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CANINE-ASSISTED THERAPY AND THE IMPROVEMENT OF PHYSICAL CHARACTERISTICS IN DISABLED CHILDREN: A PILOT STUDY

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Keywords: animal-assisted therapy, canitherapy, dogs, physiotherapy, disability, children, pediatrics.

Summary

Materials and methods. Three groups of mentally disabled children of different age participated in dog-assisted therapy sessions twice per week for two months. Motor skills evaluation was based on the Bruininks-Oseretsky motor skills evaluation test (short version). Isometric torso muscle endurance tests were based on Ito, McIntosh and McGill. The ability to focus and memorise exercises and the ability to understand and perform them was also evaluated.

Results. Movement perception and performance, as well as ability to focus and memorise the movement sequel improved after canine-assisted exercise sessions. The most significant changes in performance were observed in the torso muscle static endurance test, push-ups, fine motor skills, and coordination ($p<0.001$).

Conclusion. Dogs can be successfully used as motivation for the performance of various task or to lower psychological tension and anxiety during exercise sessions. It is hoped that the results of this study will be used for the development of formal dog-assisted therapy guidelines for use in physical therapy with mentally disabled children.

Introduction

Animal-assisted therapy (AAT) and its positive outcomes on various physical and mental qualities have been highlighted and applied worldwide over the past two decades. The benefits of this type of therapy have been observed among people of varying gender, health state, and age. Dogs are the most commonly used animals for the purpose of improving human wellbeing, particularly among children, which receive both inpatient and outpatient treatment in hospitals and are typically the focus population of existing research. Studies have shown that, in presence of therapy dogs, children with various developmental disorders can concentrate easier and that their playfulness increases. Notably, such an effect could not be mimicked with an artificial dog or other toy [1]. In another study examining the social outcomes of AAT, animal interventions affected the improvement of communication and increased socialisation among people with intellectual disabilities [2, 3]. AAT does not only help with essential daily life and communication skills. Additionally, mentally and physically disabled children learned how to cope with unpleasant feelings and used their bodies better [4]. The positive effects of dog-assisted therapy can also aid in helping children with autism spectrum disorder and can even increase their interest in school attendance [5, 6]. Some previous studies focused on single-case reports when working with intellectually disabled children [7]. In other cases, dog-assisted therapy was applied to healthy children school surroundings and universities [8-12]. However, the demand for service animals in classes for children with special needs is also rising [13]. As such, the present study explores the effectiveness of integrating dog-assisted therapy into school curriculums for children with different disabilities, as well as the outcomes it has in motivating children to improve their physical condition.

The aim of the present study was to evaluate whether dog-assisted therapy sessions integrated into the curriculum of a school for mentally disabled children can benefit the outcomes of physical therapy.

Materials and methods

Participants. The present study was performed at a public school in Kaunas, Lithuania, where several classes were specially integrated for mentally or physically disa-

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bled children. The children selected for the present study had a medically proven disability such as Down syndrome, cerebral palsy, intellectual disability, or autism spectrum disorder. Children were divided to three groups according to their age and the class they attended at school. Group No. 1 consisted of 11 children aged 9-11 (8 males and 3 females). Group No. 2 consisted of 10 children aged 18-19 years (3 males and 7 females). Lastly, Group No. 3 consisted of 7 children aged 11-13 years (2 males and 5 females).

Procedure. Exercise sessions with dogs were held twice a week, with each session lasting 45 minutes. The sessions spanned two months, for a total of 16 sessions per group. Consent was gained from the parents of each child. Parents also completed questionnaires that provided information regarding their child's health condition (e.g., any contraindications for dog-assisted therapy). Safety precautions were taken seriously, with each session beginning with a reminder for children about safety rules when communicating with animals. They were also reminded to wash their hands after each session.

A total of six dogs and their handlers participated in the study. Various dog breeds were used, which are presented in Table 1. The dogs ranged from 2 to 10 years in age, while their experience in animal-assisted therapy ranged from 1 to 7 years. All dogs were vaccinated, dewormed, and periodically checked by veterinarians. The selection of a particular dog for each session was based on the psychological and physiological qualities of each individual dog (size, speed, known commands) and the state of the dog's health. Dogs No. 1, No. 4, and No. 5 participated most often because they were more tolerant to the workload, had more experience in dog-assisted therapies, and could learn new commands for sessions more rapidly.

