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RESEARCH ARTICLE

Investigation of the Effect of Short-Term Karate Training on Walking Ability in Visually Impaired Children

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Abstract
This study aimed to investigate the effect of 6-week karate training on walking skills, a locomotor skill, in visually impaired individuals aged 10-14 years. A total of 20 visually impaired individuals participated in the study. To evaluate the walking skills of the visually impaired individuals, a 10-meter walking test was performed on a walking line that could be felt on the soles of the feet, and the participants' 10-meter walking time, step length, and step number values were recorded. SigmaPlot 11.0 program was used for data analysis. In the pre-and post-test comparisons, the Paired t-test was used for normally distributed data, and the Wilcoxon test was used for non-normally distributed data. In the comparison of two independent groups, a t-test was used for normally distributed data, and the Mann Whitney-U Test was used for non-normally distributed data. According to the findings, there was no statistically significant difference between the 10-meter walking pre-test results of the karate and control groups with and without glasses. When the post-test values were analyzed, a statistically significant difference (p<0.05) was found in all parameters of the karate group except the stride length parameter. In intra-group comparisons, while there was no significance in the pre-post test values of the control group, a statistically significant (p<0.05) difference was found in all parameters of the karate group. As a result, short-term karate training has a positive effect on the walking skills of visually impaired individuals aged 10-14 years.

Keywords
Visually impaired, Karate, Physical Fitness

INTRODUCTION

In visually impaired individuals, development lags, and the ability to move independently progresses differently than normal individuals (Sarimski, 1990). This is because not being able to see a reference point sufficiently limits the body's position awareness and the ability to maintain balance and adapt to new positions (Casselbrant et al., 2007). In addition to developmental delays in visually impaired individuals, different gait patterns emerge due to obstacle perception and balance problems. In individuals who can see at very narrow angles, different postures and gait patterns can be seen such as tilting the head to the side, turning, tilting forward to focus the angle of vision on the direction of movement during movement, extending the hands forward to prevent loss of balance during walking, to avoid accidents and to move safely, walking with slow but firm steps, limitation in joint movements while walking (Altunay & Akı, 2016; Arslantekin, 2014; Cengizel et al, 2022; Suveren-Erdogan, 2018; Suveren-Erdogan et al., 2018; Tuncer,T & Altunay,B, 1999).

Since physical awareness, correct body position, mobility, balance, and coordination skills can be supported and improved with sports, the importance of sports training in visually impaired people comes to the fore (Suveren-Erdogan, 2018; Suveren-Erdogan & Suveren, 2018). Sports

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activities are highly functional in minimizing developmental delay and the problem of independent movement in social life, to develop motor skills such as regular muscle activation, endurance, strength, balance, and coordination to provide the necessary motivation with self-confidence development and socialization (Altunay & Akı, 2016; Havik et al., 2010; Kalia et al., 2010; Winnick & Porretta, 2016).

People with disabilities can participate more in sportive activities by increasing the number of sportive activities they can do. Sportive activities can be adapted and diversified for individuals with disabilities, and such activities can increase their living standards and make their lives easier (Gallahue, 1987).

Walking skill, a locomotor skill, can be realized provided that the coordination and balance of the body are fully ensured. Individuals who have lost their eyesight and those who have no eyesight experience loss of balance due to obstacle perception problems. These balance losses cause injuries, especially during walking, and thus negatively affect social life (Coughlan et al., 2012; Jazi et al., 2012; Montarzino et al., 2007; Ray et al., 2008). Gait, posture, body control, and body management are part of the independent movement (Pogrund et al., 2012; Yılmaz, 2011). Planning sportive exercises to include auditory and kinesthetic stimuli can be used as a method to minimize balance losses by increasing the activation of motor skills (Deliceoğlu et al., 2017; Murphy, 1989; Pogrund et al., 2012). Karate exercises meet this need because they include both breathing techniques and audio stimuli while applying techniques. At the same time, since the karate techniques used for kata do not require traveling too much distance, it is essential for the body to maintain its position more quickly and to activate different functions in the meantime.

