

## The Role of Physical Activity in Preventing Postural Deformities: A Student-Centred Study

<sup>1</sup>Manish Kumar Singh, <sup>2</sup>Suraj Kumar Patel, <sup>3</sup>Dr. Balroop Yadav

<sup>1</sup>Research Scholar, <sup>2</sup>Lecturer, <sup>3</sup>Assistant Professor

<sup>1/3</sup>Dept. of Physical Education at M.G.K.V.P. University, Varanasi, <sup>2</sup>Dept. of Physical Education at Satya Narayan Inter Collage, Tindwari, Banda

<sup>1</sup>manishkumarsingh988@gmail.com, <sup>2</sup>surajkumarptl@gmail.com

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### Abstract

Little physical activity, sedentary lifestyles, and too much screen time are all contributing to postural deformities like forward head position, rounded shoulders, thoracic kyphosis, and scoliosis in school and college populations. Often arising throughout adolescence, these musculoskeletal problems usually persist into adulthood and result in persistent pain, practical limitations, and a reduced general quality of life. This student-centred study explored the link between physical activity and postural abnormalities as well as the effectiveness of a 12-week school-based physical activity intervention.

Using a mixed-method research approach, 420 observational group members and 60 intervention group members were utilised. To carry out the postural examination, plumb line analysis, craniovertebral angle (CVA) measurement, and visual postural screening were employed. The National Physical Activity Questionnaire (NPAQ-SF) was used to assess activity levels. Three times a week for twelve weeks, the intervention included exercises designed to increase strength, coordinated mobility, and posture.

The data revealed a negative correlation between the amount of physical activity and the prevalence of postural abnormalities. Students who participated in a lot of physical exercise showed significantly less musculoskeletal discomfort and much improved spinal alignment. The intervention group showed a significant posture improvement and a drop in discomfort as opposed to the control group. According to the study, frequent exercise is absolutely necessary for avoiding postural abnormalities in kids. Long-term musculoskeletal health and general well-being can be greatly improved by inexpensive programs for physical exercise in schools that are centred on the pupils.

**Keywords:** Physical Activity, Postural Deformities, Students, Forward Head Posture, Kyphosis, Musculoskeletal Health, School-Based Intervention

### Introduction

Because this stage marks a key time of physical development, neuromuscular growth, and postural adaptation, musculoskeletal health during adolescence and young adulthood is quite important. Posture is the bodily alignment in motion, sitting, and standing wherein maximum efficiency is attained with little stress on supporting systems. Poor posture stresses

muscles, ligaments, and joints excessively, hence causing postural abnormalities that might last throughout life.

Among students nowadays, postural abnormalities, including forward head attitude, rounded shoulders, excessive thoracic kyphosis, lumbar lordosis, and early-onset scoliosis, are rather prevalent. Prolonged sitting, heavy academic burden, online learning, and excessive mobile phone usage—hallmarks of the contemporary education system—have greatly raised sedentarism (Kumari et al, 2023). Research shows that kids might sit for more than eight to ten hours each day, usually with incorrect spinal alignment.

Poor core stability, joint stiffness, and impaired neuromuscular control result from low levels of moderate-to-vigorous physical activity (MVPA), which also weakens postural muscles. Physical inactivity is among the main causes of worldwide death and immediately affects musculoskeletal problems, according to the World Health Organisation (2010).

In addition to changing physical appearance, postural deformities have several functional repercussions, including neck pain, low back pain, diminished lung capacity, headaches, exhaustion, inadequate balance, and psychological distress. Lower grades, sleepless disruptions, and less attention in the classroom have all been linked to poor posture as well.

Although postural-related issues in educational settings are becoming more common, posture correction techniques are usually restricted to clinical rehabilitation environments and are rarely included in daily school activities. Preventive, student-centred, low-cost programmes that may be run inside the school setting are really needed.

This study was hence carried out with two main objectives: (I) to evaluate the link between physical activity and postural abnormalities among kids, and (ii) to investigate the efficacy of a 12-week student-centred physical activity and posture-education initiative delivered in institutions and colleges.

## **Review of Literature**

### **Concept of Posture and Postural Deformities**

Posture is the relative alignment of body components at any certain posture. Ideal posture reduces mechanical stress and maintains balance with little muscular effort. Postural distortions result from muscle imbalance, bad habits, injury, or congenital causes affecting the natural curvature of the spine.

Common deviations include:

- Forward Head Position
- Round shoulders
- Thoracic Kyphosis:
- Lumbar Lordosis
- Scoliosis

According to Murphy et al. (2007), bad postural practices cause back or neck discomfort in more than 60% of school kids. Almost 70% of school-aged populations exhibited posture flaws according to Górecki et al. (2009).

### **Physical Activity and Musculoskeletal Health**

Physical activity plays a vital role in maintaining muscle strength, flexibility, joint mobility, bone density, and postural control. Regular exercise helps balance muscular tension across the anterior and posterior muscle chains, which is essential for maintaining spinal alignment.

