

Patient Report

Effects of swimming training on physical fitness and water orientation in autism

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Key words autism, swimming, water orientation.

Autism is a severely incapacitating condition that typically appears during the first 3 years of life and is characterized by severe communication and other developmental and educational problems. Children with autism generally demonstrate poor motor skills. Consequently, rehabilitation programs should emphasize fundamental motor skills and patterns of movement, individual games and sports, and developmental activities that increase physical proficiency.^{1,2} An important goal is to help autistic children to develop responses to stimuli in the environment. Swimming pool activities have been found to be successful in this regard.³ The therapeutic use of water activities or swimming with autistic children is believed to facilitate language development and self-concept, and to improve adaptive behavior and provide an appropriate setting for early educational intervention.⁴ While the literature indicates that many autistic children respond well to swimming activities; there are no reports about the effects of swimming on autistic children's motor performance and physical fitness.

The purpose of this study was to determine the effects of water exercises and swimming on motor performance and physical fitness, and to observe the behavior of an autistic subject as he becomes familiar with the pool, and to observe the development of beginner swimming skills in children with autism.

Methods

The subject was selected from Handicaps Search Institute of Anadolu University in Turkey. The child's parents gave their

written consent for the child to participate. The subject was 9-years-old. The following tests were performed to assess children.

Tests related to physical fitness:

Six minute walking test: This test was used to determine the peak VO₂.

Balance: Standing balance on right and left foot – eyes open and closed was assessed.

Thrust test: This test was used to assess agility.

Standing broad jump: This test was used to determine the power.

Grip strength: The hand dynamometer was used to measure grip strength.

Muscle strength: Shoulder flexion (right-left) and knee extension (right-left) strength were measured.

Speed: For speed 22.86 m running test was applied.

To assess the flexibility sit and reach test, body lateral flexion test (right-left) and body hyperextension tests were used.

Aquatic Orientation Checklist³

This checklist was used as an observational tool to record water orientation and beginner swim skills. Water orientation was observed according to the following four items: (i) walking toward pool; (ii) touching the water; (iii) water entry; and (iv) sitting or attaining a horizontal position in the water.

Each aquatic orientation checklist item was rated using a behavioral scale. The following definitions were used in the behavioral scale.⁴

Spontaneous: A behavior that is observed prior to the instructor's verbal directions.

Voluntary: A behavior showing the subject's compliance with the instructor's verbal directions.

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Received 8 May 2003; revised 4 November 2003; accepted 29 January 2004.

Demonstration: Instructor uses verbal and visual cues to describe a specific task.

Manipulation: Instructor puts subject's body through a movement which corresponds to a desired task, and manipulation is accompanied by verbal and visual cues.

Objection: Avoidance of task by absolute non-compliance, tantrum, or activate resistance (i.e. pulling away crying, shouting).

The subject's autistic behaviors were assessed before and after 10 weeks of hydrotherapy application. The tests included stereotypical movement analysis (spinning, swinging, delayed echolalia) and no reaction or late reaction to stimulus within 5 s. The measurement of the duration of stereotypical autistic movements and reaction to stimulus was made using a 45 min video camera recording before and after the hydrotherapy sessions.

The Halliwick Method was used as for the hydrotherapy application.⁵ This method is based on known scientific principles of hydrodynamics and body mechanics, and is divided into four phases: adjustment to water, rotations, and control of movement in water and movement in water. The swimming education program was conducted over 10 weeks, three times weekly for 60 min each session. The assessments were performed before and after the 10 weeks training.

