JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

Original Article Volume 4, Issue 1

Association of Stress Severity and Exercise Motivation Among Undergraduate Students in Karachi

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ABSTRACT

Background: *Undergraduate students frequently experience elevated stress due to academic demands and lifestyle disruption, which may influence health behaviors, including physical activity; understanding whether stress severity relates to exercise motivation can inform student-focused health promotion.* ***Objective:*** *To determine stress severity and exercise motivation among undergraduate students in Karachi and to assess the association between stress severity and multidimensional exercise motivation.* ***Methods:*** *A cross-sectional observational study was conducted in Karachi from October 17 to December 17, 2023, recruiting undergraduate students aged 19–25 years from public and private universities using purposive sampling. Participants completed a sociodemographic form, the Student Stress Inventory–2 (SSI-2) to quantify stress severity, and the Exercise Motivation Inventory–2 (EMI-2) to assess 14 motivational subscales. Data were analyzed in IBM SPSS Statistics v16; normality was assessed using Shapiro–Wilk, and Spearman's rank correlation tested associations between SSI-2 total scores and EMI-2 subscales at* $\alpha = 0.05$. ***Results:*** *Of 215 responses, 203 were analyzed; 74.9% were female. Most students had moderate stress (66.5%), followed by mild (27.1%) and severe stress (6.4%), with a mean SSI-2 score of 92.35 ± 19.52. The highest exercise motives were positive health (3.43 ± 1.47), strength and endurance (3.25 ± 1.53), and ill-health avoidance (3.04 ± 1.56), while social recognition was lowest (2.10 ± 1.48). SSI-2 scores showed no significant correlation with any EMI-2 subscale (all* $p > 0.05$; $|r_s| \leq 0.103$). ***Conclusion:*** *Karachi undergraduates commonly reported moderate stress and predominantly health-oriented exercise motives; stress severity was not associated with exercise motivation domains, suggesting other determinants may better explain motivational patterns in this population.*

Keywords: *stress; exercise motivation; physical activity; undergraduate students; Karachi; cross-sectional study*

INTRODUCTION

Stress is a biopsychosocial state that disrupts homeostasis and elicits affective, physiological, biochemical, and cognitive–behavioral responses aimed at restoring balance (1). University life represents a particularly stress-prone developmental transition: students move from parent-supported routines to independent academic and social demands, while simultaneously navigating new peer networks, financial pressures, and performance expectations (2). Consistent with this, large proportions of college students report heightened stress during their studies, and higher perceived stress is often accompanied by coping patterns that undermine health—such as poor diet quality, reduced sleep, and lower engagement in physical activity—thereby compounding psychological and physical vulnerability (3). Because physical activity during adolescence and young adulthood is linked to better mental health profiles, including fewer depressive symptoms and healthier coping behaviors, reduced activity in stressed students is a public health concern as well as an academic one (4). In Pakistan, stress-related symptomatology has been documented across student groups, reinforcing the relevance of mental well-being as a determinant of educational performance and quality of life (5). At the same time, exercise is widely

Received: 10 December 2025
Revised: 09 January 2026
Accepted: 12 January 2026
Published: 15 January 2026

Citation: Click to Cite

recognized as a low-cost, scalable behavior with broad benefits—reduced all-cause morbidity risk, improved musculoskeletal function, and improved cardiometabolic health—while also supporting psychological well-being and stress regulation (6).

Mechanistically and behaviorally, exercise is frequently positioned as a stress-buffering strategy: participation in regular physical activity is associated with lower perceived stress, fewer stress-related symptoms, and higher self-esteem, suggesting both physiological and psychosocial pathways through which exercise may mitigate stress burden (7). However, students with high academic and interpersonal demands may experience "time scarcity" and motivational depletion that reduces their likelihood of exercising, even when they recognize its benefits (8). Evidence on the stress–activity relationship remains mixed, with some findings indicating that physical activity is associated with lower stress particularly among less active individuals, but that this association may attenuate after accounting for covariates such as gender and BMI—highlighting the potential role of confounding and effect modification (9). This variability underscores that "stress" may not uniformly suppress exercise; rather, it may differentially influence whether students initiate, maintain, or discontinue activity, depending on motivational drivers and contextual constraints.

