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A Multidimensional Study on the Role of Sports Training in Enhancing Physical and Mental Fitness under Environmental Challenges in Higher Secondary Students

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ABSTRACT

This research examines the complex effects of sports training on upper secondary students' mental and physical health, especially in light of different environmental issues. Through the integration of physical conditioning, psychological resilience, and adaptive tactics, the study explores the ways in which organised sports programs enhance academic achievement and general well-being. Environmental elements that affect student health and training efficacy are studied, including pollution, climatic fluctuation, and urban stresses. Using a mixed-method approach that includes both qualitative psychological evaluations and quantitative fitness measurements, the research emphasises the important role that sports training plays in fostering stress management, mental toughness, and physical endurance. The results highlight how important it is to include adaptive sports training modules in school curriculum in order to promote holistic development and equip children to succeed in spite of environmental challenges.

1.0. Introduction:

The importance of sports training in fostering teenagers' physical and mental well-being has attracted a lot of attention in recent years. Higher secondary kids are at a vital developmental period when physical exercise is important for developing psychological resilience and cognitive abilities in addition to improving physical strength and endurance. [1] The problems brought on by more unfavourable environmental factors, such air pollution, extremes in temperature, and urban noise, may make health risks worse and make conventional exercise programs less effective. Therefore, promoting holistic student development requires an awareness of how sports training may be maximised to reduce these environmental stresses.[2]When properly included, sports training may be a potent instrument for improving mental health, physical strength, and cardiovascular health by promoting self-control, discipline, and collaboration. Furthermore, pupils can sustain performance levels in the face of external problems thanks to adaptive training techniques designed to handle environmental challenges. The relationship between environmental conditions and physical activity results highlights the need of a multifaceted strategy in school curriculum that prioritises sustainable fitness practices and resilience-building. In light of the effects of environmental difficulties on students' academic performance and health, this research attempts to explore how sports training might improve the physical and mental fitness of upper secondary students. [3]

2.0. Literature Review:

Numerous studies have examined the connection between sports training and the improvements in teenagers' physical and mental health, emphasising the advantages of consistent physical exercise for this age group. Improved academic performance and general health are closely associated with physical fitness, which includes cardiovascular endurance, muscular strength, and flexibility [4]. According to studies, doing sports improves physical characteristics while also having a major positive impact on psychological health by lowering stress, anxiety, and depression [5]. Environmental issues including air pollution, high temperatures, and urban stresses may have a detrimental effect on students' performance and health while they are participating in physical education classes. High pollution exposure, for instance, has been shown to affect lung function and decrease teenagers' ability to exercise [6]. In order to preserve the advantages of physical exercise while lowering health hazards,

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adaptive sports training regimens that take these outside stresses into consideration must be developed.

Furthermore, psychological resilience is essential to kids' ability to handle academic stresses as well as environmental difficulties. Maintaining mental health throughout adolescence requires mental fortitude, focus, and stress management abilities, all of which are developed by sports training. By incorporating these components into school sports programs, a supporting framework for improving kids' overall fitness may be established, equipping them to successfully navigate psychological and environmental obstacles.

3.0. Methodology:

In order to thoroughly evaluate how sports training might improve students' physical and mental health in the face of environmental obstacles, this study uses a mixed-method research approach. To provide a comprehensive picture of the consequences, the technique combines quantitative and qualitative methods. [7]

Sample and Setting: 150 upper secondary students (ages 16 to 18) from urban schools dealing with environmental issues including pollution and heat stress were chosen as a purposive sample. The inclusion of organised sports training programs in the schools' curriculum led to their selection.

Quantitative Data Collection: Standardised tests, such as the Cooper 12-minute run test for cardiovascular endurance, muscular strength tests (such as push-ups and sit-ups), and flexibility evaluations (such as the sit-and-reach test), were used to gauge physical fitness. During training sessions, temperature and humidity readings as well as local air quality indicators were used to capture environmental exposure data.

Qualitative Data Collection: Semi-structured interviews and validated psychological questionnaires, including the Connor-Davidson Resilience Scale (CD-RISC) and the Perceived Stress Scale (PSS), were used to evaluate psychological resilience and mental fitness. Students' impressions of how environmental factors impacted their training and general well-being were investigated via focus group talks.[8]

Data Analysis: To ascertain the connections between sports training, fitness results, and environmental variables, quantitative data were examined using descriptive statistics, t-tests,

and correlation analysis. To find trends pertaining to stress management, mental toughness, and adaptive behaviours, qualitative data were subjected to thematic analysis. This mixed-method approach provides evidence for adaptive training treatments by enabling a thorough investigation of the ways in which environmental difficulties interact with sports training to impact teenagers' physical and mental health.

.4.0. Result and Discussion:

Table 1: Demographic and Environmental Characteristics of Sample

Variable	**Frequency (n=150)**	**Percentage (%)**	**Mean ± SD**
Age (years)	-	-	17.2 ± 0.8
Gender			
- Male	80	53.3	
- Female	70	46.7	
Exposure to Air Pollution			
- Low	45	30.0	
- Moderate	65	43.3	
- High	40	26.7	
Average Temperature (°C)	-	-	32.5 ± 3.4

A representative sample for analysing the role of sports training across genders is provided by

the research sample's demographic statistics, which show a virtually equal gender distribution among upper secondary students, with men making up 53.3% and girls 46.7%. The upper secondary schooling stage, which is crucial for both physical and psychological development, is well matched with the average age of 17.2 years. According to a review of environmental exposure, a significant percentage of students are exposed to moderate (43.3%) to high (26.7%) levels of air pollution, which is known to have a negative impact on cardiovascular and respiratory health. Heat stress conditions are indicated by the average ambient temperature of 32.5 ± 3.4°C, which might further impair physical performance and raise physiological strain during sports exercise.[9]These environmental elements emphasise how crucial it is to take adaptation methods into account when designing sports training programs in order to lessen any possible harm to students' mental and physical health. Training must be modified to account for heat and pollution exposure in order to maximise health benefits and guarantee continued engagement in physical activities in spite of environmental challenges.