The purpose of each dog differed according to the task. In static tests, a dog would "help" children to maintain a balanced body position (e.g., supporting a leg). When performing the static back muscle endurance test, a dog would have to lay on the buttocks of the child, thereby supporting the lower part of the child's body. During active tasks such as fine motor exercises, push-ups, or the movement perception test, the dog was considered as motivation to act; if the child performed the movements correctly, he could give a command to the dog and reward it with a treat himself—thus obtaining the positive feeling of "being in control". For balance tests, the dogs would perform the task alongside the child—even sitting or standing in a similar way. When children had to memorise the sequence of exercise movements, a dog was included in that sequence (Table 1).

Measures. The participants were evaluated twice—before and after two months of sessions. Motor skills evaluation exercises for children were based on the Bruininks-Oseretsky motor skills evaluation test (short version) and isometric torso muscles endurance tests based on Ito, McIntosh and McGill [14, 15, 16]. Notably, the ability of each child to understand and perform the exercises was considered; therefore, some adjustments were made to make the tasks easier for children. The following portions of the Bruininks-Oseretsky test were used: a test of balance while standing on one foot, fine motor skills test, bilateral coordination test, upper limb coordination test (with a tennis ball), and a test of strength while performing push-ups.

Balance test. The participant must stand on one leg, holding their arms at their hips or sides, while the free leg is bent and held Standing time is measured using

Table 1. Characteristics of dogs.

Dog number / Characteristics	**1**	**2**	**3**	**4**	**5**	**6**
Breed	Mixed-breed	Mixed-breed	Chihuahua	Siberian husky	Siberian husky	Brabant griffon
Gender	Male	Male	Female	Male	Male	Male
Age (in years)	4	3	3	7	10	2
Experience in therapy (years)	3	1.5	2.5	6	7	10

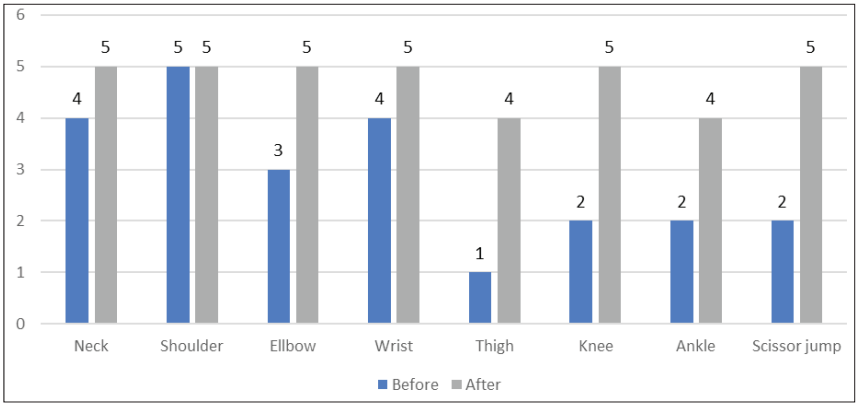

Figure 1. Medians of movement perception and performance before and after AAT sessions.

a chronometer, and the exercise is terminated if the child places the bent leg on the ground—or after 15s.

Fine motor skills test. The participant must place as many flat, coin-shaped circles into a special tray as they can during 15s. The exercise is stopped after 15s, and the amount of correctly placed circles is counted.

Bilateral coordination test. The arm and leg of a chosen side are placed in front, as if the person is walking (arm held high). The arm and leg of the opposite side is placed in the opposite direction. After the signal, participants jump up and have to change the direction of their hands and legs into the opposite one. The movement is correctly performed if the arm and leg of the same side are moving in sync and no additional moves are made. The exercise is counted until five correct movements.

Ball test. The participant holds a ball in their hand in front of them. After the signal, the child throws the ball down and beats the ball back with the other hand. The movement is then repeated with the opposite hand throwing and the other one beating the ball. The movement is incorrect if the participant does not switch hands, catches and holds the ball, cannot beat back the ball, or the ball falls somewhere else. A maximum of ten correct movements are counted.

Push-ups (evaluation of power). This movement is performed either from a plank position or facilitated one (knees and elbows on the ground). Time is measured using a chronometer for 30s. Movements are held correctly if the participant's pelvis and thighs do not touch the ground and the body is held straight. After the allotted time, the quantity of correctly performed push-ups is counted.