From a behavioral science and biostatistical perspective, motivation is a plausible intermediate construct linking stress severity to exercise engagement, because motives shape intention strength, adherence, and persistence under competing demands. Prior work using the Exercise Motivation Inventory framework suggests that longer-term exercisers score higher on motives such as stress management, enjoyment, and challenge compared with short-term exercisers, implying that motivational profiles may distinguish sustained participation from early-stage engagement (10). Experimental and quasi-experimental evidence further supports the "time-out" hypothesis: exercise can have a calming effect when it offers psychological disengagement from stressors, whereas the effect may weaken when stress exposure continues during the exercise bout—indicating that context and perceived relief may be integral to the stress–exercise pathway (11). More recent observational data among undergraduates also demonstrate that exercise self-efficacy and exercise motivation are positively correlated with exercise behavior, suggesting that motivation is not merely an attitudinal outcome but a behavioral determinant that can be targeted in intervention design (12). Importantly, in Karachi and comparable settings, where students face heterogeneous academic systems and lifestyle constraints, quantifying both stress severity and specific motivational domains may be essential to designing feasible, culturally responsive health promotion strategies.

Despite the extensive literature on stress and physical activity, a key knowledge gap remains in how stress severity relates to the multidimensional motives for exercise in undergraduate students, particularly within Pakistan where local stress prevalence estimates among university students are high and where institutional contexts vary across public and private universities (13). Karachi-based data have reported notable stress and depression prevalence among university students, supporting the need to study determinants and correlates within this population rather than relying solely on external evidence (14). Moreover, while many studies describe moderate stress as common among university populations, the distribution of stress severity and its potential linkage to exercise motives may differ by setting, academic discipline, and social environment (15). Separately, evidence suggests that college students often endorse health-related reasons as primary motives for exercise, but low endorsement of socially driven motives such as recognition indicates that motivational profiles may cluster around health maintenance rather than social reward (16). These motivational patterns matter because motives are associated with the form and consistency of activity participation; for example, identified health/fitness motives can support more autonomous

regulation, which in turn predicts greater activity involvement (17). Gender and sociocultural factors may further shape motives, with prior work indicating sex differences in appearance/weight-related versus performance-oriented motives, complicating any simple assumption that stress uniformly drives or suppresses motivation across students (18).

Critically, the directionality of the stress–exercise relationship is not settled: stress may reduce exercise through fatigue and reduced time, exercise may reduce stress through physiological and psychological mechanisms, or both may operate simultaneously, varying across individuals and time (19).

This bidirectionality, coupled with the complexity of motivational subdomains (e.g., stress management, enjoyment, appearance, health pressure), justifies focusing on exercise motivation as an outcome that can be measured even when objective activity is not directly observed. Therefore, using validated tools to quantify stress severity and exercise motives in Karachi undergraduates can clarify whether students with greater stress burden express higher motivation to exercise for stress management (a coping pathway) or lower motivation across domains (a depletion pathway), and can guide future studies that incorporate longitudinal designs and behavioral measures.

Accordingly, this study examines undergraduate students in Karachi (Population), quantifies stress severity using a validated student stress inventory (Exposure), and evaluates multidimensional exercise motivation using the Exercise Motivation Inventory-2 (Outcome), with comparisons across levels of stress severity and correlational assessment of stress–motive associations (Comparator).

The primary objective is to determine stress severity and exercise motivation among undergraduate students in Karachi and to test whether stress severity is associated with exercise motivation subscales. Given prior mixed evidence and potential bidirectionality, we specified a priori null hypothesis that overall stress severity is not significantly correlated with overall exercise motivation domains in this cross-sectional sample, while descriptively characterizing which motives are most strongly endorsed in this population (19).

MATERIAL AND METHODS

This cross-sectional observational study was designed to examine the association between stress severity and exercise motivation among undergraduate students, based on the rationale that stress and motivation are interrelated behavioral constructs that may influence health-related behaviors during early adulthood.

The study was conducted in Karachi, Pakistan, across multiple public and private universities offering undergraduate programs, including Sindh Institute of Physical Medicine and Rehabilitation, Dow University of Health Sciences, University of Karachi, NED University of Engineering and Technology, and Liaquat National Medical College. Data collection was carried out over a two-month period from October 17 to December 17, 2023, to ensure consistency in academic workload exposure and minimize seasonal variation in stress and activity patterns.

Undergraduate students aged 19 to 25 years, of either gender, who were enrolled in full-time undergraduate programs were eligible to participate. Students were excluded if they reported a current bone fracture or musculoskeletal condition limiting joint mobility and the ability to exercise, or if they had a diagnosed psychological disorder currently being treated with anxiolytic or antidepressant medication, in order to reduce clinical confounding of stress measures.

