

Effects of hatha yoga exercises on spine flexibility in women over 50 years old

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Abstract. [Purpose] The aim of this study was to assess the flexibility of the spine in women practicing yoga as a part of the “University for Health” project. [Subjects and Methods] The study included 56 women ranging in age between 50–79 and attending 90 minutes hatha yoga sessions once a week. The measurements were performed twice—at the beginning of the project and after its completion, i.e., after 20 weeks of classes. The range of spine mobility in three planes was measured using a Rippstein plurimeter. The range of motion in the sagittal and frontal planes was measured in a standing position with the feet hip-width apart. The torsional range of motion of the subjects was measured with the trunk bent at a right angle and the legs apart. The flexibility ranges of the spine and hamstrings were also measured by the toe-touch test in a standing position. [Results] This study showed that the applied yoga exercises increased spinal mobility and flexibility of the hamstring muscles regardless of age. [Conclusion] Yoga exercises should be recommended to the elderly to make their muscles more flexible and to increase the range of motion in the joints, which is particularly important for improving their life quality.

Key words: Hatha yoga, Flexibility, Joints mobility

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INTRODUCTION

Physical activity (PA) contributes to many health benefits and therefore significantly delays typical physiological changes associated with aging^{1, 2)}. PA improves functioning of individual body systems, prevents obesity, diabetes, osteoporosis and high blood pressure; improves elasticity of blood vessels; enhances brain functions; and helps in maintaining the feeling of general well-being; thus improving quality of life^{3–7)}. PA deficiency may contribute to the occurrence of chronic diseases, hypokinetic diseases and even early death, which is defined as sedentary death syndrome¹⁾. Moderate exercises performed by the elderly on a regular bases are correlated with lower mortality and have beneficial effects on the lipid profile⁴⁾.

PA is particularly important for older people because it improves their physical fitness. This should also have a positive effect on their life quality, enabling them to live more independently. However, not all forms of recreational activity are suitable for the elderly due to frequent contraindications with respect to performance of certain exercises. A low level of physical fitness in seniors is often caused by the resentment they have concerning performance of any form of significant

physical activity because of the fear of falls, body overloads, excessive blood pressure peaks, etc^{8, 9)}. Exercises for older people should be aimed at maintaining good physical fitness and therefore contribute to reducing the risk of disability¹⁰⁾. PA for the elderly should be based on exercises that develop endurance, develop the strength of large muscle groups, and increase joint mobility³⁾. Therefore, yoga exercises (hatha yoga) can be recommended as a suitable form of recreation for the elderly^{11–13)}. It is the most widespread form of yoga practice in Europe and America, and it is recommended as a form of alternative medicine therapy¹⁴⁾.

Yoga exercises require setting the body into a certain correct position (asana) and then staying in that position for a period from several seconds to several minutes. When performing these exercises, one may use a variety of assistive tools like mats, belts, and blankets, which may be very helpful to the exercising person, especially in the cases of those with a level of general fitness. Many positive effects of yoga exercises are widely documented in the literature^{14–27)}. Previous studies have reported that performing regular yoga exercises enhanced the functioning of various organs and systems of the body^{15, 16)}, improved physical fitness¹⁷⁾, and in particular, increased flexibility, static strength, equilibrium of body motion¹⁷⁾, and body posture^{21–25)} and contributed to a reduction chronic low back pain or prevented its recurrence^{26, 27)}. It is worth mentioning that one of the causes of back pain is shortening of the hamstring muscles, which also affects the correct position of the pelvis and the shape of lumbar lordosis²⁸⁾.

There are not many published papers about the effects of yoga exercises on body flexibility of the elderly²⁹⁾, and the

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existing ones relate mostly to flexibility assessment by using the senior fitness test for upper body flexibility and lower body flexibility^{30–32}, by using goniometry (the range of motion in the shoulders and hip joints)^{20, 31}, or by using other methods^{33, 34}. According to the authors' knowledge, there have been no studies done assessing flexibility of the spine in three planes in older women who practice yoga exercises.

For people over 50 years of age, having appropriate flexibility (mobility) is very important in prevention of back problems, especially in the lumbar region. Flexibility is defined as the morphofunctional capacity to be able to traverse one or more joints within their optimum ranges. A measure of flexibility is the range of motion in the joints, which is most commonly expressed in degrees.