The fluent realization of walking skills is one of the most critical factors affecting the lives of visually impaired individuals. The limitation of movement caused by the lack of vision often constitutes a significant obstacle for visually impaired individuals to participate in social life and to do their daily chores without assistance. Improving walking skills helps them to open up to the outside world more efficiently, to be more independent in their social life, and to improve their quality of daily life. In addition, increasing self-confidence allows visually impaired individuals to mix with the outside world in compulsory situations and for social activities. Karate activities can become a form of self-expression by allowing visually impaired individuals to act together in a social environment and develop walking and balance skills. Visually impaired individuals can even participate in competitions in para-karate by progressing in this field. Based on all this information, the study aimed to investigate whether the 6-week teaching of basic karate (kihon) techniques planned for visually impaired individuals can improve walking skills in visually impaired individuals.

MATERIALS AND METHODS

Research Model

This quasi-experimental study includes pre-test and post-test evaluations with karate and control groups.

Study Grups

A total of 20 visually impaired individuals participated in the study. 10 participants were included in the karate group (5 boys, 5 girls) and 10 in the control group (6 boys, 4 girls). The karate group was given karate training in addition to physical education classes one day a week for 6 weeks, while the control group only attended physical education classes and continued their daily lives. This study followed ethical standards and received approval from the Gazi University with reference number (Approval Number: 2023 - 1052). For this study, the necessary permissions were obtained from the Mitat Enç Secondary School for the Visually Impaired administration and the parents of the students from with informed consent for the participants. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Data Collection Tools

The "10 m Walking Test Scale" was applied to the students who voluntarily participated in the study.In the 10 m Walking Test; 10-meter-long starting and ending lines were drawn, a thin rope was placed on the 10-meter walking line, and visually impaired individuals were made to feel the ground with their soles. To prevent differences in vision levels from affecting the study, the tests were performed without glasses and with goalball goggles. In this way, the effect of the subjects' vision on their walking skills was also tried to be revealed. Each subject crossed the starting line on command and the time was started. The subjects recorded in seconds. In addition, the length and number of steps taken by the subjects during walking were also recorded. Step lengths were calculated in cm by dividing the number of steps by 10 m.

Ex: Number of steps taken by the subject 30

1000 cm (10 m) / 30 steps = 33.3 cm (step length)

These measurements were administered to individuals who voluntarily agreed to participate in the study under the supervision of experts in the field in a suitable ground and environment. In the application phase of this test for the visually impaired, an audible stimulus was given using a rattle and the subjects were asked to move towards the audible stimulus.

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Inclusion Criteria for the Study

a) The participant has a visual impairment

b) The participant must be between the ages of 10 and 14.

c) Not having any other disability related to visual impairment.

Exclusion criteria

walked to the finish line at an average walking speed and the time was terminated when they crossed the finish line. The elapsed time was

a) No physical injury or surgery in the last 6 months.

b) Not to have participated in more than 2 workouts.

Limitations

At the beginning of the study, 12 people were included in the control group and 14 in the karate group. However, 2 people from the control group and 4 from the karate group were excluded from the study due to not participating in more than 2 studies and health problems.

Data Analysis

SigmaPlot 11.0 program was used for data analysis. In the pre-and post-test comparisons, the Paired t-test was used for normally distributed data, and the Wilcoxon test was used for non-normally distributed data. A t-test was used to compare normally distributed data in two independent groups, and the Mann Whitney-U Test was used to compare non-normally distributed data.

RESULTS

Table 1: Analysis of Pre and Post-Test values of karate and control groups for 10 m walking with and without glasses

10 m Walk Test Parameters		Control					Karate				
		Mean		SD			Mean		SD		
		Pre Test	Post Test	Pre Test	Post Test	p	Pre Test	Post Test	Pre Test	Post Test	p
Walking Time with Glasses	(sn)	19,150	19,160	5,707	5,714	0,092	17,547	15,503	2,377	2,249	**0,001**
Walking Time without Glasses	(sn)	19,460	19,448	5,814	5,788	0,412	18,055	15,606	2,124	2,214	**0,001**
Number of Steps with Glasses		29,750	29,750	1,708	1,258	1,000	28,600	26,500	4,248	3,923	**0,001**
Number of Steps without Glasses		30,000	30,750	1,633	1,500	0,215	29,100	25,200	4,841	4,131	**0,001**
Step Length with Glasses	(cm)	33,650	33,650	1,905	1,905	1,000	35,770	38,290	5,011	5,367	**0,001**
Stride Length without Glasses	(cm)	32,525	32,525	1,595	1,595	1,000	34,450	37,560	6,047	6,211	**0,001**

(p<0,05)

When the pre-test results of the 10 m walking test with and without goggles for the Karate and Control Groups were analyzed, no statistical significance was found between the pre-test values. When the post-test values were analyzed, a statistical significance was found in all parameters of the Karate group except the step length parameter. In contrast, no statistical significance was found in any control group parameter.

