



BODY POSTURE IN YOUNG WOMEN INVOLVED IN REGULAR AEROBIC EXERCISE

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ABSTRACT

Purpose. The aim of the study was an assessment of posture in women who regularly perform aerobic exercise. **Methods.** The study group consisted of 50 women actively participating in aerobics classes (mean: age 28.64 ± 5.3 years, body mass 59.83 ± 6.7 kg, height 167.75 ± 4.9 cm, BMI 21.24 ± 3.6 m/kg²) and a control group of 50 women not involved in any regular physical activity (mean: age 28.55 ± 5.05 years, body mass 62.47 ± 10.5 kg, height 167.74 ± 4.8 cm, BMI 22.26 ± 4.8 m/kg²). All participants were subjected to a photogrammetric assessment of posture. **Results.** Statistically significant differences in posture were identified between the two groups for lumbosacral and thoracolumbar spinal curvatures. **Conclusions.** Women who regularly perform aerobic exercise present greater thoracic kyphosis and shoulder asymmetry than women not involved in aerobics.

Key words: aerobic exercise, body posture, photogrammetry, women, spine

Introduction

Aerobic exercise as a form of physical activity is continuously developing. Mass media has encouraged this form of exercise to society, touting its positive effects on health and fitness. A lot of such information, however, is not entirely based on scientifically-proven facts but instead guided by marketing strategies. Scientific research to date has analysed some of the effects of such physical activity on the body. The literature indicates that the benefits of regular aerobics exercise include an increase in muscular strength, endurance, and coordination [1] as well as better intervertebral disc nutrition, better back pain prevention, and improved physical and mental condition [2]. Although studies such forms of exercise as Pilates, stretching, or weight training on individuals with postural disorders have shown improved postural control and reduced pain [3–5], the effects of regular aerobics exercise on body posture have yet to be studied. Therefore, the aim of the study was an assessment of posture in women who regularly perform aerobic exercise.

Material and methods

The study group involved 50 women (mean: age 28.64 ± 5.3 years, body mass 59.83 ± 6.7 kg, height 167.75 ± 4.9 cm, BMI 21.24 ± 3.6 m/kg²) who had been practicing aerobics regularly (two to three times per week) for at least 5 years. All participants attended classes in the same

high quality fitness centre located in Warsaw, Poland by certified aerobics instructors holding degrees in physical education or sport. The control group consisted of 50 women (mean: age 28.55 ± 5.05 years, body mass 62.47 ± 10.5 kg, height 167.74 ± 4.8 cm, BMI 22.26 ± 4.8 m/kg²) not involved in any regular physical activity.

Criteria for inclusion in the study were informed consent to participate in the study and, for the study group, active, regular and continuing participation in aerobic classes. Exclusion criteria were any acute or recent injuries and orthopaedic or neurologic disorders. Ethical approval was obtained by the Bioethics Committee of the Medical Faculty at the University of Rzeszów, Poland. The authors declare no conflict of interest.

All participants were subjected to a photogrammetric assessment of posture, which involved photo-based anthropometric measurement of the back using equipment from CQ Elektronik System [6]. This method provides a spatial (three-dimensional) image by using projection equipment to displays lines on a patient's back. The lines deform when they are projected on a patient's back at a specific angle. These line deformations are dependent on how close or far away a reference marker is from the equipment and are registered by a computer, which uses numerical algorithms to generate a contour map of the back.

Analysis of the photograms involved calculating the following angular measures (an illustration of how these parameters were measured is shown in Figure 1):

ALPHA – lumbosacral spinal curvature calculated between the S1 and apex of lordosis,

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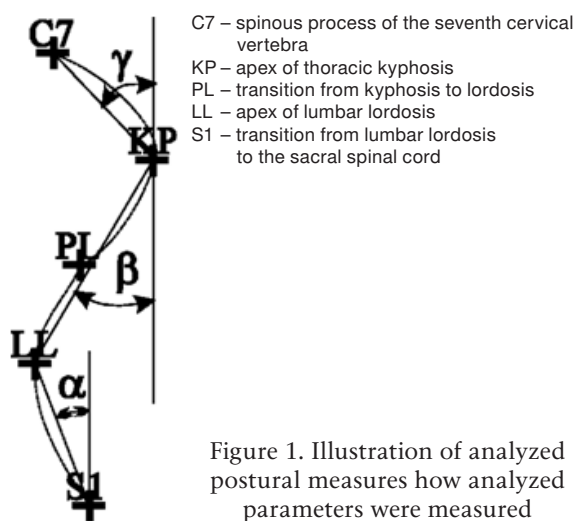


Figure 1. Illustration of analyzed postural measures how analyzed parameters were measured

BETA – thoracolumbar spinal curvature calculated between the transition from lordotic and kyphotic curves (at maximum kyphosis),

GAMMA – thoracic spinal curvature calculated between the C7 and apex of kyphosis,

KKP – thoracic kyphosis angle calculated as $180^\circ - (BETA + GAMMA)$,

GKP – depth of thoracic kyphosis calculated between the apex of kyphosis and transition from kyphosis to lordosis,

KLL –lumbar lordosis angle calculated as $180^\circ - (ALPHA + BETA)$,

GLL – depth of lumbar lordosis calculated between the transition from kyphosis to lordosis and apex of lordosis,

KLB – angle of shoulder asymmetry.

