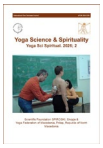
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The Influence of Yoga on the Normal Psychophysical Growth of School-Age Children

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Abstract

BACKGROUND: Poor body posture reduced spinal mobility, and spinal deformities such as scoliosis are common among school-age children and may negatively affect physical development, breathing efficiency, and overall well-being. Yoga, through its integrated system of physical exercises, breathing techniques, relaxation, and body postures, has been proposed as a non-invasive method for improving musculoskeletal health and preventing postural abnormalities.

AIM: To evaluate the influence of a specialized yoga program on body posture, spinal mobility, spinal elasticity, and scoliosis in school-age children.

METHODS: A three-month specialized yoga course was conducted within the project "Application of Yoga in Improving the Psychophysical Development of Children in Primary Education." Thirty-two children aged 7–14 years participated in the initial assessment, while 22 completed the follow-up evaluation. The program included relaxation techniques, Vyayama exercises, Asanas, and Pranayama. Anthropometric measurements, postural assessments, and telemetric spinal evaluations using the Spinal Mouse device were performed before and after the intervention. Parameters assessed included spinal and pelvic mobility, body posture, spinal elasticity, and scoliosis severity.

RESULTS: Initial measurements revealed reduced spinal and pelvic mobility in a substantial proportion of participants, with 68.7% demonstrating incorrect posture and 84.4% showing signs of scoliosis. Following the yoga intervention, significant improvements were observed in spinal mobility and elasticity. The proportion of children with correct body posture increased from 31.3% to 68.2%, while good spinal flexion improved from 43.7% to 59.1% and good spinal extension from 50.0% to 54.5%. Improvements were also observed in thoracic, lumbar, pelvic, and whole-spine mobility. Children with mild scoliosis demonstrated notable improvement, whereas moderate and severe scoliosis showed limited response to the general yoga program.

CONCLUSION: The specialized yoga program significantly improved spinal mobility, elasticity, and body posture in school-age children. Regular practice of yoga techniques contributed to better musculoskeletal function, enhanced flexibility, improved breathing patterns, and positive effects on psychophysical development. Yoga appears to be an effective preventive and supportive therapeutic approach for postural disorders and mild scoliosis in children, although more targeted interventions may be required for moderate and severe spinal deformities.

Introduction

Proper growth and development during childhood depend largely on adequate physical activity, correct body posture, and the harmonious development of the musculoskeletal system. Modern lifestyles characterized by prolonged sitting, reduced physical activity, and improper ergonomic habits have contributed to an increasing prevalence of postural abnormalities, reduced spinal mobility, and spinal deformities among school-age children [1]. Impaired spinal flexibility and poor posture may lead to functional disturbances of the musculoskeletal and respiratory systems, increased fatigue, discomfort, and a reduced quality of life during growth and development [2].

The vertebral column plays a central role in maintaining body posture, balance, and movement. Adequate mobility of the thoracic, lumbar, and lumbosacral segments is essential for normal biomechanical function and for the prevention of postural disorders such as scoliosis, kyphosis, and lordosis. Early identification of reduced spinal mobility and the implementation of corrective physical activities

are therefore important components of preventive health care in childhood [3].

Yoga is a comprehensive system of psychophysical exercises that combines body positions (asanas), breathing techniques (pranayama), relaxation methods, and conscious movement practices. These techniques have been shown to improve flexibility, muscular balance, body awareness, respiratory function, and overall physical and mental well-being [1–3]. Regular practice of yoga exercises contributes to the balanced development of the musculoskeletal system, enhances spinal mobility, and promotes correct body posture through the strengthening and stretching of postural muscles [1], [2].

Specialized yoga programs designed for children emphasize age-appropriate movements and exercises that stimulate proper growth, increase joint mobility, and improve neuromuscular coordination. Through systematic practice, yoga may serve both as a preventive measure against postural deformities and as a supportive therapeutic approach for children who already exhibit postural irregularities [2], [3].

Therefore, the aim of this study was to evaluate the influence of a specialized yoga program on body posture and spinal mobility in school-age children using telemetric measurements obtained with the Spinal Mouse system. The study sought to determine whether regular practice of yoga techniques could contribute to improved spinal flexibility, enhanced postural alignment, and the prevention or reduction of spinal deformities.