Table 2: Intragroup comparison of 10 m walking Pre-Post Test values of control and karate groups

10 m Walk Test Parameters		Pre Test					Post Test				
		With Glasses		*Without Glasses*			*With Glasses*		*Without Glasses*		
		Mean	*SD*	*Mean*	*SD*	*p*	*Mean*	*SD*	*Mean*	*SD*	*p*
Karate Gr. Walking Time	(sn)	17,547	2,377	18,055	2,124	0,089	15,503	2,249	15,606	2,214	**0,001**
Karate Gr. Number of Steps		28,600	4,248	29,100	4,841	0,485	26,500	3,923	25,200	4,131	**0,002**
Karate Gr. Stride Length	(cm)	35,770	5,011	34,450	6,047	0,245	38,290	5,367	37,560	6,211	0,450
Control Gr. Walking Time	(sn)	19,150	5,707	19,460	5,814	0,268	19,160	5,714	19,448	5,788	0,125
Control Gr. Number of Steps		29,750	1,708	30,000	1,633	1,000	29,750	1,258	30,750	1,500	0,092
Control Gr. Stride Length	(cm)	33,650	1,905	32,525	1,595	0,080	33,650	1,905	32,525	1,595	0,080

(p<0,05)

When the pre-test and post-test results of the 10 m walking test with and without glasses in the control group were analyzed, no significant difference was found in any parameter. In contrast, statistical significance was found in all parameters between the pre-test and post-test values of the Karate group.

Table 3: Intergroup Comparison of 10 m Walking Pre-post Test Values of Karate and Control Groups

10 m Walk Test Parameters		Pre Test					Post Test				
		Mean		*SD*			*Mean*		*SD*		
		Control	*Karate*	*Control*	*Karate*	*p*	*Control*	*Karate*	*Control*	*Karate*	*p*
Walking Time with Glasses	(sn)	19,150	17,547	5,707	2,377	0,456	19,160	15,503	5,714	2,249	0,099
Walking Time without Glasses	(sn)	19,460	18,055	5,814	2,124	0,503	19,448	15,606	5,788	2,214	0,086
Number of Steps with Glasses		29,750	28,600	1,708	4,248	0,616	29,750	26,500	1,258	3,923	0,138
Number of Steps without Glasses		30,000	29,100	1,633	4,841	0,728	30,750	25,200	1,500	4,131	**0,025**
Step Length with Glasses	(cm)	33,650	35,770	1,905	5,011	0,436	33,650	38,290	1,905	5,367	0,088
Stride Length without Glasses	(cm)	32,525	34,450	1,595	6,047	0,551	32,525	37,560	1,595	6,211	0,144

with and without Glasses

(p<0,05)

When the pre-test results of 10 m walking with and without glasses for the karate and control groups were analyzed, no statistical significance was found between the two groups. When the post-test results of the karate and control groups were analyzed, there was a statistical significance between the two groups only in the number of steps variable. In contrast, no statistical significance was found in any other variable.

DISCUSSION

The study examined the effect of short-term karate training on walking skills in visually impaired children, and 10 m walking time, step number, and step length parameters of the participants in the karate and control groups with and without glasses were examined. In the pre-tests, there was no significant difference between the two groups in walking with or without glasses. Still, in the post-tests, it was found that there was a significant difference (p<0.001) in favor of walking with glasses in the walking time parameter examined with and without glasses and a significant difference (p<0.002) in favor of walking without glasses in the step count parameter.

Vision helps to make sense of sound and movement experiences, provide motivation, and make sense of the world. Vision provides 80% of the information we receive from the outside (Cengizel et al., 2002). Communication with the environment, proprioception, and body awareness are extremely important for movement. Children with visual impairment are at risk of developmental processes due to learning difficulties because they cannot observe how people perform specific movements and model how they move their bodies while growing up (Mori & Olive, 1978). Postural adaptation limitations seen during gait in children with visual impairment may be due to the lack of vision, an essential motivator for early movement. Compared to the development of the sighted child, the motor development of the visually impaired child is largely dependent on external guidance (Özyürek, 1995). At the same time, visually impaired individuals have different problems arising from lack of movement. Many studies show that visually impaired children's cardiovascular endurance is lower than their sighted peers (Hopkins et al., 1987; Kobberling et al., 1989; Lieberman & McHugh, 2001; Short & Winnick, 1986). Kobberling, Leger, & Jankowski (1989) and Short and Winnick (1986) suggest that children with visual impairment have consistently lower physical fitness than their sighted peers (Kobberling et al., 1989; Short & Winnick, 1986). It is stated that visually impaired children show delays in acquiring movement skills such as rolling and walking, which enable them to change places. They have problems developing posture, gait, trunk, extremity strength, flexibility, motor planning, body rotation, and coordination (Celeste, M. A., 2002; Sundberg, 1982).