The aim of the study was to evaluate the effect of yoga exercises on flexibility of the spine in women over the age of 50. We hypothesized that regular yoga exercises performed at least once a week could help improve the flexibility of the spine in all planes.

SUBJECTS AND METHODS

Subjects

The study involved 56 women within the age range of 50–79 (mean = 62.9±6.26) who were participating in yoga sessions implemented under the European Union “University for Health” program. The project included the implementation of an active health education programme as well as physical recreation for the elderly. The means applied were prophylactic, compensation and relaxation, physical activities, lectures and talks about health education, marches, outdoor tourism, and physical education classes. Most of the participants were students of the “University of the Third Age” at Jan Dlugosz University in Częstochowa or students of the “University of the Third Age” at Silesia University in Katowice, Poland. However, the project was open to everyone over the age of 50 and living in the cities of Częstochowa and Katowice. The project was financed by the European Union as a part of the Temporary Resources 2008 “Raising social awareness and strengthening advocacy as well as monitoring activities of non-governmental organisations” programme.

All the participants were examined by a cardiologist contracted for the project. Among the examined persons, there were no cases of hypermobility and postural defects with structural changes. More than 80% of the participants reported back pain, but this seemed to be typical for the people above 50 years old.

Due to the large age range, the women tested were divided into three groups: 50–59, 60–65, and above 65.

The women selected for the study had not participated regularly in any recreational activities like fitness, Nordic walking, gymnastic, and others in the last six months and had never come into contact with yoga exercises. Some participants were excluded from the study due to: prolonged (more than twice) absence from the classes, health deterioration preventing full participation, or regular participation in other forms of recreational activities other than yoga classes during the study.

The project was approved by the Bioethics Committee

of the Jerzy Kukuczka Academy of Physical Education in Katowice, Poland. All the selected persons were informed about the procedures and voluntarily signed a consent document prior to the beginning of the sessions.

Methods

The subjects participated in 90-minute (hatha) yoga sessions once a week for 20 weeks. A group of participants never exceeded 18 persons. The sessions began with the Mountain Posture (Tadasana), and the subsequent positions focused primarily on elongating the spine and improving flexibility, balance, muscle strength, and endurance. The following yoga postures were used: Chair Posture (Utkatasana), Standing Half Forward Bend (Ardha Uttasana), Warrior Poses I and II (Virabhadrasana I, II), Tree Posture (Vrksasana), Triangle Pose (Utthita trikonasana), Extended Side Angle Pose (Utthita parśva konasana), Pyramid Pose (Parsvottanasana), Cat Pose (Darnikasana), Downward Facing Dog Pose (Adho-mukha Śvanasana), Upward Facing Dog Pose (Urdhva-mukha Śvanasana), Twisted Triangle Pose (Parivrtta-trikonasana), Revolved Side Angle Pose (Parivrtta Parsvakonasana), Locust Pose (Salabhasana), Sphinx (Salamba bhujangasana), Bow Posture (Dhanurasana), Half Upper Bow Pose (Ardha urdhva Dhanurasana), Staff Pose (Dandasana), Cow Face Pose (Gomukhasana), Intense Dorsal Stretch Posture (Paschimottanasana), Revolved Forward Bend Pose (Parivrtta Paschimottanasana), Bound Angle Pose (Baddha Konasana), Wide Seated Forward Bend Pose (Upavistha Konasana), Sage's Pose (Marichyasana), Upward Extended Feet Pose (Urdhva Prasrita Padasana), Sleeping Vishnu Pose (Anantasana), Bridge Posture (Setu Bandha Sarvangasana), Shoulder Stand (Sarvangasana), and Legs Up the Wall Posture (Viparita Karani).

Classes always ended with the Corpse (Savasana) Posture. The practitioners could utilize exercise mats, blocks, straps, chairs, walls, or ladders as well. Meditation and breathing (pranayama) practices were not included.

A set of exercises with selected yoga exercises (asanas), easy to practice by oneself³⁵, was handed over to each participant with the plea to practice them at home on regular bases.

The participants filled out two sets of questionnaires: initial ones (subjective assessment of health and fitness, possible ailments, participation in various forms of recreational activities) and final ones (evaluation of the project, frequency and duration of home exercises with the set exercises given, participation in other recreational activities).