Static back muscle endurance test. During this exercise, support for lumbar lordosis was used in order to avoid placing too much load on the lumbar portion of the spine when stretching. The child lays down on their abdomen and must lift their chest and arms from the support with their arms held behind their head. This position is maintained as long as possible and until the participant can comfortably breathe. The elevation angle, which is formed between the body and horizontal line, must be approximately 15°. When the participant deviates ± 10°, the exercise is stopped. Static back muscle endurance is measured using a chronometer. Maximum duration of the exercise is 300s.

Side muscle endurance test. The participant must lay on their side in a such way that the upper leg is in front and the lower leg is behind (position similar to walking), the legs are straight, and the upper hand is placed on the opposite shoulder. The lower hand is bent over the elbow at 90° and the body is lifted from the ground. This position must be maintained as long as possible, and the test ends when the participant can no longer maintain the position and places their pelvis on the ground. Once one side of the body is measured, the same test is then applied on the opposite side.

Plank test. The participant must lay down, facing the ground. The participant must lean on their toes, while their elbows must be flexed to 90° with their legs straight. The test is completed when the participant cannot maintain their position any longer. The duration that the position was maintained for is measured with a chronometer, for a maximum of 15 s.

Memory and ability to focus. A scale from 1 to 6 was used for the evaluation of this ability: 1 point - child does not hear the instructions and begins performing the task immediately. 2 points – child hears the instruction but cannot remember the beginning. 3 points - remembers one

Table 2. Evaluation of movement perception of ability to perform.

		Median	Minimum	Maximum	P value
Neck	Before	4	1	5	<0.001
	After	5	4	5	
Shoulder	Before	5	1	5	0.180
	After	5	3	5	
Ellbow	Before	3	1	4	<0.001
	After	5	1	5	
Wrist	Before	4	1	5	<0.000
	After	5	3	5	
Thigh	Before	1	1	4	<0.001
	After	4	1	5	
Knee	Before	2	1	4	<0.001
	After	5	1	5	
Ankle	Before	2	1	2	<0.001
	After	4	1	5	
Scissor jump	Before	2	1	4	<0.001
	After	5	1	5	

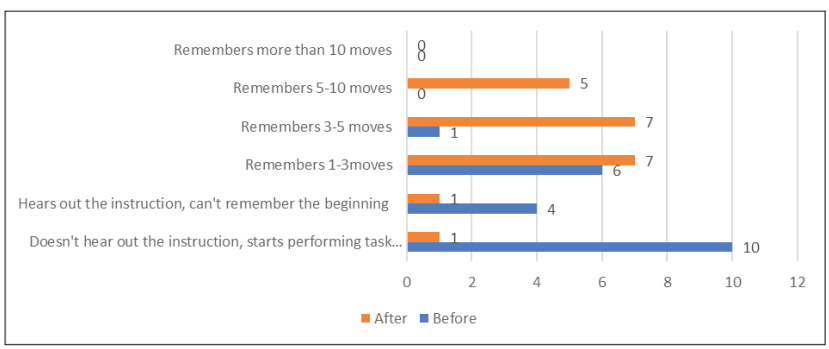

Figure 2. Childrens' ability to focus and memorize the movement sequel.

to three moves; 4 points - remembers three to five moves; 5 points- remembers five to ten moves; 6 points - remembers over ten moves.

Movement perception and ability to perform. A scale from 1 to 5 was used for the evaluation of this ability: 1 point - child cannot understand the move, and there are no attempts to perform it; 2 points - child cannot understand the move and performs it incorrectly; 3 points - child understands the move, attempts to perform it, and fails. 4 points - child understands the move and performs incorrectly or with help; 5 points - understands the move, performs incorrectly.

Data analysis. Statistical analysis of the data was performed using IBM SPSS(Statistical Package for the Social Sciences) 17.0 Software. Wilcoxon criteria and McNemar criteria were used. The results were considered statistically significant if p values were <0.05.

Results

The abilities of children were re-evaluated after two months of exercise sessions. Before secondary testing, the exercises were once again explained, and an example of moves was shown. Dogs were also present during the secondary evaluation.

