

Influence of karate exercises on motor development in pre-school children

Dariusz Boguszewski¹, Małgorzata Socha²

¹ Rehabilitation Department, Physiotherapy Division, Warsaw Medical University, Poland

² Section of Physical Culture Sciences, Students' Scientific Circle of Physiotherapy, Warsaw Medical University, Poland

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Summary

Introduction. The goal of the study was to determine the effect of exercises with karate elements on physical fitness in pre-school children.

Material and methods. The sample comprised 88 children aged 4.5-6.5 years. The study group consisted of boys and girls practising karate (n=30). The comparative groups included children participating in prophylactic-corrective gymnastics classes (n=30) and physically inactive children who did not participate in any form of movement activity (n=28). The applied tests evaluated physical fitness (explosive strength of the upper limbs – medicine ball throw, power of the lower limbs – standing long jump, agility – shuttle run, endurance of the abdominal muscles – sit ups, elasticity – forward bend), adapted for pre-school children.

Results. The girls who practised karate obtained the best results in all tests. The biggest differences ($p < 0.01$) were noted in strength/ power of the upper and lower limbs and elasticity. Only no significant differences were noted in abdominal muscle endurance. Among the boys, karate practitioners obtained the best results in the tests assessing elasticity, power of the lower limbs and abdominal muscle endurance (although the differences in the last two parameters were insignificant). The biggest differences between the karate practitioners and physically inactive children were noted in the agility and flexibility tests.

Conclusions. Exercises with karate elements favourably affected motor development in pre-school children. Better results and bigger differences (between the studied groups) may indicate a lower interest in spontaneous motor activities among girls (especially these who did not attend any sport –recreational activities).

Introduction

In pre-school children, motor activity stimulates general development and is a necessary factor in every child's life. Through motor activity performance, a child has an opportunity to participate in many forms of activity – their favourite plays involving movement. Additionally, motor activity shapes the child's personality [1,2].

Karate is a martial art which excellently develops physical fitness and can be a form of physical education. Karate training guarantees the trainees a wealth of movements and complexity of the exercises performed. It favourably affects movement coordination and spatial orientation. Exercises with elements of karate are symmetric and use laterally alternant movements, stimulating the nervous system of the child's developing body. Systematic participation in karate sessions enables comprehensive development of physical fitness. Most of the sport disciplines develop only some motor features and muscle groups. Karate develops endurance, strength, agility, motor coordination and elasticity of the entire body, increases the skeletal system endurance and movement precision and improves metabolism. Parallel development of all parts of the body, strengthening the abdominal and dorsal muscles and

improving movement apparatus elasticity contributes to shaping a correct body posture in karate practitioners. The important elements of eastern martial arts include affecting the mental sphere and shaping character, control ability, precision, systematic work and self-discipline [2-5].

During karate sessions children have an opportunity to learn about their body and develop their strength and self-confidence. Exercising in pairs, the children learn how to cooperate with their peers, how to be loyal and reliable. Karate training can also relieve tension in, hyperexcitable, hyperactive or aggressive children [6].

The goal of this study was to investigate the effect of different forms of motor activity on physical fitness in pre-school children.

Material and methods

The sample comprised 88 children aged 4.5 – 6.5 years (43 girls and 45 boys). The children attending sport-recreational karate classes or prophylactic-corrective exercise sessions as well as the children not involved in any movement activity were studied. The study was carried out between October 2010 and January 2011.

The subjects were divided into three groups: I. the study group (n=30) including karate practitioners and two comparison groups – II. The children participating in corrective gymnastics classes (n=30) and III. (n=28) the children who did not participate in any movement activities. The children from Group 1 attended training sessions, on average for 6 months and the children from Group 2 attended their classes for about 18 months.

For the purpose of comparison, the subjects were further divided into subgroups based on their age (5 and 6 year old children) (Table 1).

Physical fitness of the subjects was diagnosed after obtaining the written consent from their parents. The modified versions of the European Physical Fitness Test [7,8], the International Physical Fitness Test [9] and Sekita Test [1,7] were used for the assessment. The motor fitness measurement comprised 4 tests:

- upper limb strength test – throwing a medicine ball (1 kg) forward from behind the head; standing on both legs, slightly straddled, three ball throws, test result: measurement with the accuracy of 0.5 cm;
- lower limb strength – long jump from the start line, landing on both feet maintaining a vertical position; the subject jumped three times; test result: measurement with the accuracy of 0.5 cm;
- agility – 4x5m shuttle run; the subject standing on the start line ran on the command to the post located at 5 m distance, then ran back to the start point and again to the post, then returned to the start line; test result: time measurement with the accuracy 0.1 second.

- endurance of the abdominal muscles – the subject in the supine position with legs flexed in the knee and hip joints; hands on the small of the neck; on the command the subject performed forward bends; test result: the number of bends performed in 20 secs.;

- elasticity – test „fingers-floor”, the subjects were told to bend forward with their knees straight; the result was the distance between the third (big) finger pulp and the floor.