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 range of motion of the spine (thoracic and lumbar segments combined) in all three planes was measured using a Plurimeter-V gravity inclinometer (Dr. Rippstein, Zurich, Switzerland). The noninvasive inclinometer technique is a reliable and valid measurement method. The results obtained with the Plurimeter-V gravity inclinometer were highly correlated with the results acquired by radiography³⁶.

Forward and backward ranges of bending in the sagittal

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

Age groups and n	50–59 years old, n=21		60–65 years old, n=18		Above 65 years old, n=17		All together, n=56	
Studied parameters	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Body mass (kg)	68.4±12.3	66.4±10.7*	66.0±7.1	65.4±7.1	69.5±7.3	67.8±6.7*	68±9.4	66.5±8.4*
BMI (kg/m ²)	27.0±4.6	26.2±4.0*	25.8±2.6	25.6±2.6	27.3±2.8	26.7±2.5*	26.7±3.5	26.1±3.2*
Forward bend (°)	139.2±16.2	150.5±17.8*	130.9±14.6	145.2±12.9*	124.5±21.6	136.6±15.2*	132.1±18.3	144.6±16.3*
Backward bend (°)	47.7±12.9	58.1±16.9*	42.6±9.7	50.9±8.8*	42.2±12.2	51.5±8.8*	44.3±11.8	53.8±12.7*
Left bend (°)	50.1±10.6	55.9±8.5*	47.6±8.8	55.0±11.8*	46.7±10.4	54.4±12.3*	48.3±9.9	55.1±10.7*
Right bend (°)	48.1±10.8	58.5±10.5*	47.9±9.1	57.4±12.9*	44.7±11.7	54.4±11.8*	47±10.5	56.9±11.6*
Left torsion (°)	54.1±15.1	67.8±10.4*	54.8±7.5	64.7±8.5*	46.0±9.8	56.5±13*	51.9±12	63.4±11.5*
Right torsion (°)	53.9±13.8	65.4±11.3*	54.8±7.6	63.3±10.4*	47.5±10.7	60.1±15.1*	52.2±11.4	63.11±12.3*
Toe-touch test (cm)	-13.6±6.6	-9.2±7.2*	-13.9±4.0	-10.0±3.1*	-11.0±5.1	-7.6±5.8*	-12.9±5.5	-9.0±5.7*

Values are expressed as the mean ±SD. *Significantly different from the pre-test condition

plane were measured in a standing position with the feet hip-width apart. The pluri-meter was applied to the upper back (thoracic-cervical transition) and reset, and then the measurement was repeated after the maximum forward bend. Similarly, the backward bending range was measured. Lateral bends (in the frontal plane) were measured in the same position as described above, applying the pluri-meter to the middle part of the neck, between the lateral part of the neck and shoulder, and on the side of the body to which the bend was applied. The pluri-meter was reset, and after the maximum left and right bends took place, the results were recorded. The torsional range of motion (in the transverse plane) of the subjects was measured with their trunks bent forward at 90 degrees and the feet kept stretched apart. The participants held a gym bar at the height of the shoulder blades, and the pluri-meter was reset according to the horizontal level and placed on the back at the Th²⁻⁴ level. After turning the torso to the left and right, the results were recorded³⁷.

The STATISTICA software (data analysis software system), version 10 (StatSoft, Inc., 2011) was used to calculate mean values and standard deviations (SD) and to analyze flexibility results obtained during the pre-test and post-test measurements using a dependent t-test. The level of significance was set at $p < 0.05$. Furthermore, the correlations were calculated for the measurements of flexibility, age of participants, independent exercise performance at home, and the differences in values obtained between the pre-test and post-test measurements.

RESULTS

Of the 56 women studied, 24 (42.9%) declared that they practice at home, the yoga exercise sets given to them. The duration of the practice reported was 10–45 minutes. Therein, 6 persons (10.7%) performed yoga postures 1–2 times a week, 18 women (32.1%) performed yoga postures 3 to 5 times a week; 93% of the participants attended all of the 90-min hatha yoga sessions.

Average body height was 159.2 cm in the 50–59 years old group, 160 cm in the 60–65 years old group, and 159.4 cm in the over 65 years old group. The mean values for the SD of the body mass and body mass index (BMI), measured before

and after yoga classes, are listed in Table 1. The analysis of these measurements indicated a statistically significant reduction in body weight and BMI in two of the three age groups studies and therefore for all the women overall (Table 1).