An evaluation of children's ability to perceive and perform specific moves before and after AAT sessions is presented in Figure 1. The highest median value before the exercises with the assistance of dogs was observed for shoulder movement (min.1, max.5), while the lowest was for thigh movement(min.1, max.4). Following the completion of the AAT sessions, the resulting median values were higher for the neck, shoulder, elbow, wrist, knee, and scissor jump movements. Only the ankle and thigh movement median values remained below the maximum score; however, these improved to a score of 4. The results indicate that there were still some movements in the AAT sessions for which the minimum score did not changed, thereby suggesting that some children still could not cope with the perception and performance of the given moves. Moreover, exercises where the minimum values remained identical included the elbow, thigh, knee, ankle and scissor jump movements. Minimum scores for neck, shoulder, and wrist movements changed, with the lowest score (3) among them indicating that, after the AAT sessions, all of the movements were understood, and only performance abilities differed. As observed in Table 2, the difference in median values before and after AAT significantly differed among all movements, with the exclusion of the shoulder movement only.

Results related to children's ability to focus on instructions and memorise movement sequences are presented in Figure 2. These results indicate that, before AAT, most of the children had issues even focusing and listening to instructions. Ten of them could not listen to the instructions, while six remembered only one to three moves, and four of them managed to hear the task but could not remember it. Following AAT, the children could manage most movements better (seven children in both groups) by either remembering one to three moves or three to five moves, while five children managed to remember five to ten moves following the AAT sessions. According to these results, the children were divided into two groups for statistical analysis: those who remembered at least some moves and those who could not focus, listen to the instructor, or remember anything. McNemar's test determined that there was a statistically significant difference in proportion of children in these two groups before and after AAT sessions ($p<0.001$).

The ability to perform several movements was evaluated with the use of a chronometer, with the maximum duration of the position held being counted in seconds. As seen in Table 3, the majority of mean differences in Bruininks-Oseretsky motor test results before and after AAT are significant, including fine motor skills, coordination, and push-ups ($p<0.001$). Mean static endurance of the torso muscles also increased

Table 3. Bruininks-Osteresky and static endurance and test results before and after AAT sessions.

Test		Mean	Std deviation	p value
Fine motor skills	Before	2.48	0.349	<0.001
	After	5	0.42	
Coordination	Before	0.95	0.368	<0.001
	After	3.33	0.311	
Balance	Before	2.14	0.475	0.001
	After	5.1	0.819	
Ball test	Before	1.19	0.235	0.003
	After	2.19	0.29	
Push ups	Before	1.29	0.302	<0.001
	After	3.05	0.439	
Back muscle static endurance	Before	3.1	1.478	0.001
	After	7.43	1.956	
Torso muscle static endurance	Before	9.38	3.054	<0.001
	After	19	4.021	
Plank test	Before	7.95	3.139	0.004
	After	13.95	4.433	
Lateral right muscle endurance	Before	3.48	1.061	0.001
	After	8.38	2.001	
Lateral left muscle endurance	Before	4.71	1.488	0.012
	After	8.57	1.798	

significantly after the sessions with dogs ($p<0.001$). The lowest observed changes in the ability to perform was noted for the lateral left muscle endurance test ($p=0.012$) and the plank test (position maintenance; $p=0.004$).

Discussion

The aim of the first exercise session with dogs was to determine whether all participants of the study were able to follow instructions and perform the required exercises. During the warm up exercises, it was noted that many children could not understand neck or elbow movements and the rotation of lower limb joints. Also, nearly all participants could not understand the scissor jump. Some children had disabilities that could have affected the performance of these tasks (e.g., spasticity of the lower limbs, muteness).

Improvement of test results were observed among the other participants, which is congruent with the results of other studies claiming that dog-assisted therapy can be used as a tool for concentration improvement and proper social behaviour development [1, 4, 17]. The results of the primary testing indicated a lack of motor skill development among the children. When evaluating the perception of movement, most children could understand and perform movements of the upper limbs better than those of the lower limbs. Significantly reduced ankle mobility was noted, which is a common sign of diseases such as cerebral palsy, autism spectrum disorder, and intellectual disability [18-21].