Material and Methods

Within the framework of the project **“Application of Yoga in Improving the Psychophysical Development of Children in Primary Education,”** implemented by Yoga Society Shtip and supported by the Foundation for Local Community Development – Shtip, a specialized yoga course for children was organized over a period of three months.

The yoga course program was adapted to the age of the children and consisted of the following content:

RELAXATION TECHNIQUES – enable the release and relaxation of the body within a relatively short period of time, better mental organization and relaxation, as well as reduction of physical fatigue;

VYAYAMA – psychophysical exercises for conscious movement and stretching of all parts of the body, especially the spinal column, thereby improving elasticity, physical endurance, and stimulation for proper growth and development of the musculoskeletal system;

ASANAS – body positions that enable increased body elasticity as well as improved function of the internal organs;

PRANAYAMA – breathing techniques that increase respiratory capacity, improve the elasticity of lung tissue, as well as the musculature involved in respiration.

In order to verify the positive effects of practicing various yoga techniques, the following measurements were performed: Anthropometric measurements: body height and weight; Professional measurements for detecting deformities and irregularities in body posture; and Specialized measurements of the spinal column using a specialized device called “Spinal Mouse,” which telemetrically presents the measurement results in electronic form.

The Spinal Mouse device provides the following parameters through telemetric measurements: Information about body posture; Information about spinal mobility in all directions: anteflexion, retroflexion, and lateroflexion; Information about the individual mobility of the thoracic, lumbar, and lumbosacral parts of the spinal column; and Information about pelvic mobility in relation to the spinal column.

Results

The study included 32 children aged 7 to 14 years, of whom: 7 children were aged 6 to 8 years; 17 children were aged 9 to 11 years; and 8 children were aged 12 to 14 years (Figure 1).

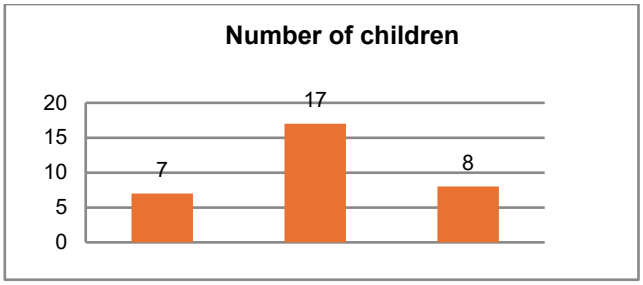


Figure 1: Number of children at the first measurements

First part of the measurements

The first part of the measurements refers to the results regarding the mobility of the spinal column as a whole, as well as the individual segments of the spinal column.

The initial measurements included: Measurement of the mobility of the thoracic part of the spinal column from an upright position to flexion; Measurement of the mobility of the lumbar part of the spinal column from an upright position to flexion; Measurement of the mobility of the lumbar part of the spinal column from an upright position to extension; Measurement of the mobility of the spinal column from

an upright position into lateroflexion; Measurement of pelvic mobility from an upright position to flexion; Measurement of pelvic mobility from an upright position to extension; Measurement of the mobility of the spinal column as a whole from an upright position to flexion; Measurement of the mobility of the spinal column as a whole from an upright position to extension (Table 1).

1. Results of the measurements of thoracic spinal mobility to flexion: 16 children, or 50%, showed good mobility of the thoracic region to flexion; 14 children, or 43.7%, showed increased mobility of the thoracic region to flexion; and 2 children, or 6.3%, showed reduced mobility of the thoracic region to flexion.

2. Results of the measurements of lumbar spinal mobility to flexion: 15 children, or 46.9%, showed good mobility of the lumbar region to flexion; 8 children, or 25%, showed increased mobility of the lumbar region to flexion; and 9 children, or 28.1%, showed reduced mobility of the lumbar region to flexion.

3. Results of the measurements of lumbar spinal mobility to extension: 11 children, or 34.4%, showed good mobility of the lumbar region to extension; 2 children, or 6.3%, showed increased mobility of the lumbar region to extension; and 19 children, or 59.3%, showed reduced mobility of the lumbar region to extension.

4. Results of the measurements of pelvic mobility to flexion: 9 children, or 28.1%, showed good pelvic mobility to flexion; 3 children, or 9.4%, showed increased pelvic mobility to flexion; and 20 children, or 62.5%, showed reduced pelvic mobility to flexion.

