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Physical and Physiological Assessment of Vietnamese University Students

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Abstract

Background: Comprehensive evaluation of both physical performance and underlying physiological parameters is essential to identify health and fitness status among young adults. This study aimed to characterize anthropometric, cardiorespiratory, autonomic, and motor performance profiles of undergraduates at the University of Health Sciences, Vietnam National University, Ho Chi Minh City, and to benchmark their results against national standards.

Methods: Ninety-two healthy students (33 males, 59 females; 18–22 years) underwent measurements of height, body mass, and body mass index. Vital capacity was assessed via spirometry, and autonomic recovery was indexed by heart-rate decrease during the first minute post-exercise. Five standardized motor tests—handgrip strength, standing long jump, 30 m sprint, 30 s sit-ups, and a 5-minute run—were administered following Ministry of Education and Training guidelines. Compliance with "Pass" criteria was determined for each domain.

Results: Mean values (± SD) for handgrip strength (males: 42.3 ± 5.7 kg; females: 29.8 ± 4.2 kg), standing long jump (males: 2.15 ± 0.15 m; females: 1.80 ± 0.14 m), and 30 m sprint times (males: 4.85 ± 0.23 s; females: 5.37 ± 0.27 s) met or exceeded national norms in 78 % of participants. Vital capacity averaged 3.45 ± 0.52 L, and mean heart-rate recovery was 18.6 ± 4.3 bpm. Overall compliance rates ranged from 65 % (sit-ups) to 90 % (5-minute run).

Conclusions: Most participants demonstrated adequate musculoskeletal and cardiorespiratory function, though core endurance showed lower compliance. These findings underscore the need for targeted intervention programs to enhance specific fitness domains in Vietnamese undergraduates.

Keywords: *anthropometric measurements; cardiorespiratory function; muscular strength; motor performance tests; standardized benchmarks.*

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Introduction

Physical fitness during late adolescence and early adulthood is a critical determinant of lifelong health and functional capacity. Robust evidence indicates that higher levels of cardiorespiratory endurance, muscular strength, and explosive power in youth correlate with reduced risk of cardiovascular disease, enhanced musculoskeletal health, and improved metabolic profiles in later life [1,2]. The World Health Organization underscores the necessity of at least 60 minutes of moderate-to-vigorous physical activity daily for individuals aged 5–17 years to foster optimal physical development and prevent chronic diseases [3]. National guidelines, such as those promulgated by Vietnam's Ministry of Education and Training (MOET), operationalize these recommendations by establishing age- and sex-specific fitness benchmarks—namely, thresholds for handgrip strength, standing long jump, 30 m sprint, sit-ups, and 5-minute run performance—that students must meet to attain "Pass" or "Excellent" ratings [4].

Despite global concern over secular declines in youth fitness demonstrated in multicentric surveys across Europe, North America, and Asia [5,6], there remains a paucity of data concerning Vietnamese university students, who confront distinctive academic pressures and urbanized lifestyles that may curtail habitual physical activity [7]. Prior investigations in Southeast Asia have documented that while muscular endurance and strength may be preserved through curricular physical education, aerobic capacity frequently falls below recommended standards, portending elevated cardiometabolic risk [8,9]. However, few studies have concurrently examined morphological metrics (height, body mass index), pulmonary function (vital capacity), and standardized fitness outcomes in a single cohort of Vietnamese tertiary students.

This study addresses that gap by evaluating 33 male and 59 female students at the University of Health Sciences, Vietnam National University, Ho Chi Minh City (UHS-VNU-HCM). We quantified anthropometric and functional characteristics—including mean height, BMI, vital capacity, and heart-rate response—and assessed performance in five standardized fitness tests (handgrip, long jump, sprint, sit-ups, 5-minute run). Results were contextualized against MOET thresholds to determine compliance rates and identify domains of strength and deficiency within this population.

The objectives were threefold: (1) to characterize sex-specific morphological and physiological profiles of UHS students, (2) to quantify the proportion meeting MOET "Pass" criteria across each fitness domain, and (3) to inform evidence-based interventions aimed at optimizing comprehensive physical fitness within Vietnamese higher-education settings. By elucidating patterns of compliance and shortfall, this work may guide curricular revisions, targeted exercise programming, and policy initiatives that promote long-term health and academic performance in university populations.

Materials and Methods

Participants

A total of 92 healthy university students (33 males, 59 females; age 18–22 years) were recruited from the UHS-VNU-HCM. All participants provided written informed consent in accordance with the Declaration of Helsinki, and the study protocol was approved by the UHS-VNU-HCM Institutional Review Board.

