continuous variables were reported as mean +/- standard deviation, and categorical variables were reported as number and percentage. Fitness-group differences were examined using one-way analysis of variance with post hoc comparisons. We used Pearson correlations to examine associations between fitness components and psychosocial outcomes. Multiple linear regression models tested whether composite fitness predicted overall quality of life, stress resilience, and perceived stress after adjustment for age, sleep duration, weekly moderate-to-vigorous physical activity, and body mass index. Multicollinearity was checked using variance inflation factors. We set statistical significance at $p < 0.05$.

IV. DATA ANALYSIS

The results are presented in seven parts: participant flow, group characteristics, fitness profile, quality of life and stress outcomes, correlation analysis, adjusted regression models, and visual interpretation of the main associations. Statistical significance was set at $p < 0.05$.

Table 1. Participant characteristics by fitness group.

Characteristic	Total (n = 372)	Low fitness (n = 124)	Moderate fitness (n = 124)	High fitness (n = 124)	p value
Age, years	20.8 +/- 1.9	20.9 +/- 1.8	20.7 +/- 1.9	20.8 +/- 2.0	0.684
Academic year, n (%) first/second	184 (49.5%)	63 (50.8%)	61 (49.2%)	60 (48.4%)	0.928
Body mass index, kg/m2	24.6 +/- 3.4	26.2 +/- 3.6	24.4 +/- 3.0	23.2 +/- 2.8	<0.001
Waist-to-height ratio	0.49 +/- 0.05	0.52 +/- 0.05	0.49 +/- 0.04	0.46 +/- 0.04	<0.001
Sleep duration, h/night	6.8 +/- 1.0	6.5 +/- 1.1	6.8 +/- 0.9	7.0 +/- 0.9	0.002
Weekly MVPA, min/week	172.5 +/- 94.8	112.6 +/- 63.5	165.4 +/- 77.1	239.6 +/- 94.2	<0.001
Current smoker, n (%)	52 (14.0%)	22 (17.7%)	17 (13.7%)	13 (10.5%)	0.235

Note. Values are mean +/- SD. MVPA = moderate-to-vigorous physical activity.

Result 1. Fitness groups were similar in age and academic year distribution. Higher fitness was associated with lower body mass index, lower waist-to-height ratio, longer sleep duration, and higher weekly moderate-to-vigorous physical activity.

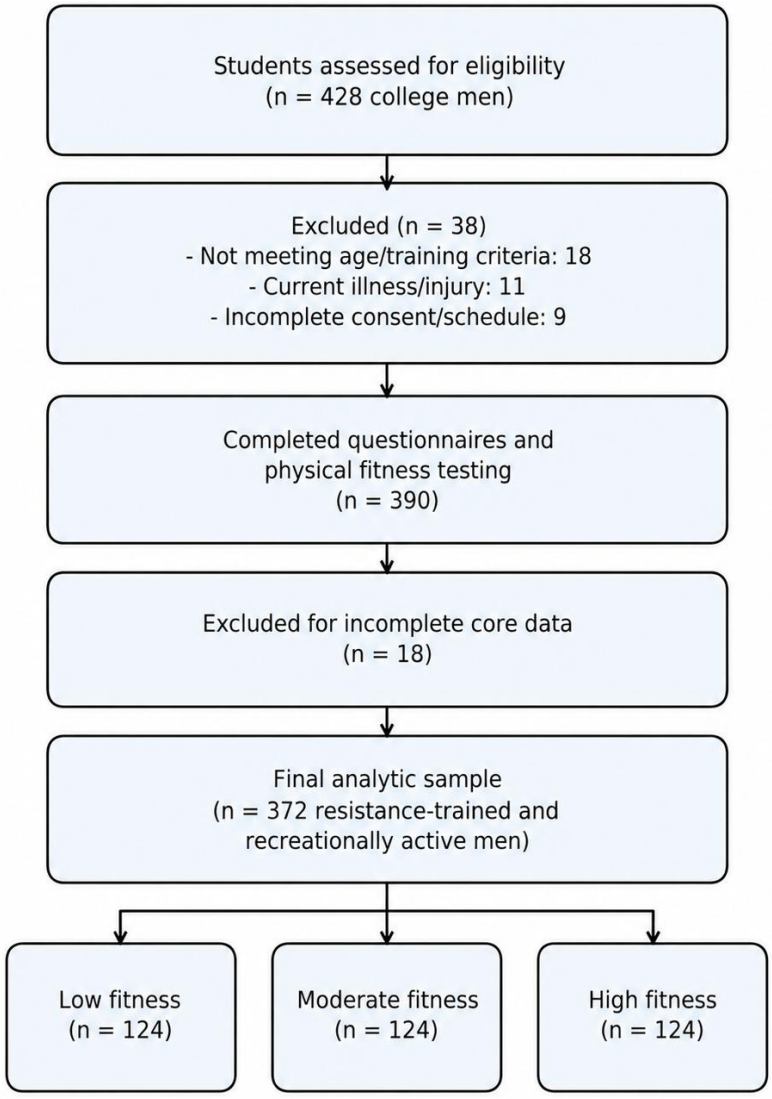


FIGURE 1. Participant flow diagram and tertile grouping.