Results

The best results of the upper limb strength test were obtained by the girls participating in karate classes (on average 235.1 cm). The differences between the results obtained from Group I and the remaining groups were statistically significant (Group II – p=0.014, Group III – p=0.009). The boys were slightly better at throwing the medicine ball. The results obtained from all the three groups were similar (Fig. 1).

In the subgroup of five year old girls, the best mean value of explosive upper limb power (throwing 1 kg medicine ball) was obtained from the children participating in gymnastics classes (on average 213 cm). The lowest values were obtained from the physically inactive girls (169 cm). In the group of six year old girls, the best results were also obtained from the girls participating in gymnastics classes and the worst ones – from physically inactive girls. The differences between the active groups (except the dancing group) and the inactive one were approaching statistic significance. Physically inactive five year old boys obtained the best results in medicine ball

Table 1. Characteristics of the studied groups

	Girls				Boys			
	5-years		6-years		5-years		6-years	
	n	%	n	%	n	%	n	%
Karate	4	16,7	6	31,5	8	34,8	12	54,6
Gymnastics	14	58,3	5	26,3	9	39,1	2	9,1
Non-active	6	25	8	42,1	6	26,1	8	36,3
Amount	24	100	19	100	23	100	22	100
	n=43		48,9%		n=45		51,1%	

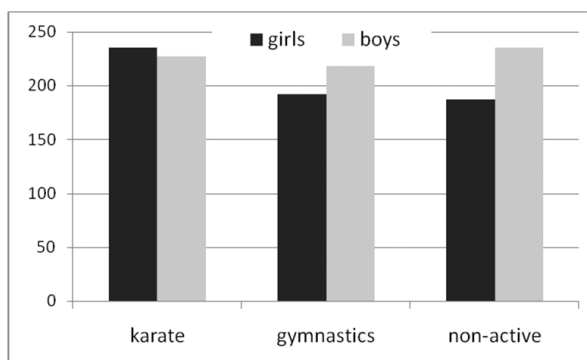


Fig.1. The results of explosive upper limb power test – medicine ball throw [cm] in boys and girls (mean values)

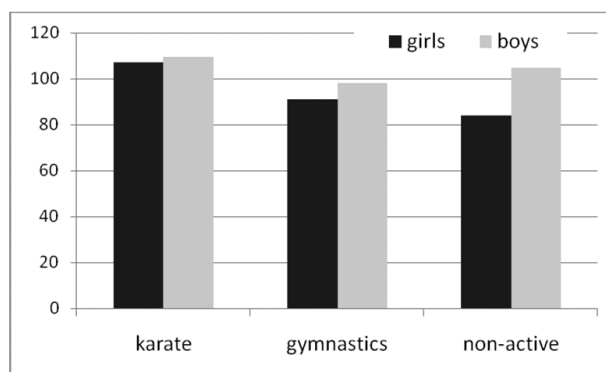


Fig.2. The results of lower limb power test – standing long jump [cm] in girls and boys (mean values)

throw (243 cm). Slightly worse, similar results were obtained in this category by karate practitioners and the boys participating in gymnastics classes. In the group of six year old children, the best results were also obtained from karate practitioners (262 cm) and the worst – from the boys participating in gymnastics classes (219 cm). The differences were statistically insignificant.

In the lower limb power test, the best results were obtained from the karate practitioners. Significant differences, however, were noted between the results of Group I and the results of Groups II and III ($p=0.000$ and $p=0.001$) – only in the girls. The results of physically active girls and boys were similar while in inactive children they significantly differed ($p=0.007$) (Fig. 2).

In the age subgroups, among five year old girls, the highest values for long jump were noted in the subjects participating in gymnastics classes (on average 104 cm). Slightly lower values were obtained from the karate practitioners, and the lowest ones – from physically inactive girls whose jumps were on average 37 cm shorter than these of the girls participating in gymnastics classes.

In the group of six year old girls, these participating in gymnastics classes also obtained the best results in jumping while physically inactive girls obtained the lowest values.

Among the five year old boys, the differences in the results between the active and inactive groups turned out statistically significant ($p=0.000$) while in six-year olds such sig-

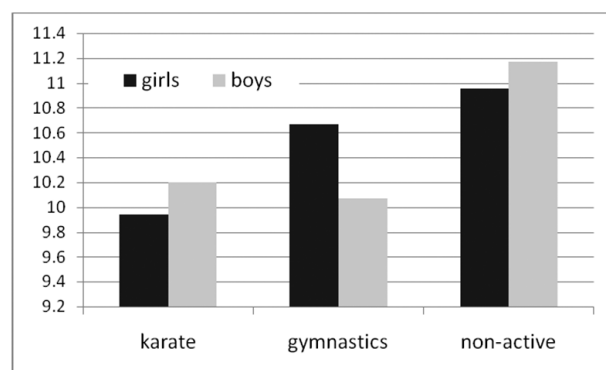


Fig.3. The results of agility test – shuttle run [s] in girls and boys (mean values)