Participants were selected using a non-probability purposive sampling approach to allow recruitment across diverse academic disciplines and institutional settings. Potential participants were approached in person within university premises, including classrooms and common areas, and were provided with a standardized verbal explanation of the study purpose, procedures, risks, and benefits. Written informed consent was obtained from all participants prior to enrollment, and participation was entirely voluntary with the option to withdraw at any stage without consequence.

Data were collected through face-to-face administration of structured questionnaires to ensure completeness and reduce item non-response. The data collection instrument comprised three components completed in a single session lasting approximately 15–20 minutes. First, a personal data sheet was used to record sociodemographic variables, including age, gender, email address, and year of study.

Stress severity was assessed using the Student Stress Inventory–2 (SSI-2), a validated instrument consisting of 40 negatively worded items distributed equally across four domains: physical, interpersonal relationship, academic, and environmental stressors.

Each item is rated on a four-point ordinal scale ranging from “never” (1) to “always” (4), yielding a total stress score, with higher scores indicating greater stress severity. The SSI-2 has demonstrated acceptable to high internal consistency, with an overall Cronbach’s alpha exceeding 0.80 and subscale reliability coefficients within acceptable ranges, supporting its use in student populations (20).

Exercise motivation was measured using the Exercise Motivation Inventory–2 (EMI-2), a multidimensional tool comprising 51 items rated on a six-point Likert scale from 0 (“not at all true for me”) to 5 (“extremely true for me”). The EMI-2 evaluates 14 distinct motivational subscales, including affiliation, appearance, challenge, competition, enjoyment, health pressure, ill-health avoidance, nimbleness, positive health, revitalization, social recognition, stress management, strength and endurance, and weight management. Subscale scores were calculated as the mean of constituent items, with higher scores reflecting stronger endorsement of that motive.

The EMI-2 has demonstrated strong factorial validity and internal consistency, with reported Cronbach’s alpha values ranging from 0.69 to 0.92 across subscales and invariance across gender, supporting its reliability for research use (21). The primary exposure variable was stress severity as measured by the SSI-2 total score, and the primary outcome variables were the EMI-2 motivational subscale scores. Stress severity categories (mild, moderate, severe) were derived according to established SSI-2 scoring conventions to facilitate descriptive interpretation.

Potential sources of bias were addressed through standardized administration procedures, use of validated instruments, and consistent data collection conditions. To reduce information bias, questionnaires were administered in person, and participants were encouraged to ask clarifying questions if items were unclear. Selection bias was partially mitigated by recruiting from multiple institutions and academic years. Confounding by age and gender was considered a priori and addressed analytically.

The required sample size was calculated using standard prevalence-based formulas for cross-sectional studies, assuming a 95% confidence level, a 5% margin of error, and an estimated prevalence of stress among undergraduate students based on prior regional data. Data were entered into a secure Microsoft Excel worksheet and cross-checked for completeness and accuracy prior to analysis. Statistical analyses were conducted using IBM SPSS Statistics

version 16. Descriptive statistics were used to summarize participant characteristics and study variables, with frequencies and percentages reported for categorical variables and means with standard deviations for continuous variables. Normality of continuous variables was assessed using the Shapiro–Wilk test. As stress and motivation variables were not normally distributed, Spearman's rank-order correlation coefficient was used to examine associations between SSI-2 total scores and EMI-2 subscale scores. All analyses were conducted using a two-tailed significance level of 0.05. Complete-case analysis was performed, as questionnaires with substantial missing data were excluded prior to analysis. Where appropriate, stratified analyses by gender and year of study were explored to assess potential effect modification.

Ethical approval for the study was obtained from the Institutional Review Board of the Sindh Institute of Physical Medicine and Rehabilitation. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki. Participant confidentiality was maintained by anonymizing data and restricting access to the dataset to the research team. To ensure reproducibility and data integrity, standardized instruments, predefined scoring procedures, and a prespecified statistical analysis plan were used, and data entry accuracy was verified through double-checking prior to analysis.