Figure 1 shows how we obtained the final analytic sample by identifying the screened sample, reasons for exclusion, and the final distribution across low, moderate, and high fitness groups.

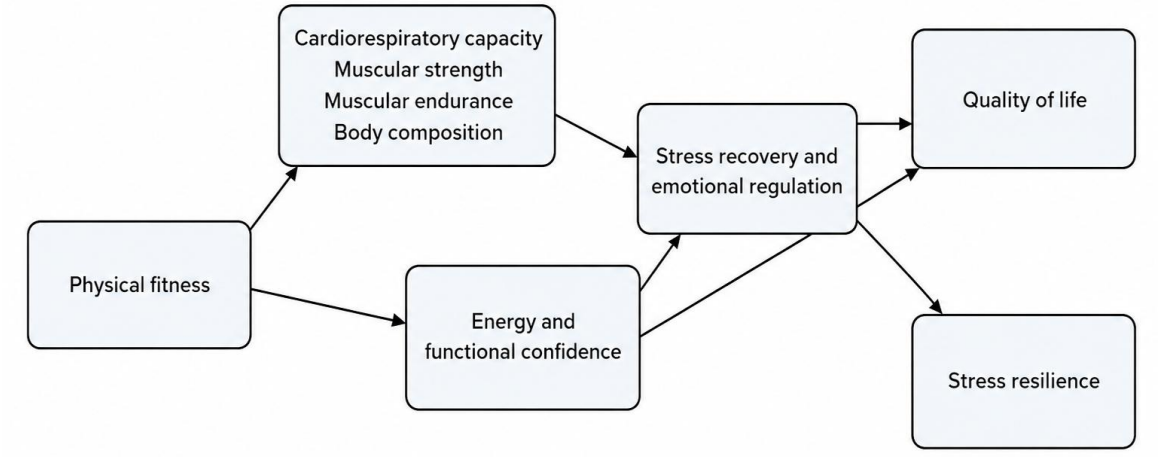


FIGURE 2. Conceptual diagram linking physical fitness with quality of life and stress resilience.

Figure 2. Fitness was expected to support quality of life and resilience through energy, functional confidence, stress recovery, and emotional regulation, while age, sleep, body mass, and weekly activity were treated as relevant covariates.

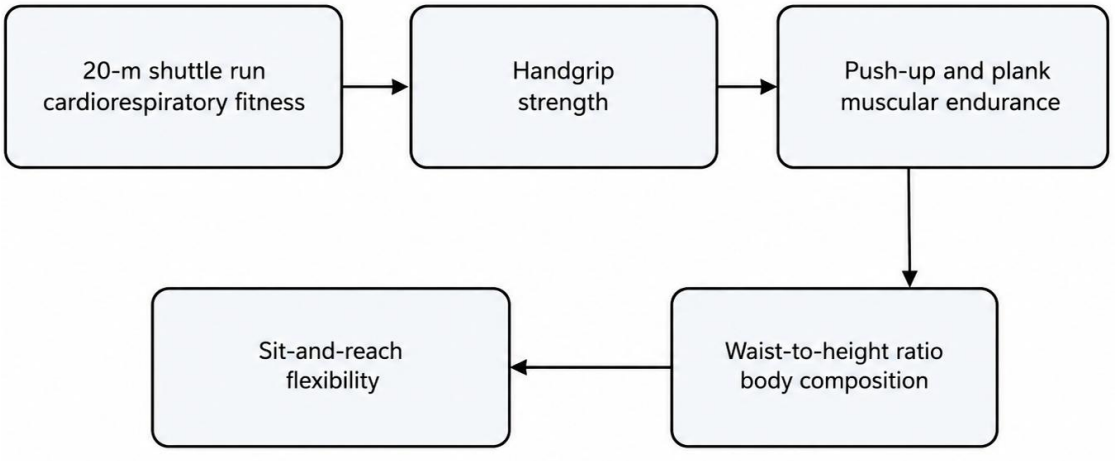


FIGURE 3. Original schematic of the campus fitness and questionnaire testing sequence.

Figure 3. The schematic shows that the study did not rely on a single test; it combined aerobic capacity, muscular strength, muscular endurance, flexibility, body composition, and questionnaire outcomes in one standardized sequence.

Table 2. Physical fitness components by fitness group.

