

# Effects of hatha yoga exercises on spine flexibility in young adults

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## Summary

*Study aim:* To assess the effects of yoga exercises on the flexibility of the spine in male and female students aged 19–22 years old.

*Material and methods:* The study comprised 59 male and female first-year students, aged 19–22 years old (mean  $19.6 \pm 0.9$ ), studying Sport and Tourism Management at the Jerzy Kukuczka Academy of Physical Education in Katowice. The participants took part in an obligatory yoga class, of 90 minutes duration, once a week over a 13-week period. The ranges of motion of the spine in the sagittal, frontal and transverse planes were measured using the Rippstein Plurimeter-V.

*Results:* The study indicated a statistically significant increase of the spine flexibility in forward and lateral bending before and after the yoga classes in the entire studied group. In the men, a significant increase of the range of motion in backward bending was also noted. In the women, and in all of the participants (women and men together), a significant increase of the range of motion in the torsion was noted.

*Conclusions:* Regular yoga exercises could increase the flexibility of the spine and the hamstring muscles. Hatha yoga training may be a good intervention for improving flexibility, but for better results it should be performed more often than once a week.

**Key words:** Yoga training – Range of motion – Spinal flexibility – Students – Fitness

## Introduction

Flexibility is the one of components of health-related physical fitness. Flexibility can be defined as a property of the musculoskeletal system, which determines the range of motion that is achievable without injury to the joints. Flexibility implies “freedom to move”, and is the ability to engage a part, or parts of the body, in a wide range of purposeful movements at the required speed [1].

Flexibility exercises should be performed by all age groups: children, adolescents, adults and the elderly. World Health Organisation (WHO) recommends taking part in muscle-strengthening activities that involve the major muscle groups on 2 or more days a week [20]. The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) also recommend performing activities to increase flexibility. Flexibility exercises should be performed using the major muscles and holding a position for at least 60 seconds, on a minimum of 2–3 days each week [2].

Flexibility exercises may contribute to the retention of musculoskeletal integrity and reduce orthopaedic complications in later life [9]. The primary results of these exercises are a transient increase in the musculotendon unit length, resulting from actin-myosin complex relaxation; and a lasting increase through alterations in the surrounding extracellular matrix [15]. Maintaining optimal flexibility could be important for ensuring a good posture and eliminating the causes of several disabilities, e.g. lower back pain [1].

Hatha yoga (physical yoga) is one of the forms of fitness activities that are defined as exercising both the body and mind. Hatha yoga is comprised of many poses and their variations, which are called “asanas”. Regular yoga training can result in many health benefits [5]. Yoga exercises have been shown to be effective in the prevention of chronic diseases of civilisation, such as cardiovascular diseases [8, 13], depression [16], diabetes [17], and lower back pain [11, 19]. Regular hatha yoga training may also be effective in decreasing stress [10], improving posture [4], and improving the health-related aspects of physical fitness [18] including flexibility.

The aim of this study was to assess the effects of yoga exercises on the flexibility of the spine in male and female students aged 19–22 years old.

## Material and methods

### Participants

The study involved 59 male and female first-year students, aged 19–22 years old (mean  $19.6 \pm 0.9$ ), studying Sport and Tourism Management at the Jerzy Kukuczka Academy of Physical Education in Katowice. The mean body height and body mass for the women were  $166.4 \pm 6.3$  and  $61.6 \pm 9.1$ , respectively; and for the men were  $181.4 \pm 6.1$  and  $78.6 \pm 12.6$ , respectively.

The inclusion criteria for this study were as follows: regular participation in the yoga classes during the 13-week period (only one absence was permitted), a lack of injuries, attendance at both measurements, non-involvement in sports or other forms of physical activity on a regular basis, and consent to participate in the study.

The study was approved by the Bioethics Committee of the Jerzy Kukuczka Academy of Physical Education in Katowice (Poland), and conformed to the standards set by the Declaration of Helsinki. All of the participants were presented with a comprehensive description of the aim and methods of the study.

### Methods and procedures

The participants took part in an obligatory hatha yoga class of 90 minutes duration, once a week for a period of 13 weeks. The hatha yoga sessions began with the Mountain Posture (*Tadāsana*), and continued with subsequent positions that focused primarily on improving flexibility, muscle strength and endurance, balance, and the elongation of the spine.