Table 1: Measurements of elasticity of the spine and pelvis

Measured parameter	Normal / good mobility	Increased mobility	Reduced mobility
Flexion of the thoracic spine	50%	43.7%	6.3%
Flexion of the lumbar spine	46.9%	25%	28.1%
Extension of the lumbar spine	34.4%	6.3%	59.3%
Pelvic flexion	28.1%	9.4%	62.5%
Pelvic extension	18.8%	78.1%	3.1%
Flexion of the whole spine	37.5%	6.2%	56.3%
Extension of the whole spine	56.3%	43.7%	0%

5. Results of the measurements of pelvic mobility to extension: 9 children, or 28.1%, showed good pelvic mobility to extension; 3 children, or 9.4%, showed increased pelvic mobility to extension; and 20 children, or 62.5%, showed reduced pelvic mobility to extension.

6. Results of the measurements of the mobility of the spinal column as a whole to flexion: 12 children, or 37.5%, showed good mobility of the spinal column as a whole to flexion; 2 children, or 6.2%, showed increased mobility of the spinal column as a whole to flexion; and 18 children, or 56.3%, showed reduced mobility of the spinal column as a whole to flexion.

7. Results of the measurements of the mobility of the spinal column as a whole to extension: 18 children, or 56.3%, showed normal mobility of the spinal column as a whole to extension; and 14 children, or 43.7%, showed increased mobility of the spinal column as a whole to extension.

Second Part of the Measurements

The second part of the measurements refers to the range of spinal movements expressed in degrees.

The following parameters were measured: Measurement of correct body posture in comparison with the vertical line as a norm; Measurement of spinal mobility in flexion; Measurement of spinal mobility in extension; and Measurement of lateral spinal mobility to the left and right, where the difference between them indicates the presence of scoliosis to the left or to the right.

1. Results of the measurements of correct body posture: The deviation of the spinal column from the vertical line was measured and expressed in degrees (10 children, or 31.3%, showed correct body posture in relation to the vertical line; and 22 children, or 68.7%, showed deviation from the vertical line, indicating incorrect body posture).

2. Results of the measurements of spinal mobility to flexion, expressed in degrees: 14 children, or 43.7%, showed forward flexion greater than 90 degrees, indicating good spinal elasticity in flexion; and 18 children, or 56.3%, showed forward flexion below 90 degrees, indicating reduced elasticity in flexion (Table 2).

Table 2: Measurements of flexion and extension of the spine

Measured parameter	Good elasticity / correct posture	Reduced elasticity / incorrect posture
Correct body posture	31.3%	68.7%
Forward spinal flexion	43.7%	56.3%
Backward spinal extension	50%	50%

3. Results of the measurements of spinal mobility to extension expressed in degrees: 16 children, or 50%, showed backward extension greater than 30 degrees, indicating good spinal elasticity in extension; and 18 children, or 56.3%, showed backward extension below 30 degrees, indicating reduced elasticity in extension.

4. Results of spinal measurements in lateroflexion, to the left and right, and the presence of scoliosis: 27 children, or 84.4%, showed a difference in lateroflexion to the left and right, indicating the presence of scoliosis; 5 children, or 15.6%, showed equal lateroflexion to both sides.

Table 3: Presence of scoliosis at the school children

Finding	Percentage
No spinal curvature / scoliosis	15.6%
Spinal curvature / scoliosis present	84.4%

Of those with scoliosis, 17 children, or 62.9%, had left-sided scoliosis, while 10 children, or 37.1%, had right-sided scoliosis; Among the children with

scoliosis, 13 children, or 48.1%, had a mild form of scoliosis with a curvature of 1–5 degrees; 10 children, or 37.1%, had a moderate form of scoliosis with a curvature of 6–10 degrees; and 4 children, or 14.8%, had a severe form of scoliosis (Table 3 and Table 4).

Table 4: Degree of the scoliotic curvature

Degree of curvature	Severity of curvature	Percentage
1–5 degrees	Mild form	48.1%
6–10 degrees	Moderate form	37.1%
Over 11 degrees	Severe form	14.8%

Results of the Second Telemetric Measurements of the Children Attending the Specialized Yoga Course

A total of 22 children completed the second measurements. For better clarity, the results of the second measurements are presented in tabular form in order to make a comparison with the first measurements of the participants (Table 5).