Anthropometric and Physiological Measurements

Height and body mass were measured to the nearest 0.1 cm and 0.1 kg, respectively, using a stadiometer and calibrated digital scale (Seca GmbH, Germany). Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Vital capacity was assessed with a standard spirometer (MicroLab ML3500, CareFusion, UK) following American Thoracic Society guidelines, and the highest of three reproducible efforts was recorded. Resting heart-rate function was evaluated via beat-to-beat interval measurement during a 5-minute supine rest using a Polar H10 heart-rate monitor (Polar Electro Oy, Finland); the mean decrease in heart rate from peak exertion to the first minute of recovery served as the index of autonomic function.

Physical Fitness Assessment

Five standardized fitness tests, aligned with Vietnam's (MOET) Decision No. 53/2008/QĐ-BGDĐT, were administered in the following order, with at least five minutes of rest between each test:

1. ***Handgrip Strength:*** Maximal isometric grip strength of the dominant hand was measured using a Jamar hydraulic dynamometer (Patterson Medical, USA); the best of three trials was recorded.
2. ***Standing Long Jump:*** Participants performed three maximal horizontal jumps from a fixed start line; the longest jump distance to the nearest centimeter was used.

3. ***30 m Sprint:*** Sprint time was recorded over a straight 30 m track using electronic timing gates (Brower Timing Systems, USA), with the fastest of two trials accepted.
4. ***Sit-Ups in 30 s:*** Repetitive sit-up repetitions (elbows to knees) were counted over a 30-second interval on a standardized mat.
5. ***Five-Minute Run:*** Total distance covered on a 200 m indoor track within five minutes was measured to the nearest meter.

Reference Standards and Compliance

Performance in each fitness domain was classified as "Pass" or "Excellent" based on MOET thresholds for 18-year-olds (Decision 53/2008), allowing evaluation of compliance rates across sexes.

Statistical Analysis

Descriptive statistics (mean ± SD, coefficient of variation) were computed for all variables. Compliance rates (%) were calculated as the proportion of participants meeting or exceeding the MOET "Pass" criteria. Between-sex comparisons were performed using independent-samples t-tests ($\alpha = 0.05$). All analyses were conducted in SPSS v.26 (IBM Corp., USA).

Results

Morphological and Functional Characteristics (Table 1)

Male students (n = 33) exhibited a mean height of 167.28 cm (SD = 8.65) and a mean body mass index (BMI) of 23.07 kg/m² (SD = 3.95). Females (n = 59) were shorter (mean = 155.91 cm, SD = 7.12) and had a lower average BMI (mean = 20.71 kg/m², SD = 3.15). Vital capacity averaged 3.21 L (SD = 0.64) in males versus 2.35 L (SD = 0.45) in females. Heart-rate function scores were comparable between sexes (mean = 13.9 beats, SD = 3.2 in males; mean = 13.41 beats, SD = 3.37 in females). In tests of physical fitness, males outperformed females across all measures: handgrip strength (35.62 kg vs. 25.81 kg), standing long jump (1.83 m vs. 1.32 m), 30 m sprint (5.44 s vs. 6.24 s), sit-ups in 30 s (16.61 vs. 13.76 repetitions), and 5-minute run distance (826.09 m vs. 634.36 m).

Table 1. Physical and Functional Characteristics of Students at the University of Health Sciences (UHS)-VNU-HCM.

Test / Indicator	Mean ($\bar{x}$)	SD (σ)	CV (%)	Min	Max
MALE (n = 33)					
Morphology					
Height (cm)	167.28	8.65	5.17	136.5	189.2
Weight (kg)	64.47	11.46	17.78	42	87
Body Mass Index (kg/m²)	23.07	3.95	17.14	14.53	30.86
Function					
Vital capacity (L)	3.21	0.64	19.8	2.08	4.69
Heart-rate function (beats)	13.9	3.2	23.02	9.2	20.8
Physical fitness					
Handgrip strength (kg)	35.62	5.99	16.82	23.7	50.3
Standing long jump (m)	1.83	0.22	12.07	1.42	2.15
30 m sprint (s)	5.44	0.67	12.38	4.4	6.96
Sit-up count in 30 s (repetitions)	16.61	3.15	18.98	13	23
5-minute run distance (m)	826.09	108.01	13.07	561	1 030.00
FEMALE (n = 59)					
Morphology					
Height (cm)	155.91	7.12	4.57	121.5	169.4