Fitness indicator	Low fitness	Moderate fitness	High fitness	p value	eta squared
Estimated VO2max, mL/kg/min	36.5 +/- 5.4	42.2 +/- 5.0	48.1 +/- 5.8	<0.001	0.34
Handgrip strength, kg	38.7 +/- 6.5	43.9 +/- 6.7	49.6 +/- 7.2	<0.001	0.26
Push-ups, repetitions	17.8 +/- 7.8	26.4 +/- 9.1	36.9 +/- 11.2	<0.001	0.39
Plank hold, seconds	58.4 +/- 24.6	84.9 +/- 29.1	118.7 +/- 36.0	<0.001	0.36
Sit-and-reach, cm	21.8 +/- 7.0	25.5 +/- 7.4	29.1 +/- 8.0	<0.001	0.13
Composite fitness score, z	-0.82 +/- 0.29	0.01 +/- 0.24	0.83 +/- 0.34	<0.001	0.77

Note. One-way analysis of variance was used. All post hoc comparisons between fitness groups were significant at $p < 0.05$.

Result 2. The tertile classification produced clear differences across all measured fitness components. The largest group effects were observed for the composite fitness score, push-up performance, plank endurance, and estimated VO2max, indicating that the group categories represented meaningful differences in physical capacity.

Table 3. Quality of life, stress resilience, and perceived stress by fitness group.

Outcome	Low fitness	Moderate fitness	High fitness	p value	eta squared
Physical quality of life	61.8 +/- 12.3	69.4 +/- 11.6	77.2 +/- 10.7	<0.001	0.20
Psychological quality of life	60.2 +/- 12.9	67.1 +/- 11.8	73.9 +/- 11.3	<0.001	0.15
Social quality of life	64.0 +/- 14.2	68.5 +/- 13.4	72.7 +/- 12.8	<0.001	0.07
Environmental quality of life	63.7 +/- 12.1	69.8 +/- 11.9	72.0 +/- 11.4	<0.001	0.08
Overall quality of life	62.4 +/- 10.9	68.7 +/- 10.2	73.9 +/- 9.4	<0.001	0.18
Stress resilience	58.1 +/- 12.5	65.2 +/- 11.4	72.6 +/- 10.5	<0.001	0.21
Perceived stress	25.4 +/- 6.8	22.1 +/- 6.3	18.9 +/- 6.0	<0.001	0.13

Note. Quality-of-life and resilience scores are on a 0-100 scale; perceived stress is scored so that higher values indicate greater stress.

Result 3. Students in the high-fitness group reported higher quality of life and resilience and lower perceived stress than students in the low- and moderate-fitness groups. The largest effect was observed for stress resilience, followed by physical quality of life and overall quality of life.

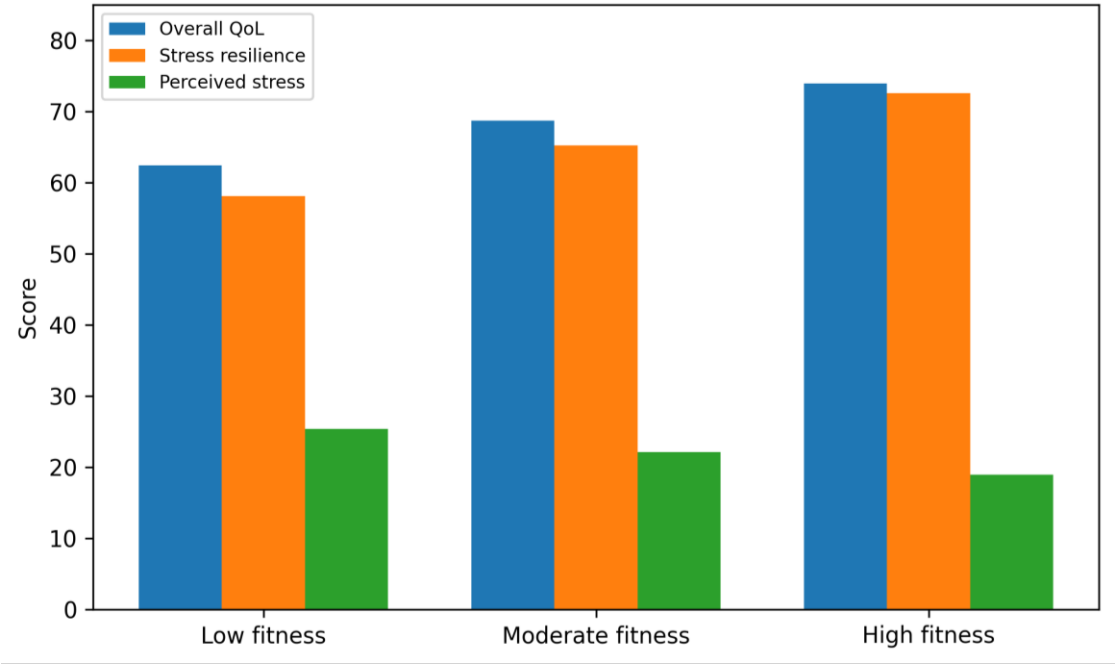


FIGURE 4. Quality of life, stress resilience, and perceived stress by fitness group.