Differences between the means of the two groups were analysed with the use of Student's *t* for independent samples. Additional analysis was limited measures with statistically significant differences at $p < 0.05$. As the variance in the compared groups could be considered homogenous (established with the Levene's test), Student's original *t* test with the assumption of equality of variance was used to compare the means. All calculations were performed with SPSS ver. 8.0 (IBM, USA).

Table 1. Results of the photogrammetric assessment

Measures	Study group		Control group	
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>
ALPHA (°)	19.42	26.10	31.37	27.03
BETA (°)	9.02	2.56	4.10	5.77
GAMMA (°)	24.61	24.15	29.39	22.48
GKP (mm)	19.11	7.90	2.92	9.58
KLL (°)	180.58	31.85	193.40	38.95
GLL (mm)	-20.32	6.53	-15.06	35.47
KLB (°)	4.16	8.85	-1.65	8.79

Table 2 Differences in body posture between the two groups

	Levene's test for homogeneity of variance		Independent <i>t</i> test of mean differences		
	<i>F</i>	<i>p</i>	<i>t</i>	<i>df</i>	<i>p</i>
ALPHA (°)	3.870	0.052	-2.043	83	0.044
BETA (°)	0.622	0.433	4.771	83	0.000
GAMMA (°)	1.075	0.303	-0.940	83	0.350
GKP (mm)	2.605	0.110	8.269	83	0.000
KLL (°)	11.849	0.001	-1.615	83	0.110
GLL (mm)	2.325	0.131	-0.877	83	0.383
KLB (°)	0.063	0.802	3.001	83	0.004

Results

The mean values of the analysed measures of posture are presented in Table 1. Statistically significant differences were found between the two groups were found for ALPHA and BETA, indicating that lumbaro-sacral ($p = 0.044$) and thoracolumbar ($p = 0.000$) spinal curvatures were significantly greater in the control group (Table 2). The posture of women involved in aerobic exercise showed significantly deeper thoracic kyphosis ($p = 0.000$) and greater shoulder asymmetry ($p = 0.004$). The remaining measures did not reveal any statistically significant differences.

Discussion

The results revealed an increased lumbosacral angle and decreased thoracolumbar angle in women who performed aerobic exercise. Moreover, the posture of these women showed greater shoulder asymmetry and deepened thoracic kyphosis.

Aerobic exercise is usually conducted in groups. This might have an adverse effect on the quality of exercise and may have lead the participants to adopt poor or incorrect form. The incidence of deepened thoracic kyphosis may have resulted from assuming incorrect body posture or by overloading. The same may have led to the decrease in thoracolumbar spinal curvature. When compared with the control group, the deepened thoracic kyphosis accompanied with decreased BETA angle in the study group indicates kyphosis of the whole spine. Shoulder asymmetry could have resulted from strengthening exercises performed in these types of classes.

Based on the available literature, no studies to date have assessed body posture in women who regularly perform aerobic exercise, making it very difficult to compare our results with the findings reported in other studies. However, the beneficial effects of other related forms of physical activity on the body and health have been thoroughly discussed. Cruz-Ferreira et al. [7] presented

the effects of Pilates exercises in women, finding an improvement in some of the postural alignment measures (frontal alignment of the shoulder and sagittal alignment of the head and pelvis). This group suggested that the significant improvement in the sagittal alignment of the head may imply that 6 months of Pilates-based exercise can enhance sagittal alignment of the cervical or thoracic spine.

In turn, physical exercise, mainly in the form of resistance training, has led to increased muscle mass and also increased bone mineral density in postmenopausal women [8]. Physical activity has also been recommended as a form of rehabilitation for and in the prevention of low back pain [9]. Other studies determined that a high level of physical fitness is related to a decreased incidence of spine-related pain [10].