RESULTS

Table 1 summarizes the sociodemographic profile of the 203 included participants. Females constituted nearly three-quarters of the sample (n = 152, 74.9%), while males represented one-quarter (n = 51, 25.1%). The most represented single age was 19 years (n = 59, 29.1%). When ages were grouped, 20–22 years accounted for the largest segment (n = 84, 41.4%), followed by 23–25 years (n = 60, 29.5%). Representation across academic years was broadly balanced, with third-year students forming the largest proportion (n = 56, 27.6%), followed by fourth-year (n = 53, 26.1%), first-year (n = 50, 24.6%), and second-year students (n = 44, 21.7%), indicating that perspectives were captured across different stages of undergraduate training. Table 2 presents the descriptive statistics for stress severity and exercise motivation. The mean total SSI-2 score was 92.35 ± 19.52, indicating an overall moderate stress burden in the cohort. Across EMI-2 subscales, the highest mean motive score was observed for positive health (mean 3.43 ± 1.47), followed by strength and endurance (3.25 ± 1.53) and ill-health avoidance (3.04 ± 1.56), showing that health- and fitness-oriented motives were the most strongly endorsed.

A second tier of motives clustered closely around a mean of approximately 2.8–2.9, including stress management (2.91 ± 1.52), appearance (2.90 ± 1.54), revitalization (2.89 ± 1.50), and enjoyment (2.86 ± 1.54), suggesting moderate endorsement of both psychological and aesthetic drivers. Challenge also showed moderate endorsement (2.77 ± 1.46). Lower-ranked motives included weight management (2.56 ± 1.61) and health pressure (2.40 ± 1.34), while more socially oriented or performance-comparative motives were comparatively less endorsed, including affiliation (2.17 ± 1.44), competition (2.15 ± 1.58), nimbleness (2.12 ± 1.13), and social recognition (2.10 ± 1.48), the latter being the lowest mean score overall. Table 3 depicts the distribution of stress severity categories. Most students fell into the moderate stress category (n = 135, 66.5%), which was more than double the proportion classified as mild stress (n = 55, 27.1%). Only a small minority were categorized as having severe stress (n = 13, 6.4%), indicating that extreme stress levels were relatively uncommon in this sample compared with moderate stress levels, which predominated.

Table 4 reports the inferential association between SSI-2 total stress scores and each of the 14 EMI-2 motivational subscales using Spearman's rank correlation. None of the correlations reached statistical significance (all $p > 0.05$), and effect sizes were uniformly small, indicating

negligible monotonic relationships between stress severity and exercise motivation domains in this cohort. The strongest (largest magnitude) correlation observed was for strength and endurance ($r_s = -0.103$, $p = 0.143$), which remained weak and non-significant.

Table 1. Sociodemographic characteristics of undergraduate students (N = 203)

Variable	Category	n	%
Gender	Female	152	74.9
	Male	51	25.1
Age (years)	19	59	29.1
	20–22	84	41.4
	23–25	60	29.5
Year of study	First year	50	24.6
	Second year	44	21.7
	Third year	56	27.6
	Fourth year	53	26.1

Table 2. Descriptive statistics of stress severity and exercise motivation (N = 203)

Variable	Mean ± SD
SSI-2 total score	92.35 ± 19.52
Positive health	3.43 ± 1.47
Strength and endurance	3.25 ± 1.53
Ill-health avoidance	3.04 ± 1.56
Stress management	2.91 ± 1.52
Appearance	2.90 ± 1.54
Revitalization	2.89 ± 1.50
Enjoyment	2.86 ± 1.54
Challenge	2.77 ± 1.46
Weight management	2.56 ± 1.61
Health pressure	2.40 ± 1.34
Affiliation	2.17 ± 1.44
Competition	2.15 ± 1.58
Nimbleness	2.12 ± 1.13
Social recognition	2.10 ± 1.48

Table 3. Distribution of stress severity categories (N = 203)

Stress severity category	n	%
Mild	55	27.1
Moderate	135	66.5
Severe	13	6.4

Table 4. Association between stress severity (SSI-2 total score) and exercise motivation subscales (EMI-2) (N = 203)

EMI-2 subscale	Spearman's r_s	p-value
Stress management	−0.003	0.965
Revitalization	−0.050	0.478
Enjoyment	−0.074	0.293
Challenge	−0.057	0.422
Social recognition	−0.033	0.642
Affiliation	−0.004	0.958
Competition	−0.008	0.905
Health pressure	0.055	0.434
Ill-health avoidance	−0.022	0.758
Positive health	0.000	0.999
Weight management	0.029	0.686
Appearance	0.007	0.916
Strength and endurance	−0.103	0.143
Nimbleness	−0.052	0.463