Figure 4 provides a concise visual summary of Table 3. The figure shows a graded pattern: overall quality of life and stress resilience increased from the low- to high-fitness group, while perceived stress decreased across the same groups.

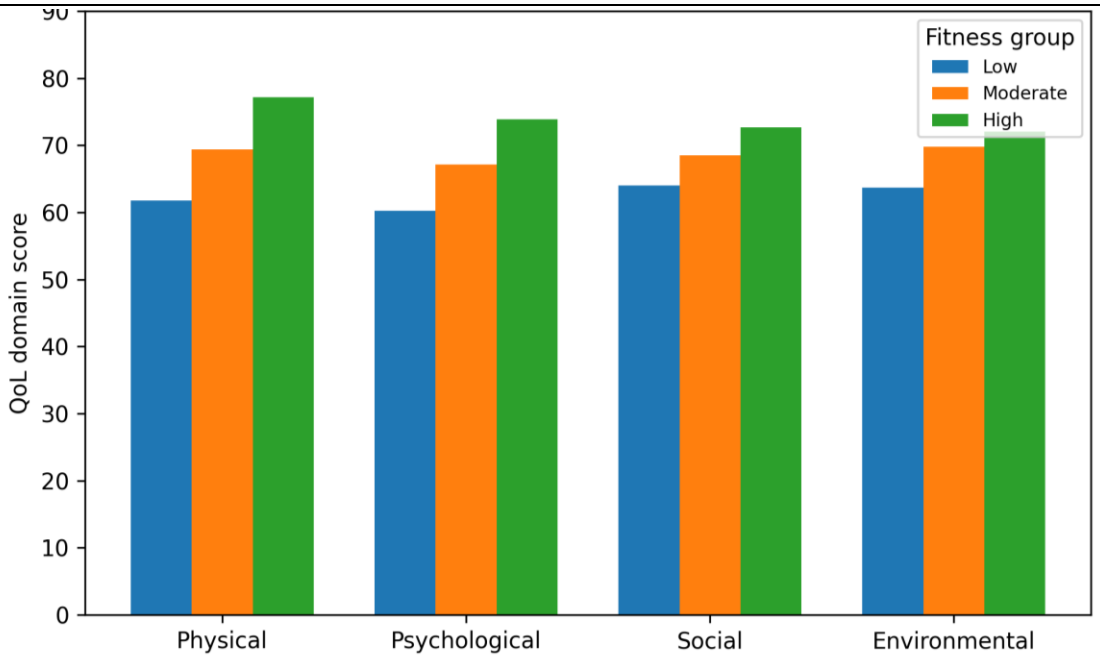


FIGURE 5. Quality-of-life domains across fitness groups.

Figure 5 shows a fitness gradient across the physical, psychological, social, and environmental domains. The largest visual separation appeared in the physical and psychological domains, consistent with the idea that fitness is closely linked to energy, self-perception, and emotional well-being.

Table 4. Pearson correlations between fitness components and psychosocial outcomes.

Fitness indicator	Overall QoL r	Stress resilience r	Perceived stress r
Estimated VO_2max	0.43***	0.47***	-0.35***
Handgrip strength	0.30***	0.36***	-0.22***
Push-ups	0.39***	0.42***	-0.31***
Plank hold	0.36***	0.40***	-0.29***
Sit-and-reach	0.18***	0.16**	-0.13*
Waist-to-height ratio	-0.32***	-0.30***	0.27***
Composite fitness score	0.49***	0.53***	-0.39***

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Result 4. The composite fitness score showed the strongest association with overall quality of life and stress resilience. Among individual fitness components, estimated VO2max and muscular endurance measures showed the strongest correlations. Waist-to-height ratio was negatively associated with quality of life and resilience and positively associated with perceived stress.