Straker and Mathiassen (2009) concluded that physical inactivity combined with static posture leads to musculoskeletal overload. Zapatero et al. (2004) reported that adolescents who participated in regular sports demonstrated significantly better postural alignment than sedentary peers.

#### Sedentary Behaviour, Screen Time, and Posture

The excessive use of smartphones, laptops, and tablets promotes sustained flexed neck and trunk postures. Smith and Lee (2016) found a strong relationship between screen exposure duration and the severity of forward head posture. Prolonged forward head posture increases the load on the cervical spine, contributing to degenerative changes.

#### School-Based Interventions for Posture

School-based programs provide a cost-effective way to prevent problems. Brown and Martin (2019) proved that classroom movement breaks lowered neck pain and improved posture awareness. Johnson et al. (2017) showed that posture-specific activities produced major cervical alignment.

#### Research Gap

Most current research is either clinical or short-term. Few studies combine practical school-based treatments targeted at posture prevention with large student samples. Moreover, restricted research highlights student acceptance and actual application.

### **Objectives of the Study**

1. To assess the level of physical activity in students.
2. To examine the relationship between physical activity and postural deformities.
3. To evaluate the effectiveness of a 12-week student-centred physical activity program on posture.
4. Students with low physical activity will show a significantly higher prevalence of postural deformities.
5. The 12-week student-centred physical activity program will significantly improve postural alignment.

### **Hypotheses**

1. Students with low physical activity will show a significantly higher prevalence of postural deformities.
2. The 12-week student-centred physical activity program will significantly improve postural alignment.
3. The intervention will significantly reduce musculoskeletal discomfort.

### **Research Methodology**

#### Research Design

A mixed-method approach was adopted using:

- Cross-sectional observational study

- Quasi-experimental intervention study

#### Sample and Participants

A total of 420 students (ages 14–24) were selected from four secondary schools and one university using random sampling. From this population, 60 students exhibiting postural deformities were selected for the intervention program and divided equally into:

- Experimental Group (n = 30)
- Control Group (n = 30)

#### Inclusion and Exclusion Criteria

##### Inclusion

- Full-time students
- Age 14–24 years
- No history of spinal surgery

##### Exclusion

- Structural scoliosis requiring medical treatment
- Neurological disorders
- Recent musculoskeletal injury

#### Tools and Instruments

1. International Physical Activity Questionnaire (IPAQ-SF)
2. Postural Observation Chart
3. Plumb Line Test
4. Craniovertebral Angle (CVA)
5. Visual Analogue Scale (VAS) for Pain

#### Intervention Program

The 12-week program consisted of:

- Warm-up exercises
- Postural strengthening exercises
- Stretching of tight muscles
- Awareness and ergonomic education

#### Sessions:

- Frequency: 3 days/week
- Duration: 20 minutes/session

#### Data Collection Procedure

Pre-test measurements were taken before the intervention. After 12 weeks, post-tests were conducted using the same tools. The control group followed routine academic activities.

#### Statistical Analysis

Data were analysed using:

- Mean and Standard Deviation
- Chi-square test
- Independent t-test
- ANCOVA

Significance level was set at  $p < 0.05$ .

## Results

### Prevalence of Postural Deformities

Among 420 students, 59% exhibited at least one postural deformity.

- Forward head posture: 38%
- Rounded shoulders: 34%
- Kyphosis: 21%

### Physical Activity Levels

- Low activity: 32%
- Moderate activity: 44%
- High activity: 24%

### Relationship Between Physical Activity and Posture

Students with low physical activity showed significantly higher rates of postural deformities ( $p < 0.01$ ). Active students displayed better CVA scores and spinal alignment.

### Intervention Outcomes

The intervention group demonstrated:

- Significant improvement in CVA ( $p < 0.01$ )
- Reduced pain scores on VAS
- Improved shoulder and spinal alignment

No significant changes were observed in the control group.

## Discussion

This research validates that engaging in physical activity significantly helps prevent postural deformities. The results are consistent with earlier studies that have highlighted the advantages of regular exercise on musculoskeletal alignment. The student-focused program saw high participation rates due to its brief timeframe, ease of implementation, and compatibility with academic schedules (Dubey et al., 2023). Enhanced posture led to less discomfort, increased sitting tolerance, and better overall daily functioning.

### Educational and Health Implications

- Integration of daily posture exercises in schools
- Teacher training in ergonomic education
- Active classroom learning environments
- Routine postural screening programs

### Limitations

- Short intervention duration
- Limited geographic coverage
- Self-reported physical activity data

## Conclusion

Regular physical activity is a powerful preventive measure against postural deformities among students. The 12-week student-centred intervention significantly improved posture and reduced musculoskeletal pain. Educational institutions should prioritise structured movement programs as part of health promotion strategies.

### Recommendations

1. Posture correction exercises should be included in school timetables.
2. Students should be encouraged to take movement breaks every 30–40 minutes.
3. Posture screening should be conducted annually.
4. Mobile phone use posture education should be emphasised.
5. Schools should promote sports participation.

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