Other exercise-based interventions resulted in significant improvements in range of motion and body posture and significant decreases in low back pain. The functional ability of patients in everyday activities of life improved as well [11]. Several studies were conducted on the effects of various forms of dance in patients suffering from Parkinson's disease, showing an increase in the quality of life of patients who did dance [12]. The relevant literature reveals a wide spectrum of beneficial effects resulting from physical activity both in healthy individuals and patients with health conditions. The need for additional research on the posture of individuals performing particular forms of physical activity appears to be necessary in order to determine recommendations for and against participation in certain sports and forms of physical activity. In light of the present study, a postural assessment of women who perform aerobic exercise including comparisons with a control group could help determine what types of body posture would or would not benefit from aerobics. Based on the results of the present study, particular attention should be paid to the prevention of exaggerated thoracic kyphosis and kyphosis of the whole spine. On this basis, the results indicate that aerobic exercise is suitable for individuals with decreased thoracic kyphosis whereas those with kyphosis or kyphoscoliosis should avoid this form of exercise. Instead, it is recommended that this population should be involved in individual training targeting particular disorders that, for example, involve relaxing and stretching exercises. Such exercises should be conducted in isolated and spine-relieving positions. Current research has shown that body posture correlates with spinal disc disorder, which confirms the importance of the issue studied herein [13] and also indicates the need for additional study on this issue.

The results of the present study also point to the importance of monitoring body posture throughout the physical training process. This should be one of the responsibilities of aerobics instructors, where, apart from

explaining the aim and execution of a particular exercise, should also educate participants on the ergonomics of maintaining correct posture during training and provide exercises strengthening proper posture habits.

Considering the limitations of the present study, it would be useful to broaden the scope of the study by incorporating individuals from different age groups as well as assess the effects of aerobic exercise on body posture pre- and post-intervention.

Conclusions

The results indicate statistically significant differences between the study and control groups, where women who regularly perform aerobic exercise present greater thoracic kyphosis and shoulder asymmetry than women not involved in aerobics

References

1. Donath L., Roth R., Hohn Y., Zahner L., Faude O., The effects of Zumba training on cardiovascular and neuromuscular function in female college students. *Eur J Sport Sci*, 2014, 14 (6), 569–577, doi: 10.1080/17461391.2013.866168.
2. Prouty J., Fitness fact or fitness fad. *ACSM's Health Fit J*, 1999, 3 (6), 35, doi: 10.1249/00135124-199911000-00011.
3. Da Fonseca J.L., Magini M., de Freitas T.H., Laboratory gait analysis in patients with low back pain before and after Pilates intervention. *J Sport Rehabil*, 2009, 18 (2), 269–282.
4. Kluemper M., Uhl T.L., Hazelrigg H., Effect of stretching and strengthening shoulder muscles on forward shoulder posture in competitive swimmers. *J Sport Rehabil*, 2006, 15 (1), 58–70.
5. Sculco A.D., Paup D.C., Fernhall B., Sculco M.J., Effects of aerobic exercise on low back pain patients in treatment. *Spine J*, 2001, 1 (2), 95–101, doi: 10.1016/S1529-9430(01)00026-2.
6. Drzał-Grabiec J., Snela S., The influence of rural environment on body posture. *Ann Agric Environ Med*, 2012, 19 (4), 846–850.
7. Cruz-Ferreira A., Fernandes J., Kuo Y.L., Bernardo L.M., Fernandes O., Laranjo L. et al., Does pilates-based exercise improve postural alignment in adult women? *Women Health*, 2013, 53 (6), 597–611, doi: 10.1080/03630242.2013.817505.
8. Nelson M.E., Fiatarone M.A., Morganti C.M., Trice I., Greenberg R.A., Evans W.J., Effects of high-intensity strength training on multiple risk factors for osteoporotic fractures. A randomized controlled trial. *JAMA*, 1994, 272 (24), 1909–1914, doi: 10.1001/jama.1994.03520240037038.
9. Krismer M., van Tulder M., Strategies for prevention and management of musculoskeletal conditions. Low back pain (non-specific). *Best Pract Res Clin Rheumatol*, 2007, 21 (1), 77–91, doi: 10.1016/j.berh.2006.08.004.
10. Heneweer H., Picavet H.S., Staes F., Kiers H., Vanhees L., Physical fitness, rather than self-reported physical activities, is more strongly associated with low back pain: evidence from a working population. *Eur Spine J*, 2012, 21 (7), 1265–1272, doi: 10.1007/s00586-011-2097-7.
11. Dzierżanowski M., Dzierżanowski M., Maćkowiak P., Słomko W., Radziwińska A., Kaźmierczak U. et al., The in-

- fluence of active exercise in low positions on the functional condition of the lumbar-sacral segment in patients with discopathy. *Adv Clin Exp Med*, 2013, 22 (3), 421–430, Available from: <http://www.advances.am.wroc.pl/pdf/2013/22/3/421.pdf>.
12. Batson G., Feasibility of an intensive trial of modern dance for adults with Parkinson Disease. *J Evidence-Based Complement Altern Med*, 2010, 15 (2), 65–83, doi: 10.1177/1533210110383903.
 13. Lee P.J., Lee E.L., Hayes W.C., The ratio of thoracic to lumbar compression force is posture dependent. *Ergonomics*, 2013, 56 (5), 832–841, doi: 10.1080/00140139.2013.775354.

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