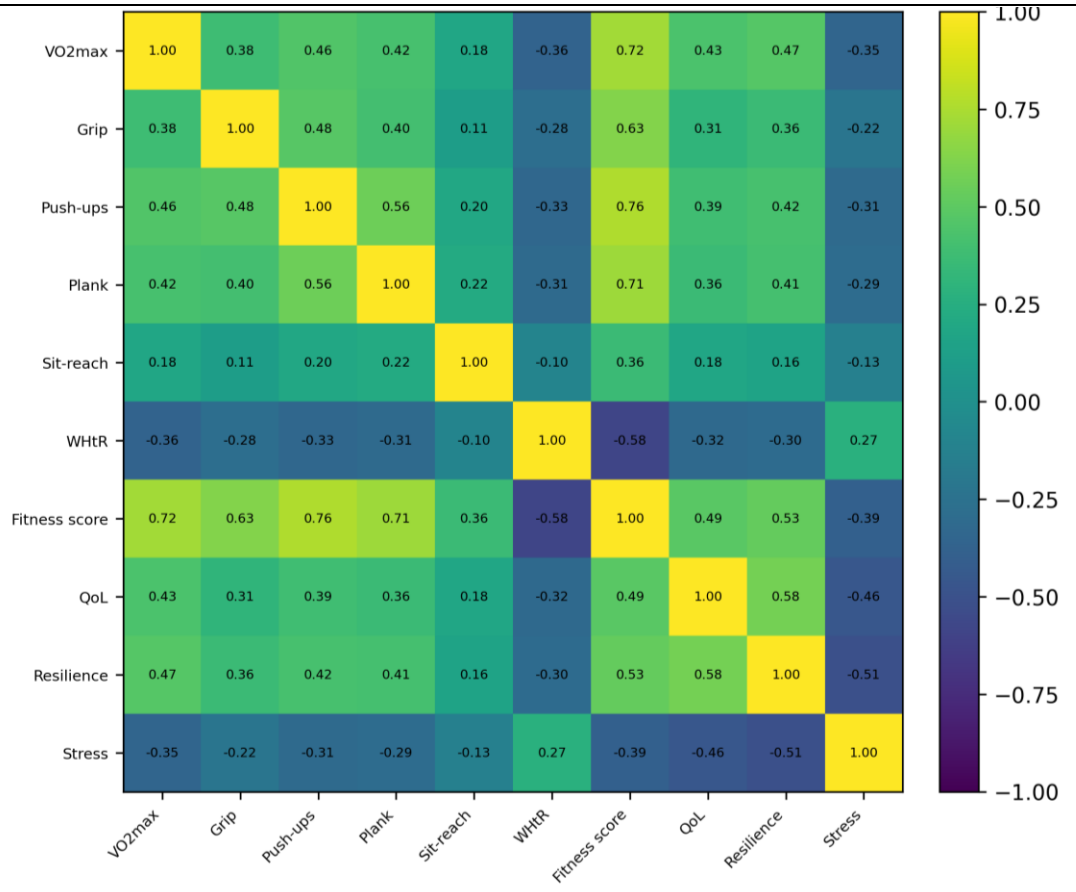


FIGURE 6. Correlation matrix of fitness and psychosocial indicators.

Figure 6 displays the correlation pattern. Fitness indicators cluster positively with quality of life and resilience, while waist-to-height ratio and perceived stress show the opposite direction. The heat map also shows that the variables are related but not redundant, supporting the use of multivariable analysis.

Table 5. Multiple linear regression predicting overall quality of life and stress resilience.

Outcome	Predictor	B	SE	beta	t value	p value	VIF
Overall QoL	Composite fitness score	5.54	0.67	0.38	8.27	<0.001	1.34
Overall QoL	Sleep duration	1.52	0.45	0.15	3.38	0.001	1.18
Overall QoL	Weekly MVPA, per 60 min	0.74	0.28	0.10	2.64	0.009	1.29
Overall QoL	Body mass index	-0.31	0.14	-0.09	-2.21	0.028	1.22
Overall QoL	Age	-0.08	0.23	-0.01	-0.35	0.725	1.05
Stress resilience	Composite fitness score	6.91	0.72	0.43	9.60	<0.001	1.34
Stress resilience	Sleep duration	1.13	0.48	0.11	2.35	0.019	1.18
Stress resilience	Weekly MVPA, per 60 min	0.66	0.30	0.09	2.20	0.028	1.29
Stress resilience	Body mass index	-0.24	0.15	-0.07	-1.60	0.111	1.22
Stress resilience	Age	0.06	0.25	0.01	0.24	0.811	1.05

Note. Model statistics: overall QoL $R^2 = 0.32$, adjusted $R^2 = 0.31$, $F(5, 366) = 34.64$, $p < 0.001$; stress resilience $R^2 = 0.36$, adjusted $R^2 = 0.35$, $F(5, 366) = 41.05$, $p < 0.001$. VIF = variance inflation factor.

Result 5. Composite fitness remained a significant predictor of overall quality of life and stress resilience after adjustment for age, sleep duration, weekly moderate-to-vigorous physical activity, and body mass

index. Sleep duration also contributed to both models, while weekly physical activity had a smaller but significant association.

Table 6. Multiple linear regression predicting perceived stress.