Table 2: Physical Fitness Assessment Results

Fitness Test	**Mean Score (± SD)**	**Normal Range***	**% Meeting Norms**
Cooper 12-Minute Run (meters)	2200 ± 300	≥ 2100 m	72%
Push-Ups (repetitions/min)	28 ± 8	≥ 25 reps	68%
Sit-Ups (repetitions/min)	30 ± 7	≥ 30 reps	55%
Sit-and-Reach (cm)	18 ± 5	≥ 17 cm	60%

*Normal ranges based on standardized fitness guidelines for adolescents.

The majority of upper secondary pupils reach or surpass the standardised fitness standards across a range of metrics, according to the findings of the physical fitness exam. In the Cooper 12-minute run test, 72% of students met or exceeded the standard, indicating strong

cardiovascular endurance—a critical component of both academic success and general physical health. Push-up and sit-up strength tests revealed that 68% and 55% of pupils, respectively, fulfilled the suggested standards, suggesting moderate physical endurance. Sixty percent of the students had appropriate flexibility as determined by the sit-and-reach test, confirming the importance of flexibility in preventing injuries and promoting functional mobility. [10]These findings highlight the beneficial effects of regular sports training on teenagers' physical fitness. The somewhat smaller proportion of sit-ups, however, indicates that abdominal muscle endurance could need more attention in training regimens. Maintaining and enhancing these fitness components requires regular, well-structured physical activity, particularly in the face of environmental factors like heat and pollution that might impair exercise ability.

Table 3: Psychological Resilience and Stress Levels

Psychological Measure	**Mean Score (± SD)**	**Scale Range**	**Interpretation**
Perceived Stress Scale (PSS)	18.5 ± 5.3	0–40	Moderate Stress Level
Connor-Davidson Resilience Scale (CD-RISC)	70.2 ± 10.1	0–100	Moderate to High Resilience

With a mean PSS score of 18.5 ± 5.3, upper secondary pupils' psychological evaluation indicates a moderate degree of experienced stress. Increased social and academic demands that come with adolescence may raise stress levels, which may have an effect on mental health and academic achievement. Nonetheless, a moderate to high degree of resilience is shown by the CD-RISC scores (70.2 ± 10.1), indicating that many adolescents have significant psychological resources to manage stresses.[11]This equilibrium between resilience and mild stress emphasises the potential protective benefits of sports training in developing mental toughness and flexible coping mechanisms. Regular exercise and organised sports participation may improve resilience and stress management by fostering self-efficacy, discipline, and social support. Building resilience is essential to promoting kids' mental and physical health in settings plagued by pollution and climate stresses.

Table 4: Correlation between Environmental Factors, Physical Fitness, and Mental Health

Variables	r-value	p-value	Interpretation
Air Pollution Level vs. Cooper Run Test	-0.42	< 0.01	Moderate negative correlation
Temperature vs. Push-Ups	-0.30	< 0.05	Weak negative correlation
Air Pollution Level vs. Perceived Stress	0.45	< 0.01	Moderate positive correlation
Resilience (CD-RISC) vs. Fitness Scores	0.50	< 0.01	Moderate positive correlation

Significant connections between environmental variables, physical fitness, and mental health among upper secondary students are shown by the correlation analysis. The Cooper 12-minute run test performance and air pollution levels showed a moderately negative connection ($r = -0.42$, $p < 0.01$), suggesting that increased exposure to polluted air has a deleterious impact on cardiovascular endurance. Likewise, there is a modest negative connection ($r = -0.30$, $p < 0.05$) between temperature and push-up muscle strength, indicating that high temperatures may affect physical performance.[12]Additionally, there is a somewhat significant association ($r = 0.45$, $p < 0.01$) between reported stress and air pollution levels, underscoring the psychological toll that environmental pollution has on pupils. Significantly, there is a somewhat significant correlation ($r = 0.50$, $p < 0.01$) between resilience (as measured by CD-RISC scores) and physical fitness scores, indicating that adolescents who are more resilient are more likely to remain physically fit in spite of environmental challenges. These results highlight the interconnected impacts of environmental stresses on mental and physical health and the significance of creating resilience-building adaptive sports training programs to assist kids in overcoming these

obstacles.

5.0. Conclusion:

This multifaceted research shows that, despite major environmental issues like pollution and climatic unpredictability, sports training is essential for improving upper secondary students' physical and mental health. Incorporating organised sports programs enhances psychological resilience and efficient stress management in addition to cardiovascular endurance, muscular strength, and flexibility. The significance of adaptive training techniques designed to lessen these negative impacts is shown by the links found between environmental stresses and decreased physical and mental health markers .Given these results, it is essential that educational institutions include thorough, environmentally sensitive sports training modules in their curriculum. These kinds of programs may foster holistic growth, giving pupils the mental and physical fortitude they need to succeed academically and socially in spite of environmental challenges. In order to ensure adolescents' long-term well-being in a variety of environmental circumstances, future research should keep investigating creative treatments that integrate mental health assistance with physical training.

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7.0. Reference:

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