

Evaluation of selected postural parameters in children who practice kyokushin karate

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Summary

Study aim: martial arts can be traced back thousands of years. Karate is one of the most common martial arts, and both children and adults practice it. The aim of the study was to evaluate selected body posture parameters in children aged 7–10 years who regularly practice karate.

Material and method: the study population (Group I) consisted of 50 children aged 7–10 years, mean age 8.1 ± 1.5 years, who had been practicing karate more than two years. The control group consisted of 50 children of the same age (Group II). Body posture was assessed with photogrammetric method based on the phenomenon of the projective moiré pattern, using CQ Elektronik equipment.

Results: on the basis of analysis of the inclination of the thoracolumbar section of the spine in both the study population and the control group, a statistically significant difference was found. Analysis revealed a statistically significant difference between the SIT parameter measurements of the two groups ($p < 0.05$). There is a similar difference regarding the measurements of depth of thoracic kyphosis and depth of lumbar lordosis ($p < 0.001$ and $p < 0.05$, respectively). Analysis also revealed a statistically significant difference between the mean shoulder line inclination angle parameter measurements for the two groups of children ($p < 0.01$).

Conclusion: karate training children had a significant deepening of physiological thoracic kyphosis and lumbar lordosis. The body posture in karate training children is characterised by a greater angle of thoracolumbar region and a smaller shoulder asymmetry.

Key words: Body posture – Photogrammetric – Karate kyokushin

Introduction

Martial arts can be traced back thousands of years. Karate is one of the most common martial arts, and both children and adults practice it [4]. It is a Japanese martial art that is classified as a striking art [1, 19]. For many practitioners, it is not just a sport, but also a philosophical practice [9]. Kyokushin karate, one of the most commonly practiced styles in Poland, is also the most common full contact karate around the world. Literally, it means ‘the ultimate truth’. The style was founded by Masutatsu Oyama. Kyokushin karate is based on the main elements: kihon – the basic techniques, which aim at acquiring the correct techniques of punches, kicks and blocks; Ido geiko – the way of moving; kata – formal, detailed choreographed patterns of defence and attack;

and kumite – free sparring without strikes to the knees, spine or head. The ultimate aim of karate is the spiritual development achieved through demanding physical exercise.

Practicing martial arts is supposed to bring numerous benefits. In addition to better health, karate practitioners have, among other characteristics, better postural stability [18]. Many scientists believe that martial arts are more beneficial for adults than for children; however, most of the studies on karate have been conducted in adults. This has resulted in a shortage of information on the effects of martial art training on biomechanical and anthropometrical parameters in children. A crucial element of karate training is maintaining correct body posture throughout. However, there is no information in the available literature on the effect of regular karate training on the body posture of school children.

The aim of the study was to evaluate selected body posture parameters among children aged 7–10 years who regularly practice karate in comparison to their non-practicing peers.

Material and method

The study group (Group I) consisted of 50 children – 29 boys and 21 girls – aged 7–10 years, mean age 8.1 ± 1.5 years, who had been practicing karate. Inclusion criteria were: age 7–10 years, more than two years of training, the lack of locomotor diseases affecting posture, and lack of any other regular physical activity based on an interviews with parents. The control group consisted of 50 children of the same age (Group II). Exclusion criteria were: distinctive divergence from the developmental norms

and/or uncompensated postural disorders. To achieve a greater reliability of research, the clinical control group members were chosen on a 1 : 1 basis, which meant that, for example, each 7-year-old girl from the study population had a 7-year-old girl counterpart in the control group. The children from both groups differed significantly neither in terms of body mass nor height. Furthermore, they were between 25th and 75th percentile. This allowed for a reliable comparison of the studied parameters. In addition, all children from the study group had correct weight and height according to percentile curves. The tests were conducted at the Kyokushin Karate Club in the Bielany district of Warsaw, Poland. Consent to conduct the tests was obtained from the Bioethics Commission.

The children from the study population practiced karate twice a week for 1.5 hours. The children from the clinical control group were not involved in any physical activity on a regular basis.

After obtaining both family consent and child assent to participate, body posture was assessed with the photogrammetric method based on the phenomenon of the projective moiré pattern, with the use of CQ Elektronik equipment. CQ Elektronik equipment is produced in Świerc, Poland. In this method, a spatial image was obtained by the equipment displaying lines of strictly defined parameters on a patient's back. When the lines fell on the patient's back at a specific angle, the lines became deformed. The deformations depended on whether a given point was closer to or further from the equipment. The line deformations were registered by a computer, which used numerical algorithms to process them into a contour map of the examined surface. The tests were conducted according to the manufacturer recommendations [5, 6]. Table 1 presents the parameters applied in the study. The parameters were graphically presented in Fig. 1.