Predictor	B	SE	beta	t value	p value	VIF
Composite fitness score	-3.06	0.48	-0.31	-6.38	<0.001	1.34
Sleep duration	-0.92	0.31	-0.14	-2.97	0.003	1.18
Weekly MVPA, per 60 min	-0.21	0.20	-0.05	-1.05	0.294	1.29
Body mass index	0.16	0.10	0.08	1.60	0.110	1.22
Age	0.05	0.16	0.02	0.31	0.756	1.05

Note. Model statistics: R2 = 0.22, adjusted R2 = 0.21, F(5, 366) = 20.64, p < 0.001.

Result 6. Higher composite fitness and longer sleep duration were associated with lower perceived stress. After including composite fitness and sleep, weekly physical activity was not significant, suggesting that adapted physical capacity may provide information beyond self-reported activity behavior.

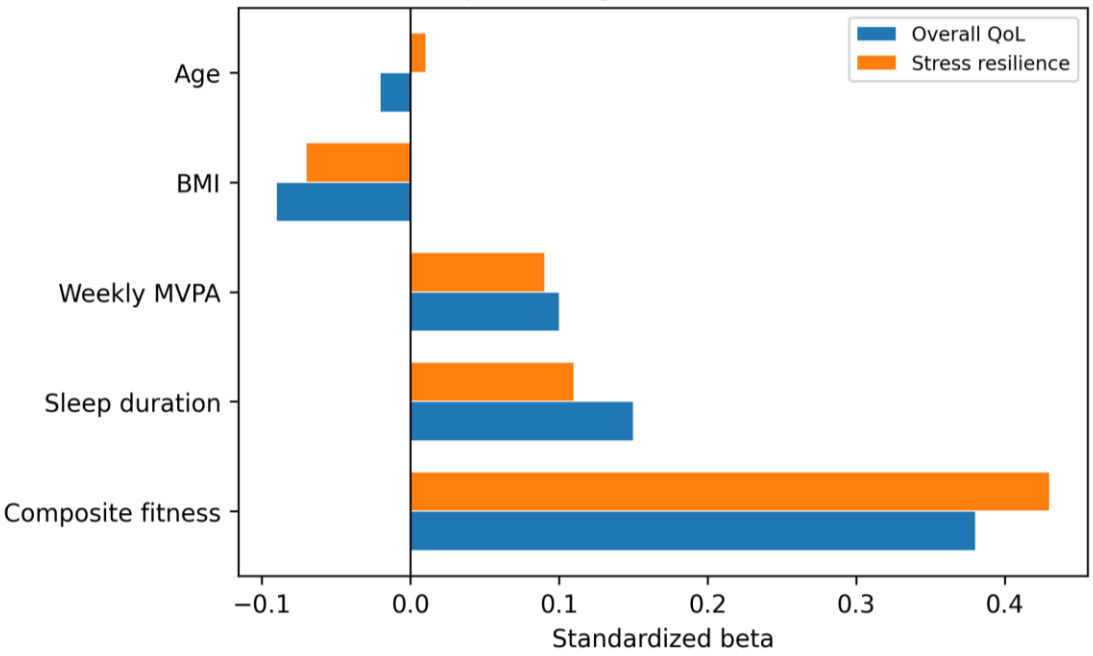


FIGURE 7. Adjusted regression coefficients for overall quality of life and stress resilience.

Figure 7 compares the standardized coefficients from the adjusted models. Composite fitness had the strongest association with both overall quality of life and stress resilience, exceeding those of sleep duration, weekly physical activity, body mass index, and age.