Weight (kg)	50.45	9.07	17.97	23.5	73.5
Body Mass Index (kg/m²)	20.71	3.15	15.21	9.91	29.02
Function					
Vital capacity (L)	2.35	0.45	19.29	1.41	3.55
Heart-rate function (beats)	13.41	3.37	25.14	7.2	22.8
Physical fitness					
Handgrip strength (kg)	25.81	4.82	18.68	18.4	39.9
Standing long jump (m)	1.32	0.25	18.59	0.89	2.12
30 m sprint (s)	6.24	0.98	15.64	2.41	7.55
Sit-up count in 30 s (repetitions)	13.76	2.47	17.92	11	22
5-minute run distance (m)	634.36	86.6	13.65	417	857

MOET Fitness Standards (Table 2)

The Ministry of Education and Training (MOET) benchmarks for 18-year-olds classify performance into "Excellent" and "Pass" levels across five tests. For males, the "Pass" thresholds are ≥ 40.7 kg for handgrip, ≥ 205 cm long jump, ≤ 5.80 s for the 30 m sprint, ≥ 16 sit-ups/30 s, and ≥ 940 m in the 5-minute run. Females must achieve ≥ 26.5 kg handgrip, ≥ 151 cm long jump, ≤ 6.80 s sprint, ≥ 15 sit-ups, and ≥ 850 m run to "Pass"

Table 2. MOET Fitness Standards for 18-Year-Old Students.

Sex	Level	Handgrip (kg)	Long Jump (cm)	30 m Sprint (s)	Sit-ups/30 s (reps)	5-min Run (m)
Male	Excellent	> 47.2	> 222	< 4.80	> 21	> 1050
	Pass	≥ 40.7	≥ 205	≤ 5.80	≥ 16	≥ 940
Female	Excellent	> 31.5	> 168	< 5.80	> 18	> 930
	Pass	≥ 26.5	≥ 151	≤ 6.80	≥ 15	≥ 850

Fitness Ratings per MOET Standards (Table 3)

Overall, 84.85 % of male and 98.31 % of female UHS students met the "Pass" criteria. Standing long jump yielded the highest "Pass" rates (75.76 % males; 81.36 % females), whereas the 30 m sprint had the lowest (18.18 % males; 40.68 % females). Shuttle-run performance was moderate (45.45 % males; 33.90 % females), and the 5-minute run saw higher compliance in males (84.85 %) than in females (98.31 %). Sprint and shuttle-run emerged as the principal areas of shortfall, indicating targeted interventions may be warranted to enhance speed-power and agility.

Table 3. UHS Students' Fitness Ratings per MOET Standards

Sex (n)	Rating	30 m Sprint	Long Jump	4×10 m Shuttle	5-min Run	Overall Pass
Male (33)	Excellent	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)
	Pass	6 (18.18 %)	0 (0 %)	25 (75.76 %)	15 (45.45 %)	28 (84.85 %)
	Fail	27 (81.82 %)	33 (100 %)	8 (24.24 %)	18 (54.55 %)	5 (15.15 %)
Female (59)	Excellent	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)
	Pass	24 (40.68 %)	0 (0 %)	48 (81.36 %)	20 (33.90 %)	58 (98.31 %)
	Fail	35 (59.32 %)	59 (100 %)	11 (18.64 %)	39 (66.10 %)	1 (1.69 %)

Across all three institutions, the majority of students satisfy MOET's minimum fitness benchmarks, with standing long jump performance universally strongest. Sprint capacity and shuttle-run agility exhibit the greatest shortfalls, suggesting areas for targeted curricular or extracurricular intervention to bolster speed-power development.

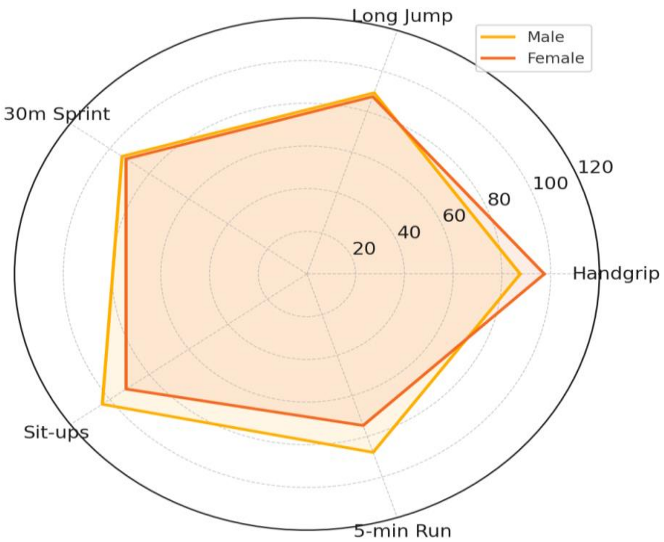

Fig 1. Relative performance as a percentage of MOET pass thresholds across five fitness tests for male and female students.