Table 1 Physical fitness scores before and after training

Fitness tests	Before	After
Peak VO ₂ (mL/kg/min)	20.33	20.69
Grip strength (kg)	9.4	12
Shoulder flexion strength (right) (kg)	10.1	13.2
Shoulder flexion strength (left) (kg)	8.3	11.2
Knee extension strength (right) (kg)	15.1	24.3
Knee extension strength (left) (kg)	12	15.1
Body lateral flexion (right) (cm)	10	14
Body lateral flexion (left) (cm)	9	12
Body hyperextension (cm)	9	29
Sit and reach (cm)	-5	0
Balance – open eyes (right) (s)	12.9	46.19
Balance – open eyes (left) (s)	8.92	21.16
Balance – close eyes (right) (s)	12.72	16.59
Balance – close eyes (left) (s)	2.33	10.69
Agility (thrust) (point)	10	13
Standing broad jump (cm)	104	110
Running 22.86 m (s)	7.47	5.88

Table 2 Autistic behaviors of the case over a 45 minute before and after swimming training

	Duration of stereotypical movements			No reaction to stimuli (number)
	swinging	spinning	delayed echolalia	
Before hydrotherapy	7 min	2 min	4 min	12
After hydrotherapy	5 min	0 min	2 min	6

Results

After the 10 weeks swimming training; the balance, speed, agility and power scores increased. Also, the hand grip, upper and lower extremity muscle strength, flexibility and cardio-respiratory endurance increased (Table 1). The water orientation was assessed by aquatic orientation checklist. It was found that the child oriented to the water after the swimming training (Fig. 1). After the hydrotherapy, the amount of stereotypical autistic movements (spinning, swinging and delayed echolalia) decreased (Table 2).

Discussion

The results of this study showed that swimming training and water exercises were effective for the development of physical fitness and water orientation capabilities of an autistic subject. The autistic child's apparent interest in water activities has led to the suggestion that swimming can be a valuable addition to education programs as it is both enjoyable for the subject and contributes to motor development.^{6,7}

The study of Best and Jones used swimming as a major component of movement therapy research on three autistic children.⁴ The subjects participated in an individualized swim program which utilized manipulation, imitation, commands and self-motivation in an unspecified way to measure progress. It was reported that over a period of 15 weeks the subjects improved in confidence and body awareness.⁴ The study of Killian *et al.* investigated the effects of swimming training on water orientation in autistic children. They

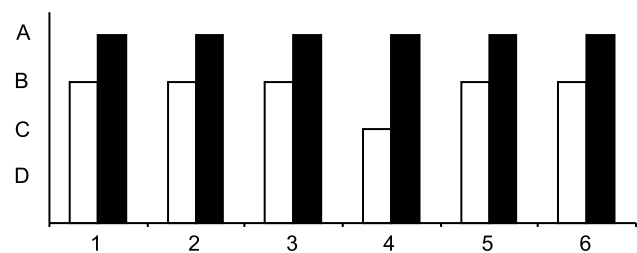


Fig. 1 Measuring water orientation. 1, Walks to pool; 2, touches water; 3, enters pool; 4, sits etc. in pool; 5, blows bubbles; 6, face submersion. A, spontaneous; B, voluntary; C, manipulation; D, objection.

reported that swimming pool activities may offer potential learning opportunities for many autistic individuals.³ In our study we found that swimming training was effective on water orientation. The subject's spontaneous movements decreased as aquatic orientation tasks grew more difficult, and objection responses increased as the degree of difficulty increased. The results of the present study are similar to the results of the previous studies.

To our knowledge there are no previously published reports in the literature about the effects of swimming on physical fitness in autistic children. The study of Yilmaz reported that hand grip strength increased after water exercises in children with mental retardation.⁸ The study of Bumin *et al.* investigated the effects of hydrotherapy application in a girl with rett syndrome. Yilmaz reported that after the hydrotherapy application stereotypical hand movements decreased and purposeful hand functions and feeding skills increased.⁹ In our study we applied swimming training for 10 weeks. It was found that the child's upper and lower extremity and grip strength increased. Flexibility, cardiorespiratory endurance, balance, agility and power also increased in the child. In the case described here, the amount of stereotypical autistic movements decreased after hydrotherapy. The results of the present study are similar to the results of the previous studies. In conclusion, we found that swimming training is effective for development of physical fitness and water orientation in autistic children. The effects

of swimming training on physical fitness in autistic children should be investigated using more subjects. We are continuing to research this topic.

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