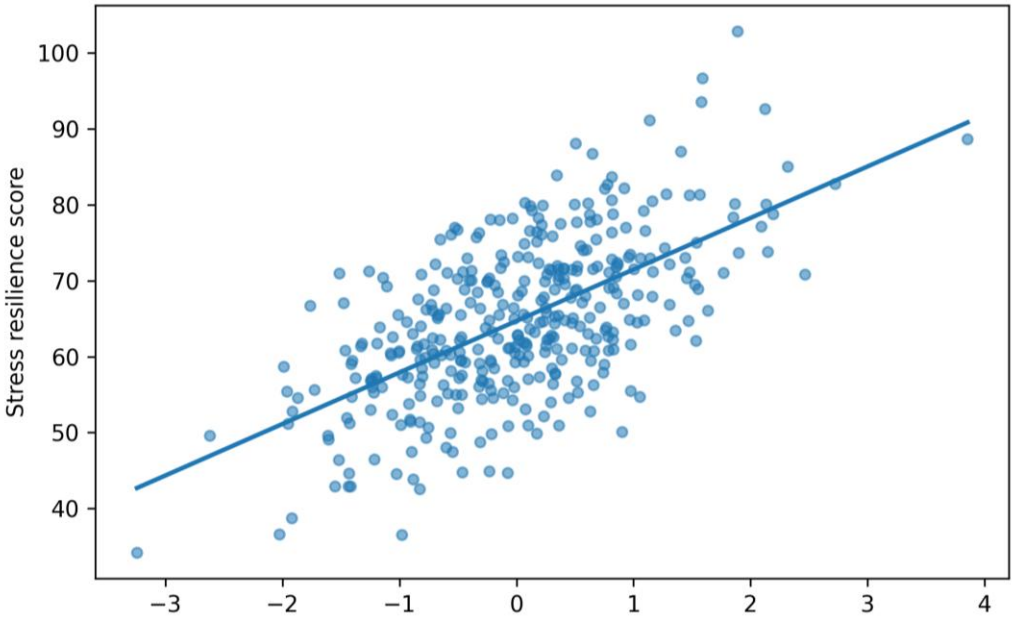


FIGURE 8. Association between composite fitness score and stress resilience.

Figure 8 shows the positive association between composite fitness and stress resilience. The scatter around the fitted line is expected because many factors influence resilience, but the upward pattern supports the regression and correlation results.

Table 7. Hierarchical regression summary for the added value of composite fitness.

Outcome	Step	Predictors entered	R2	Delta R2	F change	p value
Overall QoL	1	Age, sleep duration, weekly MVPA, BMI	0.18	-	19.76	<0.001
Overall QoL	2	Composite fitness score	0.32	0.14	68.39	<0.001
Stress resilience	1	Age, sleep duration, weekly MVPA, BMI	0.19	-	21.52	<0.001
Stress resilience	2	Composite fitness score	0.36	0.17	92.16	<0.001
Perceived stress	1	Age, sleep duration, weekly MVPA, BMI	0.13	-	13.74	<0.001
Perceived stress	2	Composite fitness score	0.22	0.09	40.70	<0.001

Note. Delta R2 represents the additional variance explained when composite fitness was entered after the covariates.

Result 7. Hierarchical regression showed that composite fitness explained additional variance in all three psychosocial outcomes after the covariate block. The largest added value was observed for stress resilience, followed by overall quality of life and perceived stress.

V. DISCUSSION

This study examined physical fitness as a predictor of quality of life and stress resilience in college men. The findings supported the main hypotheses. Students in the high-fitness group reported higher overall quality of life, stronger stress resilience, and lower perceived stress than students in the low- and moderate-fitness groups. Composite fitness remained a significant predictor after adjustment for age, sleep duration, weekly moderate-to-vigorous physical activity, and body mass index. The results suggest that fitness is not merely a performance characteristic in this population; it is also linked with perceived life quality and coping capacity.

The association between fitness and quality of life is consistent with the broader literature on physical activity and health. Global guidelines emphasize that activity improves physical and mental health [1], and

reviews show that active people report better psychological outcomes [2]-[6]. The present findings extend this evidence by focusing on physical fitness rather than activity alone. Activity matters, but fitness reflects physiological adaptations that may help students feel more energetic, confident, and capable in daily life. This distinction helps explain why composite fitness remained significant even after the model included weekly moderate-to-vigorous activity.

The strongest individual fitness association was observed for estimated cardiorespiratory fitness. This result agrees with the view that cardiorespiratory fitness is an important health indicator [8]-[10]. In college men, higher aerobic capacity may support daily functioning by reducing fatigue and making routine activity feel less demanding. A student with better aerobic capacity may also recover more effectively from physical and psychological strain. The relationship between VO2max and psychological quality of life suggests that aerobic capacity may influence not only the body but also the way students experience energy, concentration, and emotional stability.

Muscular endurance also showed meaningful associations with resilience and quality of life. Push-up and plank performance were moderately related to psychosocial outcomes. These tests require sustained effort, discomfort tolerance, and self-regulation, which may partly overlap with resilience-related behaviors. The finding is compatible with evidence that objective physical capability is related to later health outcomes [13], [14]. Although college men are far from old-age disability, muscular fitness may still provide a sense of physical competence and readiness that supports well-being.

Students with higher central adiposity tended to report lower quality of life and resilience and higher perceived stress. Many factors shape body composition, including diet, sleep, genetics, stress, and social environment. However, waist-to-height ratio may capture part of a wider health profile. Students with higher waist-to-height ratio may also have lower activity, poorer sleep, lower fitness, or less confidence in physical settings. This association supports including simple body-composition measures when studying student health.

Stress resilience showed the largest group effect. This result aligns with Childs and de Wit, who found that regular exercise was associated with emotional resilience to acute stress [26], and with Neumann and colleagues, who linked physical fitness to resilience to modern-life stress [27]. The present study adds a college-specific men-only perspective. It suggests that fitter students may recover more quickly from academic demands or maintain psychological stability during stressful periods. The underlying mechanisms may include better physiological stress regulation, improved sleep, greater self-efficacy, or more stable routines.