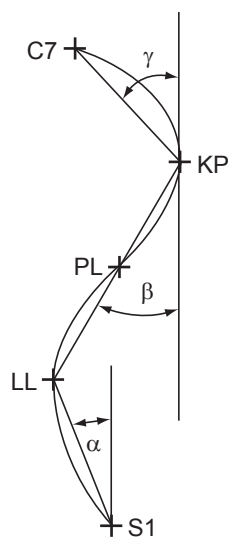


Fig. 1. Graphical presentation how posture parameters were measured

Table 1. Postural parameters examined in this study

Variable	Description
ALPHA	Inclination of the lumbosacral section of the spine in degrees
BETA	Inclination of the thoracolumbar section of the spine in degrees
GAMMA	Inclination of the upper thoracic section of the spine in degrees.
SIT	Sagittal inclination of the trunk in mm
TKA	Angle of thoracic kyphosis; the smaller the angle, the more advanced the kyphosis in degrees
DTK	Depth of thoracic kyphosis in mm
ALL	Angle of lumbar lordosis; the smaller the angle, the more advanced the lordosis in mm
DLL	Depth of lumbar lordosis in mm
CIT	Coronal inclination of the trunk in mm
AS	shoulder line inclination angle; the angle between the line connecting the acromions of the shoulders and the horizontal plane
UL	Difference of heights of the lower corners of scapulae in mm
OL	Difference of distances from the lower corners of scapulae to the spine in mm

Statistical analysis of the collected data consisted of comparing the results of the two groups: Group I (the study group consisting of karate training children) and Group II (the clinical control group). As distribution of most of the results obtained was at variance with the normal distribution (verified with the Shapiro-Wilk test) and as there was no equality of variance (controlled with the use of Levene's test), the non-parametric Mann-Whitney U test was applied for the analysis. The test revealed the presence of differences among parameters between the two groups. The statistical significance was set at $p < 0.05$. The results that were statistically significant are marked red in the Table, and are illustrated in the form of graphs. Descriptive statistics of the studied parameters are presented: the mean $[\bar{x}]$, the standard deviation $[s]$, and the median $[Me]$ were calculated.

Results

On the basis of the BETA parameter analysis in both the study population and the control group, a statistically significant difference was found between the mean values in the two groups ($p < 0.01$). Karate training children had larger mean results, which means that the inclination of the thoracolumbar section of the spine was bigger.

The analysis revealed a statistically significant difference between the SIT parameter measurements for the two groups (statistical significance $p < 0.05$). Karate training children were also found to have higher mean results, which means that sagittal inclination of the trunk was lower – children were standing more upright (Fig. 2).

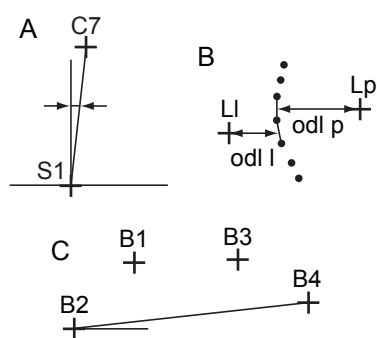


Fig. 2. A method of determining the following parameters: A – coronal inclination of the trunk, B – difference of distances from the lower corners of scapulae to the spine, C – shoulder line inclination angle

There was a similar difference regarding the DTK parameter measurements (statistical significance $p < 0.01$). Once again, karate training children had higher mean results, which means that depth of thoracic kyphosis was flattened in non-training children.

Analysis revealed a statistically significant difference between the mean DLL parameter values in the measurements of the two groups (statistical significance $p < 0.05$). The control group children also had flattened lumbar lordosis.

Analysis also revealed a statistically significant difference between the mean AS parameter measurements of the two groups of children ($p < 0.01$). The karate training children had smaller asymmetry regarding the shoulder position on the horizontal plane (Fig. 3).

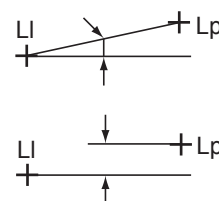


Fig. 3. A method of determining the difference of heights of the lower corners of scapulae

The existence of the differences between the studied parameters in both groups was confirmed by the Mann-Whitney U test. The Mann-Whitney U test is a nonparametric test of the null hypothesis that two populations are the same against an alternative hypothesis, especially that a particular population tends to have larger values than the other. The other studied parameters did not reveal any statistically significant differences. All details were presented in Table 2.

Discussion

Results revealed a deepening of physiological thoracic kyphosis and lumbar lordosis in karate training children in comparison to the control group. Moreover, the body posture in karate training children was characterised by a greater angle of thoracolumbar region and a smaller shoulder asymmetry.

The deepening of the physiological spinal curvatures was caused by assuming a characteristic body posture during training. The increased thoracolumbar region angle is related to the lumbar lordosis deepening. Kyokushin karate is a sport that requires the trainee to maintain the correct body posture for the duration of training. The results confirmed this by revealing a smaller shoulder asymmetry in the karate training children.

The issue of postural stability in martial arts contestants has been discussed to a great extent in the available scientific literature [2, 7]. However, the effects of regular training on body posture parameters in children have not been previously discussed.

