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SWIMMING THERAPY FOR SCHOOL CHILDREN WITH FUNCTIONAL SPINAL CORD DISORDERS AND ASTHMATIC SYMPTOMS

DÁNIEL LŐKÖS[1], ISTVÁN GYENE[2], KORNÉL SIPOS[1], LÁSZLÓ TÓTH[1] & PÁL HAMAR[1]

ABSTRACT. The first author, a physiotherapist, has organized swimming therapy sessions and has taught elementary school children to swim in satellite settlements of Budapest (Fót, Dunakeszi and Erdőkertes) and Újpest (the fourth district of Budapest) for more than ten years. The applied teaching method has been built on previous studies at Semmelweis University, Faculty of Physical Education and Sport Sciences and the special method of group swimming therapy for children under eighteen years by Jády (2002). According to the *"Will-model"* „Akarat-modell" (Gyene, 2006), the following question was investigated: How do standard psychomotor tests including rhythm change running, boomerang running, balance test on one foot & obstacle course (Farmosi and Gaál S-né, 2007), as well as physical self-concept and motivation skills, differ from each other, and from body mass index, in a homogeneous group of children of decimal age, who take part or do not take part in swimming therapy sessions because of their functional spinal cord disorders? In this article it is reported that after 18 months, in 2011, the follow-up research revealed some changes in the variables of the former study for the group taking part in swimming therapy and the control group without functional spinal cord disorders not taking part in swimming therapy.

Keywords: sport therapy, therapeutic swimming, anxiety, motor abilities, physical self-concept, follow-up examination

Introduction

Development of swimming therapy

Swimming therapy (STH) started with swimming education organized for asthmatic patients in Hungary in the 1970s. The "Akarat-modell" (Will-model)

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STH educational program worked out by István Gyene, and its innovation – the the breathing function values of asthmatic children who regularly do organization of the sessions during the symptom-free periods of asthmatic patients – has been in use since 1973. The method is extremely effective because sport continue to improve, the number of symptom-free days increase, their medicinal requirements are much less, their stamina improves, and their physical capacity reaches the same level as that of healthy children. (Gyene, 2006)

The two most important factors related to controlling asthma in economic terms are the reduced number of days with symptoms and the consumption of medicines, as the expenses related to asthma are estimated to be higher than the combined costs of TBC and HIV/AIDS (Dobosné Nádházi, 2009). It is a fact that therapeutic swimming has a favourable cost-benefit ratio; its organization does not require much effort, it has no side-effects and the breathing problems caused by loading can be handled by with its use. Based on the successful programs, the National Health Insurance Fund (OEP) made it possible in the 1980s and 1990s to support the treatment of patients with internal, orthopaedic and neurological disorders and help prevent of these diseases.

Jády (1996, 1997) reported that asthmatic people's STH cannot be limited to the teaching process of swimming, as the improvement in the personality characteristics of asthmatic children becomes increasingly necessary because of the psychosomatic character of the illness. Physicians and psychologists pay special attention to the patient's personality and family relationships. It seems to be important to attach a long-term aim: holding a recreation activity program for parents in which they can learn the proportion of the factors influencing the state of health, which are as follows: lifestyle – 43%, genetic factors – 27%, environmental effects – 19%, medical care – 11%.

Personality problems can be decreased with the help of sport. It is important to develop a model for athletes based on positive values, and to display to them the need and respect for sport and training. In addition, discipline and self-control have to be presented as values so that the participants taking part in physiotherapy sessions obtain positive self-esteem. The convincing of parents and the lessening of their anxiety in relation to the fact that their children need physical exercise might be problematic. Therefore, the families of those children taking part in STH sessions are encouraged to join the sessions. (Gyene and Lőkös, 2009)

Parents overprotect their asthmatic kids; they make them feel that even a minimal physical load can cause dyspnoea. Asthmatic children's aims are special compared with those in competitive sports. The special motivation is typically given by the tasks which increase self-confidence in the asthmatic children. (Jády and Szánthó, 1998)

The HRG® (Hydrotherapeutic Rehabilitation Gymnastic) method is a Hungarian rehabilitation procedure that was patented in 1994. It is characterized by a neurological and sensomotor examination preceding its application. The maturity of the children's nervous system can be given in percents with its help, and the profile of existing abilities – partial abilities and defects – can be determined as well. The HRG® training sessions are planned by taking these items into consideration, so the actual maturity level of the individuals is known when the group is created. The regular and sufficiently intensive use of the HRG method with exercise has a positive effect on the normalization of the corpus striatum control of the central nervous system. In line with this, the patterns which are necessary for the successful regulation of behaviour and the development of cognitive functions help the conformation of the positive transfer processes (Lakatos, 1994, 1999).