The following yoga postures were performed: Chair Posture (*Utkatāsana*), Standing Forward Bend (*Uttāsana*), Pyramid Pose (*Parsvottanāsana*), Downward Facing Dog Pose (*Adho-mukha Śvanāsana*), Upward Facing Dog Pose (*Urdhva-mukha Śvanāsana*), plank (*Phalakāsana*), low plank (*Caturanga Dandāsana*), side plank (*Vasisthāsana*), Warrior Poses I, II and III (*Virabhadrāsana I, II, III*), Tree Posture (*Vrksāsana*), Extended Triangle Pose (*Utthita trikonāsana*), Extended Side Angle Pose (*Utthita Parśva Konāsana*), Revolved Triangle Pose (*Parivrtta-trikonāsana*), Revolved Side Angle Pose (*Parivrtta Parsvakonāsana*), Locust Pose (*Salabhāsana*), Bow Posture (*Dhanurāsana*), Upper Bow Pose (*Urdhva Dhanurāsana*), Cobra (*Bhujangasāna*), Camel Pose (*Ustrāsana*), Cow Face Pose (*Gomukhāsana*), Intense Dorsal Stretch Posture (*Paschimottanāsana*), Revolved Forward Bend Pose (*Parivrtta Paschimottanāsana*), Bound Angle Pose (*Baddha Konāsana*), Wide Seated Forward Bend Pose

(*Upavistha Konāsana*), Sage's Pose (*Marichyāsana*), Sitting Half Spinal Twist (*Ardha-matsyendrāsana*), Upward Extended Feet Pose (*Urdhva Prasarita Padāsana*), Sleeping Vishnu Pose (*Anantāsana*), Supported Shoulder Stand (*Sarvangāsana*) and Plow Pose (*Halāsana*).

The classes always ended with the Corpse Pose (*Savāsana*). The practitioners could utilise blocks and straps for assistance. Meditation and breathing (pranayama) practices were not included in the classes.

The measurements were carried out before the first (hatha) yoga class (pre-test); and after the last yoga class (post-test). They were performed after a 10-minute warm-up. In order to avoid errors, each measurement was repeated twice, and the best result was recorded.

The ranges of motion of the spine (thoracic and lumbar segments combined) in the sagittal, frontal and transverse planes were measured using a Plurimeter-V gravity inclinometer (Dr Rippstein, Zurich, Switzerland). The non-invasive inclinometer technique is recognised as a reliable and valid measurement method.

The forward and backward ranges of bending were measured in a standing position with the subject's feet placed hip-width apart. The plurimeter was applied to the upper back and was reset, and the measurement was then repeated after the maximum forward bend or the maximum backward bend. The lateral bends were also measured in a standing position with the subject's feet placed hip-width apart. The plurimeter was applied between the lateral part of the neck and shoulder, and on the side of the body to which the bend was applied. The plurimeter was reset, and after the maximum left and right bends took place, the results were recorded. The torsional range of motion was measured with the participant's trunk bent forward at 90 degrees and the feet stretched apart. The participant held a gym bar at the height of the shoulder blades, and the plurimeter was reset according to the horizontal level and placed on the back at the Th<sub>2-4</sub> level. After rotating the torso to the left and the right, the results were recorded [6].

### Statistical analysis

The results are expressed as the mean and the standard deviation ( $\bar{x} \pm SD$ ). The normality of distribution was verified with the Shapiro test. The results of the pre-test and post-test measurements were compared with the paired samples t-test or the Wilcoxon signed-rank test. The level of significance was set at  $p \leq 0.05$ . The statistical analysis was performed using STATISTICA v. 10 software (Statsoft Inc., USA).