Several correlations were near zero, including positive health (r_s = 0.000, p = 0.999), appearance (r_s = 0.007, p = 0.916), competition (r_s = −0.008, p = 0.905), and affiliation (r_s = −0.004, p = 0.958), suggesting no meaningful trend in these motives across stress levels. Motives that might theoretically relate to stress—such as stress management (r_s = −0.003, p = 0.965), enjoyment (r_s = −0.074, p = 0.293), revitalization (r_s = −0.050, p = 0.478), and ill-health avoidance (r_s = −0.022, p = 0.758)—also showed minimal, non-significant correlations. Overall, the pattern across Table 4 indicates that higher or lower stress scores were not accompanied by systematic increases or decreases in any measured exercise motive within this undergraduate sample.

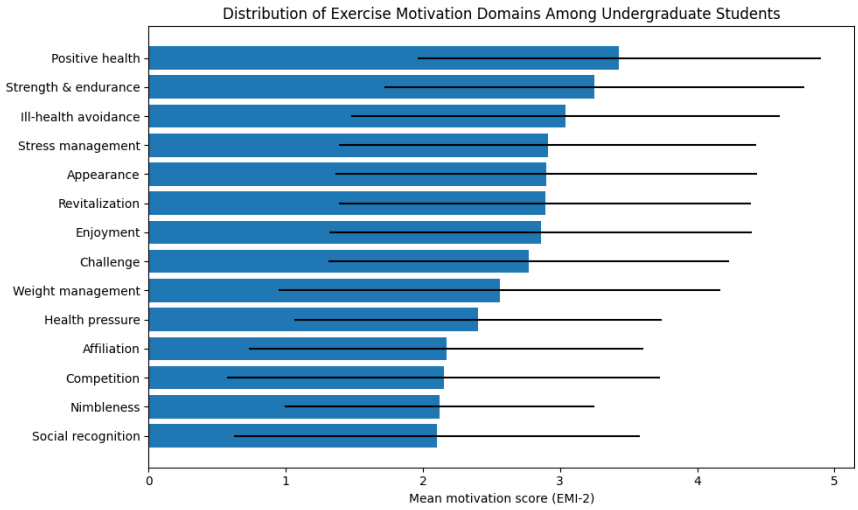

Figure 1 Distribution of Exercise Motivation Domains Among Undergraduate Students

This figure presents a ranked distribution of Exercise Motivation Inventory-2 subscale scores, ordered from highest to lowest mean, with horizontal bars representing mean motivation levels and error bars denoting standard deviations. Health-oriented motives dominated the motivational profile, with positive health showing the highest mean score (3.43 ± 1.47),

followed by strength and endurance (3.25 ± 1.53) and ill-health avoidance (3.04 ± 1.56), indicating that intrinsic and preventive health considerations were the most salient drivers of exercise behavior in this population. A middle cluster of motives—stress management, appearance, revitalization, enjoyment, and challenge—showed closely aligned mean values ranging from 2.77 to 2.91, suggesting moderate but relatively uniform endorsement across psychological and self-perceptual domains. In contrast, socially oriented and externally reinforced motives were consistently least endorsed, with social recognition (2.10 ± 1.48), nimbleness (2.12 ± 1.13), competition (2.15 ± 1.58), and affiliation (2.17 ± 1.44) occupying the lowest ranks. The wide overlap of variability across subscales, particularly among mid-range motives, highlights substantial inter-individual heterogeneity despite stable group-level rankings. Clinically, this gradient underscores that undergraduate students' exercise motivation is predominantly health-driven rather than socially reinforced, providing important context for interpreting the observed lack of association between stress severity and exercise motivation and for designing targeted, health-focused physical activity interventions in this population.

DISCUSSION

The present study examined stress severity, exercise motivation, and their association among undergraduate students in Karachi, with findings indicating a predominance of moderate stress levels and a motivation profile largely driven by health-related factors. The mean SSI-2 score of 92.35 ± 19.52 places the majority of participants within the moderate stress category, consistent with earlier evidence reporting moderate stress as the most common level among university students in Pakistan and comparable settings (13,14,15). This pattern likely reflects the cumulative academic, interpersonal, and environmental demands faced during undergraduate education, particularly during the early years of transition into independent academic life. The relatively small proportion of students experiencing severe stress (6.4%) suggests that, while stress is widespread, extreme stress burden may be less prevalent in this cohort, potentially due to adaptive coping mechanisms or institutional support structures.