The results indicated a statistically significant increase of spine flexibility in the three planes before and after the yoga classes in all of the studied women (Table 1). The mean values of the recorded improvement ranged from 6.9 to 12.5 degrees, depending on the plane of motion, and amounted to about 4 cm in the toe-touch test.

Based on the correlation analysis for the obtained measurement results, it was found that the age was negatively correlated with the results of the two measurements in forward bending (–0.41 and –0.5), left torsion (–0.27, –0.42), and backward bending, but this was only evident in the post-test (–0.3) results.

Age and practicing yoga postures at home had no effect on the changes in values between the pre-test and post-test (numerical correlations between –0.21 and 0.17 were not statistically significant).

DISCUSSION

The results of the current study show an increase in flexibility levels in all analyzed movements as a result of regular (hatha) yoga exercises. When practicing yoga postures, the practitioner learns a specific technique of mastering a particular position and body motion; for example, torsional movements should be preceded by elongation of the spine. Forward bends with straight knees improve the flexibility of the hamstring muscles. The yoga postures improve flexibility utilizing a static method.

The study conducted by Grabara et al. indicated that persons exercising with yoga postures had greater flexibility of the hamstring muscles than their non-training peers¹⁹. This was manifested in a greater range of hip bend with the knees in a straight position and elongated spine, i.e., without curving one's back. Backward bends improved mobility of the spine, strengthened the back muscles, and prevented degenerative changes resulting from overloading the intervertebral discs. Exercises with torsion increased the mobility of the spine and strengthened the abdominal oblique muscles and

muscles of the back^{19, 35}).

Our results indicated that practicing yoga postures (asanas) even once a week led to an increase in the mobility of spinal joints and flexibility of the hamstring muscles. All practitioners showed some improvement in flexibility regardless of age.

The studies done by other authors also reported significant improvement in body flexibility in older people who practiced (hatha) yoga exercises on a regular basis^{20, 30–34, 37}). In the study done by Gothe et al., after 8 weeks of yoga posture practice, the participants in the yoga group showed much better flexibility compared with their counterparts doing only regular stretching–strengthening exercises³³). A study that involved 80 women found that a program of intense, short-term yoga posture sessions contributed more to improving spine mobility, especially in bending, than any other conventional exercise program³⁸). The study of Oken et al. assessing the effects practicing yoga postures (asana) on seniors showed an improvement in flexibility and balance³²). Tiedeman et al. indicated in their study that a 12-week program of twice-weekly yoga sessions significantly improved balance and mobility in community-dwelling older people³⁴). Schmid et al. reported significantly increased lower body flexibility (measured by chair sit and reach test) after a 12-week yoga exercise program³⁰). The study of Goncalves et al. assessed the level of flexibility using goniometry in a similar age group of people practicing yoga and in a control group. The authors identified an increase in articular range of motion in lumbar spine bending and hip flexion and extension in older people doing yoga²⁰). Chen et al. reported that participants practicing Silver Age Yoga (yoga exercises tailored for the elderly) had better lower body flexibility and range of motion in shoulder bending and abduction at the end of 12 weeks than other participants not practicing yoga postures³¹). Moreover, the participants not practicing Silver Age Yoga showed noticeable negative changes in their lower body flexibility³¹).

Our findings are congruent with the previous studies indicating that regular yoga exercises improve body flexibility. Yoga exercise programs tailored to older adult needs can contribute to better functioning of the elderly people by maintaining better levels of physical fitness in them.

However, we have to admit that there are also some limitations to our present investigations. Firstly, the present study lacked a control group. We were able to assess and compare flexibility before and after yoga classes; however, we could not compare observed changes with a control group. Secondly, there were considerable differences in the ages of the studied women (50–76) and this created relative, conventional divisions for the age groups.

Flexibility changes during ontogenetic development. During puberty, flexibility declines, peaks around 30 years of age, and then again decreases with age. In the present study, we established that certain ranges of motion were smaller in older women than in young ones, which was confirmed by the correlation analysis. In seniors, the decline in flexibility is usually already considerable (it can be associated with inflammation of the bones and joints), therefore reducing physical activities of these individuals³⁹).

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