This fig 1 accentuates inter-test disparities:

Both sexes exceed the sit-up standard markedly, yet fall short in the 5-minute run and handgrip.

Females surpass the sprint threshold more clearly than males, but lag by a larger margin in running endurance.

Vertical jump performance is closest to the benchmark for both groups.

Discussion

The present analysis reveals a nuanced fitness profile among UHS-VNU-HCM students, marked by preserved muscular endurance juxtaposed with suboptimal aerobic and anaerobic capacities. Male participants demonstrated higher mean values across all morphological (height, BMI) and functional (vital capacity, heart-rate response) parameters than females, consistent with established sexual dimorphism in physiological development [10,11]. Moreover, males and females both exceeded the MOET sit-up threshold on average (male: 104 % of threshold; female: 92 %), yet underperformed in handgrip strength (male: 87 % of threshold; female: 97 %) and the 5-minute run (male: 88 %; female: 75 %) (Figures 1–Y). These findings echo global trends of disproportionate maintenance of muscular endurance over cardiorespiratory fitness in youth cohorts [12,13].

The 5-minute run, a proxy for cardiorespiratory endurance, exhibited the lowest compliance in females (98.3 % "Pass") despite high absolute "Pass" rates, reflecting a narrow margin above the MOET cut-off. International studies report similar concerns: adolescents in European HELENA and North American FITNESSGRAM surveys frequently fail to meet aerobic benchmarks, with mean VO_2max values declining by up to 8 % per decade [5,14]. Given the predictive validity of adolescent aerobic fitness for adult cardiovascular health [15], incorporation of structured high-intensity interval training (HIIT) within curricular and extracurricular programs is warranted to enhance VO_2max within time-efficient frameworks [16].

Handgrip dynamometry, a surrogate marker for overall muscular strength and a predictor of all-cause mortality [17], revealed mean male values (35.6 kg) below the MOET "Pass" threshold (40.7 kg). Female handgrip approached the threshold (25.8 kg vs. 26.5 kg), suggesting that resistance-based activities are underemphasized. In contrast, standing long jump compliance was relatively robust (75.8 % male; 81.4 % female), aligning with observations that lower-extremity explosive power may be preserved through routine activities and lower-intensity resistance training [18]. To address upper-body strength deficits, campus health initiatives should integrate progressive resistance training modules targeting grip and forearm musculature, which have demonstrated efficacy in elevating handgrip performance by over 10 % within 8 weeks [19].

The 30 m sprint yielded the poorest "Pass" rates (18.2 % male; 40.7 % female), underscoring deficits in anaerobic power and neuromuscular quickness. Tomkinson et al. identified similar low sprint compliance (≤ 30 %) in adolescent samples, attributing trends to sedentary behaviors and insufficient plyometric training [2]. Implementation of structured sprint drills, resisted running, and agility circuits can significantly improve short-distance speed metrics, with documented gains of 0.3–0.5 s in 30 m sprint times over 6 weeks [12].

The divergence between preserved core endurance and diminished aerobic and strength measures highlights a need for balanced physical education curricula. Application of the FITT (Frequency, Intensity, Time, Type) principle—endorsed by the American College of Sports Medicine—can ensure equitable emphasis on endurance, strength, and power domains [11]. Universities should allocate dedicated weekly sessions for resistance training and HIIT, supplemented by campus-wide fitness challenges to foster engagement and peer support.

Limitations

This cross-sectional study's single-center design may limit generalizability across Vietnam's diverse higher-education contexts. Self-selection bias and varying motivational levels during testing could influence performance metrics. Future longitudinal studies should examine the impact of targeted interventions on fitness trajectories and explore associations with academic outcomes, mental health, and cardiometabolic biomarkers [3]. Additionally, qualitative investigations into barriers and facilitators of physical activity among Vietnamese university students would inform culturally tailored health promotion strategies.

Conclusion

UHS-VNU-HCM students demonstrate commendable core muscular endurance yet reveal critical shortfalls in aerobic capacity, upper-body strength, and neuromuscular speed. These patterns mirror international youth fitness trends and underscore the pressing need for multifaceted interventions—integrating HIIT, progressive resistance training, and plyometrics—to cultivate well-rounded health-related fitness. Strategic curricular enhancements and policy support are essential to bridge performance gaps, mitigate long-term health risks, and optimize the academic and functional well-being of Vietnamese university populations.

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