With respect to exercise motivation, the findings demonstrate that undergraduate students primarily endorsed intrinsic and health-oriented motives, including positive health, strength and endurance, and ill-health avoidance. This motivational hierarchy aligns closely with prior literature indicating that young adults often engage in physical activity to maintain general health and physical fitness rather than for externally regulated reasons (16,17). The relatively high endorsement of stress management as a motive further suggests that students conceptually recognize exercise as a strategy for psychological well-being, even if this recognition does not necessarily translate into behavior. Conversely, socially driven motives such as social recognition, affiliation, and competition were least endorsed, a pattern previously observed among college populations where exercise is perceived more as a personal health behavior than a socially rewarded activity (16). These findings may reflect sociocultural norms within the local context, where structured or competitive exercise opportunities are less emphasized and personal health maintenance takes precedence.

A central finding of this study is the absence of a statistically significant association between stress severity and any of the fourteen exercise motivation subscales. All observed Spearman correlation coefficients were small in magnitude, indicating negligible monotonic relationships between perceived stress levels and motivational drivers for exercise. This result contrasts with some prior studies suggesting either a negative association—where higher stress suppresses physical activity—or a compensatory pattern in which stressed individuals report greater motivation to exercise for stress relief (9,19). However, the present

findings are consistent with evidence that the stress–exercise relationship is neither uniform nor linear and may vary according to individual differences, contextual constraints, and the specific motivational constructs assessed (19). One possible explanation is that stress severity in this sample was relatively homogeneous, with most participants clustered in the moderate range, thereby limiting variability and attenuating observable correlations.

From a behavioral perspective, it is also plausible that stress influences actual exercise behavior more strongly than it influences motivational endorsement. Motivation, as measured by the EMI-2, reflects cognitive and affective reasons for exercising rather than enacted behavior. Prior work has shown that even when students endorse health or stress-management motives, high academic workload, time constraints, and fatigue may prevent translation of motivation into regular activity (8,12). Thus, stress may operate as a barrier at the behavioral execution stage rather than at the motivational appraisal stage. Additionally, the multidimensional nature of motivation suggests that different stressors (academic versus interpersonal or environmental) may differentially relate to specific motives, an effect that may not be captured when using only total stress scores.

The findings also support the notion that motivation to exercise among undergraduates is multifactorial and shaped by influences beyond perceived stress, including self-efficacy, social support, access to facilities, and cultural attitudes toward physical activity (12,18). The dominance of health-related motives across stress levels suggests that interventions aimed at increasing physical activity in this population may benefit more from reinforcing health knowledge, skill-building, and habit formation rather than solely framing exercise as a stress-reduction tool. Importantly, the lack of association observed in this cross-sectional analysis does not preclude a bidirectional or time-dependent relationship between stress and exercise, as longitudinal and experimental studies have demonstrated that exercise can reduce stress over time and that stress can variably influence activity patterns depending on context (11,19).

Overall, the present findings contribute to the existing literature by clarifying that, within this undergraduate cohort, stress severity was not a determinant of exercise motivation profiles. This underscores the need for future research employing longitudinal designs, objective physical activity measures, and broader psychosocial covariates to disentangle whether stress primarily affects motivation, behavior, or the translation between the two. Such work would be essential for developing targeted, evidence-based interventions to promote physical activity and mental well-being among university students in similar academic and cultural contexts.

CONCLUSION

This study demonstrates that undergraduate students in Karachi predominantly experience moderate levels of perceived stress and are primarily motivated to engage in exercise for intrinsic, health-related reasons such as positive health, strength and endurance, and avoidance of ill health. Despite theoretical and empirical expectations of a link between stress and exercise-related motivation, no meaningful association was observed between stress severity and any domain of exercise motivation in this cohort. These findings suggest that, within this population, perceived stress does not appear to influence how or why students are motivated to exercise, and that other factors—such as self-efficacy, environmental access, social context, and cultural norms—may play a more substantial role in shaping motivational profiles. Recognizing that motivation alone may not translate into actual exercise behavior, future research should adopt longitudinal and mixed-method approaches incorporating objective activity measures and broader psychosocial

determinants to better understand pathways linking stress, motivation, and physical activity among university students.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: FHQ; Design: KN; Data Collection: MA; Analysis: TI; Drafting: AS

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

Funding: This research received no external funding.

Data Availability: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Acknowledgments: NA

Study Registration: Not applicable.