Differences between primary and secondary testing among all groups confirmed the hypothesis that dog-assisted therapy sessions implemented in education facilities can improve the motor and physical skills of mentally disabled children [17, 22-24]. Dogs were not only motivating children to perform, but also helped to lower pressure, tension, and anxiety due to performance difficulty, group inner conflicts, and individual qualities. After only a short intervention with the animals, participants were more likely to demonstrate socially appropriate behaviours, a lower occurrence of non-desirable behaviour episodes, and improved motivation to perform the tasks. Such findings were also noted in previous studies [1, 5, 25, 26]. Since we focused on the evaluation of physical abilities, positive outcomes in emotional and social qualities were observed and evaluated subjectively. However, other researchers have also highlighted the positive outcomes of dog-assisted therapy in terms of verbal and non-verbal communication as well as social development (Berry et al., 2013). Notably, according to previous studies, implementing such AAT practices into daily school life could benefit autistic children more than having a dog in the household from an early age [26]. Moreover, the application of dog-assisted therapy sessions with mentally and physically disabled children improved their social response, making desirable behaviours more prevalent [27, 28].

The positive effect of dog-assisted therapies was also observed among children with autism spectrum disorder [5]. Improvements in social development, verbal and non-verbal communication, as well as the reduced occurrence of autostimulation episodes and aggression outbreaks were also noted [7, 17]. Furthermore, eye contact had improved, and smiling as a response to pleasant communication occurred more often [26]. The effect of using a real dog in this context surpasses the effect of a robotic equivalent [29].

While the present study has provided strong evidence on the benefits of using dogs for AAT, this research has some limitations. Firstly, only dog-assisted therapy was used, with no comparison to other therapy methods. Also, a variety of study designs among similar studies reduce the possibility of comparing outcomes on the physical wellbeing of mentally and physically disabled children. As previously mentioned, some of the disabilities could also affect the perception and performance of tasks. Since the disabilities of children in different groups varied, we decided to examine the results of movement perception and performance tests for all the children combined, and did not compare them among the three groups, thus opening the effects of age differences for discussion. However, similar limitations were observed in previous studies [4]. As such, further research on these specific features in the context of animal-assisted therapy is needed.

Conclusion

In the present study, the most significant changes were observed for the torso muscle static endurance test, push-ups, fine motor skills, and coordination. The results for children with severe movement disorders and significant communication and information perception difficulties improved less than that for other portions of the group. However, it is evident that dogs can be successfully used as a motivation for improving the performance of various tasks and lowering tension and anxiety during sessions. The strongest aspect of this study is that we identified the tasks which dogs were most efficient at improving; as such, these tasks could be included in sports classes or physical therapy programmes in schools. It was also determined which movement tests are suitable when evaluating therapy effect. It is hoped that the results of this study will be used in the development of formal dog-assisted therapy guidelines for mentally and physically disabled children in the future.

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KANITERAPIJA IR NEĮGALIŲ VAIKŲ FIZINĖS BŪKLĖS GERINIMAS: BANDOMASIS TYRIMAS

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Raktažodžiai: gyvūnų asistuojama terapija, kaniterapija, šunys, kineziterapija, negalia, vaikai, pediatrija.

Santrauka

Tikslas. Šio tyrimo tikslas buvo įvertinti, ar terapiniai užsiėmimai su šunimis, integruoti į psichikos negalią turinčių vaikų ugdymo programą, gali pagerinti kineziterapijos užsiėmimų rezultatus.

Metodai. Trys skirtingo amžiaus psichikos negalią turinčių vaikų grupės du mėnesius per savaitę dalyvavo šunų terapijos užsiėmimuose. Motorinių įgūdžių vertinimas buvo grindžiamas „Bruininks-Oseretsky“ motorinių įgūdžių vertinimo testu (trumpąja versija). Izometriniai liemens raumenų ištvermės testai parengti pagal Ito, McIntosh ir McGill. Taip pat buvo vertinamas vaikų gebėjimas susikaupti ir įsiminti pratimus bei gebėjimas juos suprasti ir atlikti.

Rezultatai. Judesių suvokimas ir atlikimas, taip pat gebėjimas susikaupti ir įsiminti pratimų seką po užsiėmimų su šunimis pagerėjo. Reikšmingiausi fiziniai pokyčiai buvo pastebėti atliekant liemens raumenų statinės ištvermės testą, atsispaudimus, smulkiosios motorikos ir koordinacijos testus ($p < 0{,}001$).

Išvados. Šunys gali sėkmingai būti naudojami kaip motyvacija atlikti įvairias užduotis arba sumažinti psichologinę įtampą ir nerimą mankštos metu. Tikimasi, kad šio tyrimo rezultatai bus panaudoti formuojant oficialias kaniterapijos gaires, skirtas naudoti kineziterapijos su psichikos negalią turinčiais vaikais metu.

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