Table 2. Comparison of body posture parameters between children practicing karate (n = 50) and those from control group (n = 50)

Variable	Group I				Group II			
	$\bar{x} \pm SD$	Me	Min.	Max.	$\bar{x} \pm SD$	Me	Min.	Max.
ALPHA	23.4 ± 29.4	9.2	0.0	83.7	14.6 ± 16.9	10.7	0.8	82.9
BETA	8.8 ± 2.8***	8.4	3.6	15.7	4.8 ± 3.5	5.5	0.3	12.4
GAMMA	24.0 ± 25.5	12.1	2.3	78.6	18.6 ± 18.2	12.6	4.3	70.6
SIT	-1.7 ± 17.9*	0.0	-32.6	31.5	-3.6 ± 12.5	-3.7	-35.2	33.4
TKA	147.2 ± 25.8	159.7	91.2	173.6	156.8 ± 18.7	161.9	103.5	176.6
DTK	13.2 ± 5.2***	11.3	4.5	26.3	5.5 ± 8.1	4.5	-8.3	26.3
ALL	182.1 ± 36.5	164.8	150.7	256.6	169.5 ± 21.6	165.7	149.5	261.8
DLL	-13.8 ± 5.1*	-12.8	-26.3	-5.3	-9.7 ± 8.8	-11.3	-26.3	7.5
CIT	-0.7 ± 1.5	-0.6	-5.8	2.3	-0.9 ± 1.2	-0.9	-2.9	2.7
AS	0.7 ± 6.7**	0.0	-15.1	15.1	-3.9 ± 8.2	-5.7	-21.7	18.9
UL	-0.1 ± 6.1	0.0	-12.3	16.1	-0.2 ± 5.6	0.0	-20.8	14.2
OL	0.6 ± 7.6	1.0	-16.2	17.2	3.1 ± 8.4	2.7	-16.7	21.0

Significantly different from control: * – $p < 0.05$, ** – $p < 0.01$, *** – $p < 0.001$,

Scientific studies showed that every sporting discipline, when it was practiced regularly, influenced body posture. Depending on the specificity of the discipline and the training itself, the effect on body posture parameters was different. There are several studies available that compare the body posture of practitioners of different disciplines of sport.

In a study of a group of training athletes, Grabara et al. found that trunk asymmetry is significantly more common than in the control group [15]. Sagittal spinal curvatures were studied among young paddlers aged 13–14 years. When compared to non-athletes, differences regarding thoracic kyphosis and lumbar lordosis were not found [13]. A study of cyclists by Muyor et al. found thoracic hyperkyphosis and flattening of lumbar lordosis in these athletes. These tendencies were revealed both when standing and sitting, and were stronger in older athletes [15]. A study conducted with athletes by Grabara et al. observed asymmetry of the trunk significantly more frequently [12]. Maćkowiak and Wiernicka studied teenage girls training in synchronised swimming. Their results revealed that correct posture in the sagittal plane was more common in athletes than in their non-training peers. Moreover, posture in the coronal plane was characterised by smaller asymmetries in athletes, for example, shoulder asymmetry occurred half as often in athletes. [14]. In their study of volleyball players, Tabor et al. found that thoracic kyphosis flattened along with the time of training [16]. When analysing children practicing handball, Grabara et al. found a reduction of lumbar-thoracic inclination, increasing the

inclination angle of the torso and the reduction of lumbar lordosis [10]. Assessing judokas posture also pointed to the frequent occurrence of good (67%) and very good (26%) posture [20]. Researchers also evaluated the effect of a sporting discipline on body posture. Studies revealed that the proportion of correct body postures decreased with the age of the subjects [8]. Wojtys et al. found that intensive stretching training in athletes aged 8–18 years resulted in an increase of thoracic kyphosis angle and lumbar lordosis [17]. According to Grabara, the posture of gymnastic training girls was characterized by better symmetry and their spine was shaped better [11]. According Barczyk-Pawełec et al., tennis players were characterized by kyphotic, asymmetric posture [3].

The analysis of authors' own results, as well as of other authors' reports, confirmed that training for a sport influences body posture in terms of both global and selected postural parameters.

Authors' study is the first to discuss selected body posture parameters in children who practice Kyokushin karate. The comparison of body postures of children in the study population and the control group showed significant differences in postural parameters. Kyokushin karate, apart from being a sport discipline, may constitute a supplementary element of postural disorder therapy. Parents often find it easier to have their child participating in sporting activities rather than organising individual corrective therapy. Children themselves find sporting activities more interesting than corrective therapy. Authors' results showed that karate training may be a suitable sport for children

presenting flattening of physiological spinal curvatures, as karate results in a deepening of these curvatures. Flat back is one of the most common postural disorders in the sagittal plane, and karate training may constitute an excellent supplement of individual therapy in treating this disorder.

Karate training in cases of scoliosis or postural disorders on the structural level should not constitute a form of treatment itself, but may be a supplement to therapy and an excellent form of compensational activity in children at risk of postural disorders. Authors' study and analysis of the available literature showed that karate provides a useful means for forming the habitually correct posture, which is a basis for the neurophysiological sphere in postural re-education and a good way to form postural endurance in children.

Conclusions

1. Deepening of physiological thoracic kyphosis and lumbar lordosis appeared among karate training children.
2. The body posture among karate training children was characterised by a greater angle of thoracolumbar region and a smaller shoulder asymmetry.
3. Karate training may constitute an excellent supplement to individual therapy in treating posture disorders.

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