The measurement results showed that, in individuals with normal elasticity, there was a significant improvement in mobility in all possible directions.

Table 5: Results of the telemetric measurements with the "spinal mouse"

Measured parameter	Normal		Increased		Reduced	
	First measurement	Second measurement	First measurement	Second measurement	First measurement	Second measurement
Flexion of the thoracic spine	50%	59.1%	43.7%	36.4%	6.3%	4.5%
Flexion of the lumbar spine	46.9%	45.5%	25%	31.8%	28.1%	22.7%
Extension of the lumbar spine	34.4%	45.5%	6.3%	13.6%	59.3%	40.9%
Pelvic flexion	28.1%	36.4%	9.4%	18.1%	62.5%	45.5%
Pelvic extension	18.8%	45.5%	78.1%	54.5%	3.1%	0%
Flexion of the whole spine	37.5%	45.5%	6.2%	18.1%	56.3%	36.4%
Extension of the whole spine	56.3%	50%	43.7%	45.5%	0%	4.5%

In participants with reduced and increased elasticity, the practice of yoga techniques contributed to a redistribution of the elasticity of the spinal column, thereby improving overall mobility in all directions (Table 6).

Table 6: Measurements of spinal elasticity

Measured parameter	With good spinal elasticity		With reduced spinal elasticity	
	First measurement	Second measurement	First measurement	Second measurement
Correct body posture	31.3%	68.2%	68.7%	31.8%
Spinal flexion	43.7%	59.1%	56.3%	40.9%
Spinal extension	50%	54.5%	50%	45.5%

The results of the measurements of body posture, as well as spinal mobility in flexion and extension, showed that there was a significant improvement in the mobility of the spinal column, resulting in better posture and greater flexibility of the spinal column as a whole (Table 7).

Table 7: Comparison of scoliotic curvature before and after yogic exercises

Degree of scoliosis	Severity of scoliosis	First measurement	Second measurement
1–5 degrees	Mild form	48.1%	57.1%
6–10 degrees	Moderate form	37.1%	28.6%
Over 11 degrees	Severe form	14.8%	14.3%

The measurements showed that individuals with a mild form of scoliosis demonstrated considerable improvement in their condition, whereas individuals with moderate and severe forms of scoliosis did not show improvement. In persons with more serious scoliosis, the application of specialized spinal movements is necessary in order to achieve correction of the scoliotic curvature.

Discussion

Based on the telemetric measurements performed on school-age children using the specialized Spinal Mouse device, it was concluded that a large number of participants showed partial or greater stiffness in the movements of the spinal column and pelvis. This, among other things, contributes to reduced elasticity, a tendency toward spinal deformities, breathing difficulties, rapid fatigue, and poor body posture [1], [2], [5].

Some measurements showed increased mobility of certain parts of the spinal column, which is a sign of uneven distribution of elasticity across all segments. This is a result of poor body posture, shallow breathing, and reduced physical activity [2], [4], [5].

The specialized yoga program intended for school-age children contributed to:

• Improvement of spinal column elasticity [1], [2], [3], [4], [5];

• Improvement of pelvic elasticity through increased mobility of the sacroiliac and coxofemoral joints [1], [2], [3];

• Even distribution of elasticity along the spinal column, which contributes to greater mobility of the spinal column as a whole [1], [3], [5];

• Improvement in individuals with a mild degree of scoliosis through increased mobility and elasticity of the spinal column and pelvis [3], [4];

• In individuals with more severe forms of scoliosis, the application of selective exercises and appropriate breathing techniques is necessary in order to achieve greater correction of scoliosis [3], [4], [5].

Conclusion

The results obtained from the telemetric measurements using the Spinal Mouse showed that the specialized yoga program contributed to increased mobility of the spinal column — thoracic, lumbar, and lumbosacral regions — in all directions.

The examined individuals are at an age when stimulation is necessary for proper growth and development of the body. This is largely enabled through the application of yoga techniques, which contribute to the movement of the entire body and to increasing the range of motion of all joints. Breathing techniques help improve the quality of breathing, which is essential for proper growth. Relaxation techniques and specific body positions — asanas — also contribute to the psychomental maturation of school-age children.

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