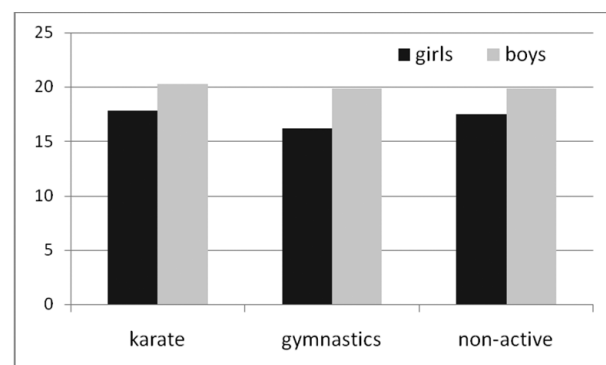


Fig.4. The results of abdominal muscle strength test – sit ups [n] in girls and boys (mean values)

nificance was not noted. The best results in long jump were obtained by karate practitioners (on average 95.6 cm) and physically inactive boys (95.5 cm). Among the six year olds, the best results were also obtained from karate practitioners and physically inactive children. The results, however, were statistically insignificant.

In the shuttle run test (below 10 s) the best results were obtained from the girls participating in karate training. Slightly lower values were obtained from the boys attending gymnastics classes and karate practitioners. Much lower results were obtained by the girls from Group II ($p=0.034$) and III ($p=0.011$). Physically inactive boys obtained the worst results (Fig.3).

Five year old girls from all the studied groups, except the group of karate practitioners, had similar results of the agility test (about 10 s). Slightly lower results of this test were obtained from karate practitioners. The results of six year old girls were similar (the average time – about 10 s). Physically inactive girls had slightly higher results in this test than their training peers. No significant between-group differences were noted.

In the group of five year old boys, karate practitioners obtained the best results in the shuttle run test. Among the six year old boys, karate practitioners and the boys participating in gymnastics classes were the best. Slightly poorer results were noted among the boys from the dancing group and the poorest results were obtained from physically inactive boys. The differences were statistically insignificant.

The results of the abdominal muscle endurance test were similar in the physically active and inactive children – no significant between-group differences were noted. In all the groups, the girls made slightly fewer repetitions than the boys (Fig. 4).

Bigger differences were found after the division of the sample into age compartments. Five year old girls practising karate performed slightly fewer bends than the inactive girls and these participating in gymnastics classes. Among the six year old girls, karate practitioners obtained the best results (about 20 bends). Five year old boys participating in gymnastics classes performed the biggest number of bends during 20 seconds. The poorest results were obtained by physically inactive boys. Among the six year old boys, karate practitioners and the boys attending gymnastics classes performed the biggest number of bends. The test, however, did not reveal significant between-group differences.

The results of fingers-floor test in girls revealed statistically significant differences between the studied active and inactive groups ($p=0.000$). The best results were obtained from the girls practising karate (100% performed forward bends with touching the floor) while the lowest values were obtained from the physically inactive girls. In the group of boys, the best results were obtained from Group I subjects and the worst – from physically inactive boys.

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Discussion

The development of science and technology is connected with the occurrence of phenomena adversely affecting the human organism. They involve reduction of motor activity in favour of sedentary lifestyle, negatively affecting child's physical development. According to some researchers, children rest in a seated position for about three hours every day and spend about an hour daily in the same position during meals [10,11].

For normal development, a child needs adequately prepared meals, spending a proper amount of time outdoors, adequate amounts of sleep and movement [10]. According to experts, physical activity of children and youth involves an hour of exercise of moderate or high intensity every day. In turn, the minimal level of motor activity is defined as everyday exercise performed for at least half an hour [12]. In the case of children, the time of exercise should amount on average to five hours daily [11].

Systematic motor activity results in multiple favourable changes occurring in the human body. These include the features which one can notice at first glance: normal, slim silhouette, correct gait, better musculature and better well being, and favourable changes occurring in some body systems [11,13].

Apart from the above mentioned advantages, we should also mention the favourable effect of motor activity on body mass control and in obesity prophylaxis [10-14].

Motor activity supports child's development on the social and didactic basis. It helps with choices, shapes strong will, prepares for competition and group work, develops reflex, intelligence and positive attitudes and reduces stress level [11, 14].

Conclusions

1. The study results show a favourable effect of physical activity on motor fitness in children. In most of the fitness tests, physically active children obtained better results than their physically inactive peers.
2. The level of physical activity slightly differed in the children involved in different forms of physical activity. In most of the tests, the children practising karate obtained the best results. Bigger differences were noted in girls who obtained the best results in all the tests. This is indicative not only of the effectiveness of karate in fitness development, but also of the unwillingness of most of the girls (especially these not uninvolved in additional sports-recreational activities) to perform spontaneous motor activities.
3. The analysis of this study results indicates that the children's age determines their level of physical fitness. The fitness parameters were higher in six year old children than in their five year old counterparts. Bigger differences were noted in physically active children, which may indicate acceleration of their motor development.

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Address for correspondence:

Dariusz Boguszewski
Rehabilitation Unit, Medical University of Warsaw
Solec str. 57, 00-424 Warsaw, Poland
phone: +48 (22) 629-46-65, e-mail: dboguszewski@wum.edu.pl

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