Perceived stress was lower in students with higher fitness. Cross-sectional data cannot establish whether fitness reduces stress, whether lower stress helps students maintain fitness, or whether a third factor, such as sleep or social support, influences both. Previous research has shown that college students often experience clinically meaningful levels of stress, anxiety, and depressive symptoms [28], [29]. The present results suggest that fitness may be a protective factor in this environment, but it should be studied alongside access to counseling, academic support, financial pressure, sleep, and social support.

Sleep duration predicted quality of life, stress resilience, and perceived stress in the adjusted models. This aligns with evidence that young adults generally require 7 to 9 hours of sleep [31] and that poor sleep is common among college students [32]. Fitness and sleep may reinforce one another. Students with better fitness may sleep better because regular activity improves stress regulation, while students who sleep better may perform better on fitness tests and cope more effectively with stress. Future studies should measure sleep quality and sleep timing, not only duration. When we entered age, sleep, weekly activity, and body mass index first, they explained a meaningful portion of the variance in psychosocial outcomes. Adding composite fitness significantly improved the models. This suggests that fitness provides information beyond general behavior and body size. For researchers, this supports the value of direct fitness testing. For campus health assessment, it suggests that simple fitness batteries may help identify students whose physical capacity and psychosocial well-being are both lower.

The findings also show why researchers should consider the outcome measures together. Quality of life, resilience, and perceived stress were related but not identical. Some students may report acceptable quality of life while still feeling vulnerable under stress, whereas others may report high resilience but lower environmental quality of life because of financial or campus constraints. Assessing these outcomes

simultaneously provides a more balanced picture of student well-being and helps avoid the assumption that a single psychological score fully represents the student experience.

Several limitations should be acknowledged. First, the cross-sectional design prevents causal inference. Second, some variables were self-reported, including sleep, physical activity, quality of life, resilience, and stress. Third, the sample included college men from a campus setting, so findings may not generalize to women, non-students, or older adults. Fourth, diet, financial stress, mental health diagnosis, social support, and academic workload were not fully modeled. Fifth, the shuttle-run test estimates rather than directly measures maximal oxygen uptake.

Future research should use repeated measurements across the academic calendar. Fitness, sleep, stress, and perceived quality of life may change during examination periods, holidays, sport seasons, and transitions between academic years. A longitudinal design could determine whether fitness declines precede increases in stress, or whether high stress disrupts activity and reduces fitness over time. Intervention studies are also needed to test whether improving cardiorespiratory fitness and muscular endurance leads to measurable improvements in resilience and quality of life.

VI. CONCLUSION

This study examined whether physical fitness predicts quality of life and stress resilience in college men. The findings indicate that students with higher physical fitness reported better physical, psychological, social, and environmental quality of life, stronger stress resilience, and lower perceived stress. These relationships were not limited to one test. Cardiorespiratory fitness, muscular strength, muscular endurance, flexibility, and waist-to-height ratio each contributed to the broader fitness profile, while the composite fitness score showed the strongest overall association with psychosocial outcomes.

The results support the view that physical fitness should be considered part of student well-being rather than only a sport or appearance-related characteristic. College men face academic deadlines, social expectations, financial pressure, screen-based workload, and sleep disruption. In this context, fitness may provide a practical foundation for energy, confidence, emotional regulation, and adaptive coping. A fitter student is not necessarily free from stress, but he may have stronger physical and psychological resources to manage stress and recover after demanding periods.

Composite fitness predicted overall quality of life and stress resilience even after accounting for age, sleep duration, weekly moderate-to-vigorous physical activity, and body mass index. This suggests that direct fitness assessment captures information not fully reflected in self-reported activity or body size. Physical activity describes what students do, while fitness reflects what their bodies have adapted to do. Both are valuable, but they are not interchangeable.

Students with higher fitness reported lower perceived stress. This finding highlights that student well-being is multidimensional. Improving fitness alone cannot address every source of academic or personal stress. However, fitness may be one modifiable factor within a wider health strategy that includes sleep support, academic guidance, mental health services, active campus design, and opportunities for inclusive exercise.

In conclusion, physical fitness appears to meaningfully predict quality of life and stress resilience in college men. Future research should test these relationships over time and determine whether structured fitness programs can improve both physical capacity and psychosocial outcomes. Longitudinal and intervention studies are needed to clarify directionality, but the current findings support the scientific value of integrating fitness assessment into college health research.

Author Contributions

The author conducted the conceptualization, methodology, data analysis, investigation, writing, review, editing, and final approval of the manuscript.

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Data Availability

The dataset will be available from the author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest.

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