Some typical views have emerged in studies on the gait pattern of visually impaired individuals. In a study comparing the stride-time parameters of sighted, later blind, and congenitally blind individuals, it was shown that visually impaired individuals have a slower walking speed, a shorter stride length, and a longer stance duration. These adaptations reflect a strategy to maintain a more stable posture without vision (Hallemans et al., 2011).

Postural stabilization during gait helps to improve motor performance. Reasonable postural control is dependent on good balance skills. Healthy individuals have been observed to compensate for disturbances during locomotor movements through "anticipatory postural corrections," which are known to precede the onset of voluntary movement and use a lateral swing foot placement strategy (Caderby et al., 2014; Roden-Reynolds et al., 2015). In a study conducted by Altunay Arslantekin, Altuntaş et al. (2015), the functional balance of individuals with and without visual impairment (Porro et al., 2005) was compared, and it was determined that the functional balance score was lower in individuals with more visual impairment (Altunay & Akı, 2016; Arslantekin, 2014). Akyol et al. (2017) concluded that sports positively affect balance and walking distance. They stated that visually impaired individuals can become more independent in their daily activities if directed to sports (Akyol et al., 2017).

In some studies in the literature, it has been reported that visually impaired individuals have shorter stride lengths, longer stance phases, slower gait, and less trunk flexion than sighted individuals (Hallemans et al., 2010; Nakamura, 1997; Ranavolo et al., 2011). The study conducted by Porro et al. (2005) found that a significant proportion of visually impaired students could not keep their heads upright while walking and the spine was tilted forward. This may be due to decreased postural tone and negatively affecting shoulder girdle and trunk stability. The study's results support the study conducted by Porro et al. (2005) (Porro et al., 2005). The researchers also observed that the subjects who participated in the study were limited in walking along a straight line. Huri concluded that basic position combinations, weight transfers, and direction changes also influence the vestibular system in many studies. In contrast, basic standing positions are very useful and applicable exercises in the gait training of visually impaired individuals (Huri et al., 2015).

In his study, Suveren concluded that wall-supported exercises positively affected the balance and walking skills of visually impaired individuals. In another study conducted by Suveren and colleagues, it was observed that basic postures positively affected visually impaired individuals. It is among the findings of the study that visually impaired individuals who successfully perform basic postures and combinations have smoother and safer walking skills, as well as increased walking distances, reduced balance losses, and fewer deviations (Suveren-Erdogan, 2018; Suveren-Erdogan et al., 2018). Urhan (2018) applied a 1-mile run-walk-run test to visually impaired children at the end of rope jumping and strength exercises, improving walking times and other findings (Urhan, 2018) .

As a result, the fact that there was a significant difference between the pre and post-tests as a result of the karate (kihon) training applied for 6 weeks in the karate group and that there was no significant difference in the control group shows that the karate training is beneficial for visually impaired individuals. It is thought that there was no significant difference in all parameters in the intergroup comparison related to the functional movement capacity of the participants, obstacle perception problems, the short duration of the study, and the training content. When the literature was examined, it was found that physical activity improves gait, balance, and physical fitness in visually impaired individuals.

It is thought that extending the training duration and enriching the training content with exercises that require space, such as kata, may be more effective on the walking skills of visually impaired individuals.

Conflict of Interest

No conflict of interest was declared by the authors. In addition, no financial support was received.

Ethics Statement

This study was approved by Gazi University and Human Research Ethics Committee (Approval Number: 2023 - 1052).

Author Contributions

Planned by the authors Study Design- CS; Data Collection- CS,YA,SA; Statistical Analysis – YA,CS; Data Interpretation- YA,SA; Manuscript Preparation- CS,SA; Literature Review- YA,SA. The authors have read and accepted the published version of the article.

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