## Results

The results indicated a statistically significant increase of the spine flexibility in forward and lateral bending before

**Table 1.** Flexibility parameters measured before (pre-test) and after (post-test) the yoga classes

Groups	Women (n = 37)		Men (n = 22)		Combined group (n = 59)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Forward bend	129.3 ± 21.1	137.7 ± 18.1*	129.9 ± 15.5	136.1 ± 15.4*	129.5 ± 19	137.1 ± 17*
Backward bend	65.6 ± 9.8	64.9 ± 10.4	66 ± 15.7	73.2 ± 16*	65.9 ± 12.3	67.6 ± 13.6
Left bend	49.2 ± 11.2	57 ± 10.1*	56.8 ± 12.5	63.5 ± 9.4*	52.1 ± 12.1	59.4 ± 10.3*
Right bend	52.3 ± 11.7	57.3 ± 10.9*	57.5 ± 11.8	65.7 ± 9.7*	54.2 ± 11.9	60.5 ± 11.2*
Left torsion	58.6 ± 11	64.4 ± 14.5*	62.9 ± 10.7	65.6 ± 9.4	60.2 ± 11	64.8 ± 12.8*
Right torsion	59 ± 11.2	64.9 ± 13.7*	65.6 ± 13.3	66.7 ± 12.4	61.5 ± 12.3	65.6 ± 13.1*

The values are expressed as the mean ± standard deviation (SD) \* Significantly different from the pre-test condition at  $p < 0.05$

and after the yoga classes, in the entire studied group. In the men, a significant increase of the range of motion in backward bending was also noted. In the women, and in all of the participants (women and men together), a significant increase of the range of motion in the torsion was noted (Table 1).

## Discussion

The aim of this study was to assess the effects of yoga exercises on the spine flexibility in young adults – male and female students who were participants in a yoga class. The findings showed an increase in the range of motion in most, but not in all of the tested movements, as a result of regular yoga exercises.

The increase in the range of motion in the forward bends, recorded in both women and men, could be related to better hamstring flexibility. Most of the hatha yoga poses involving forward bends should be performed an elongated spine and straight knees, which leads to the improvement of hamstring flexibility. Flexibility of the hamstrings is important for health and for physical fitness. Furthermore, a reduction of their flexibility could lead to an increased risk of damage to the musculoskeletal system [14].

A significant improvement in the backward bending was noted only in the men. Generally, the participants did not like performing backward bends in the hatha yoga classes, because they experienced lower back pain or discomfort in the lumbar region. However, if the backward bends are performed with a decrease in the pelvic anteversion, then there will be a lack of pain or tension in the lumbar region muscles. A significant increase in the lateral bending was observed in all of the participants. This could be considered surprising, because there is a lack of lateral bends in hatha yoga training. On the other hand, there are numerous poses which improve the flexibility of the hip adductors, as well as poses which elongate the spine.

For example, the Extended Triangle Pose or Extended Side Angle Pose are poses (asanas) that improve the range of motion in the hip joints and elongate the spine in the vertical axis. A significant increase of the torsional range of motion was noted only in the women and in the group that included all of the participants. Hatha yoga comprises numerous poses with trunk twists, e.g. Revolved Triangle Pose, Revolved Forward Bend Pose, Sage's Pose and Sitting Half Spinal Twist.

The lack of a significant increase in the torsional range of motion in the men, and of the range of the backward bends in the women, does not necessarily imply that a hatha yoga intervention is not beneficial for the spinal mobility in all planes.

Previous studies investigating the effects of the spinal flexibility in all planes after a hatha yoga intervention are limited. The study conducted by Grabara and Szopa, using the same method of measurement as the current study, indicated that practicing yoga asana even once a week led to an increase in the range of motion of the spinal joints and better flexibility of the hamstring muscles in women 50–79 yrs. who attended yoga classes for 20 weeks [6]. Also, the study performed by Tran et al. involving women and men aged 18–27 yrs. confirmed an improvement in the range of forward and backward bending, and also revealed an improvement in the participants' flexibility of the ankle and shoulder joints [18]. Grabara et al. reported in their study that women exercising with yoga postures had more significant improvements in the flexibility of the hamstrings, hip flexors and the range of bending backward than a control group that performed the other activities [7]. The other studies also confirm an improvement in the flexibility of individuals who regularly exercise with yoga postures [3, 12]. The present findings are in line with the previous studies, and indicate that the flexibility of the spine and the hamstring muscles could increase as a result of regular yoga exercises.

However, the present study has some limitations. For example, although there was an assessment and a comparison

of the flexibility before and after the yoga classes, the study lacked a control group; therefore, there was no comparison of the observed changes with a control group.

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Received 15.06.2016

Accepted 08.08.2016

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