Effect of therapeutic swimming on quality of life and state of psychomotor skills

Balla (2009) examined the effect of regular physical activity on the endurance and life style of asthmatic children. He proved that complex sport therapy, based on Gyene-type swimming therapy, has a positive effect on the running endurance of asthmatic children. This endurance of swimmers with asthma proved to be significantly better compared to non-swimming asthmatic and healthy children. Balla found that the rate of being overweight and obese was smaller for those who swam compared to non-swimmers.

Weisgerber et al. (2003) examined the effects of swimming on asthmatics and concluded that endurance developing movements executed in the water have a decisively positive effect on treating the symptoms of the illness.

Rosemini (2003) examined the effects of swimming therapy on asthmatics of lower primary school age and those of an adolescent age. He found that the subjective feeling of the symptoms decreased with swimmers of all ages.

Wedderkopp et al. (2004) found a significant decreasing tendency in the level of training-related preparedness, body mass index (BMI) and the time spent doing physical activity compared to the previous years while he was examining children from Denmark and the European Union.

Preliminary results of this study

The results of those participating in school PE lessons in Újpest (4th district of Budapest) in the Bajza Street Primary School (N=93) and two examination groups (the swimming therapy group with functional spinal cord disorders (N=26) and the complex sport-therapy group with functional spinal

cord disorders and asthmatic problems (N=15), differed from each other in two running performances. The therapeutic group's times measures of rhythm change running and the obstacle course showed significantly poorer than the control group's (Group A: rhythm change running, Group B: obstacle course). (Lőkös and Sipos, 2009).

The total therapy group (N=41) reached worse result in rhythm change running test than the control group in the 1st examination. Results of the total sample didn't show gender differences. The boys from the total control sample had significantly better results in the rhythm change running than the girls. To the total sample matched control group had better results in the rhythm change running.

Considering the fact that the results of the children with functional spinal cord disorders taking part in STH sessions didn't lag behind the results of the control group comprised of healthy children, it can be stated as fact that the development of physical and mental health was effectively realized in the carrying out of STH. (Lőkös, 2010)

The aim of the study

Our aim is to present how the rhythm skill, spatial orientation, static balance ability and complex skilfulness, and self-concept of children with functional spinal cord disorders and mild/moderate asthmatic symptoms have changed as a result of the effect of STH and complex sport therapy programs.

The method and sample

In Hungary four to five thousand children under eighteen years of age took part in the STH program, which consisted of special swimming teaching supported by the National Health Insurance Fund (OEP). In the fourth district of Budapest this number was 300-400. With sampling, the first element was to create subgroups for the homogeneous group based on sex, age, health condition, level of swimming skill and the effects of school (for example, PE lessons, school requirements, teachers' personalities). In the first through fourth grades (N=123) of Bajza József Primary School in the fourth district of Budapest, functional spinal cord disorders (functional scoliosis - without spinal cord deformity) and overweight conditions appeared with a high frequency. That is why these characteristics made these students (N=26) suitable for participation in the STH program. Their classmates were also involved in the study; thus, we could create a control group according to gender, decimal age and body mass index. The swimming therapy group members (N=15) with functional spinal cord disorders and asthmatic symptoms were exposed to exciting additional training programs – running, gymnastics, bicycle riding and skiing training – and together with the above-mentioned control group, they were examined twice.

One-four class pupils (N=221) of the Bajza József Primary School in Újpest served as the reference sample of our study.

A) Swimming therapy group (with functional spinal cord disorders);

- 8.5-11 year old boys (N=11);
- 8.5-11 year old girls (N= 15);

B) Complex sport-therapy group "Will-method" (with functional spinal cord disorders and mild/moderate asthmatic symptoms);

- 8.5-11 year-old boys (N= 8);
- 8.5-11 year-old girls (N=7).

The three groups (Group A - swimming therapy group of children with functional spinal cord disorder; Group B - complex sport therapy with swimming therapy for children with asthmatic symptoms and functional spinal cord disorder; and control group (Group C) of healthy children according to gender, decimal age and body mass index) were examined with the following scales:

1. In the Tennessee Self-Concept Scale (TSCS-H) A test, 12 yes-no-I do not know (true or false) answers could be given. After a quick evaluation, the body image of the child can be easily determined. The higher the total scores, the better their self-evaluation was.
2. Standard psychomotor tests – rhythm change running, obstacle course, boomerang running & balance test on one foot.

Skills	Factors	Tests
Coordination	Rhythm skill	Rhythm change running
	Spatial orientation	Boomerang running
	Static balance	Balance test on 1 foot
	Complex skilfulness	Obstacle course

(Farmosi and Gaál, 2007)

Each person was examined twice in a longitudinal examination. Eighteen months transpired between the first and final measurements.

Hypotheses

It was assumed that the following changes would be observed in children with functional spinal cord disorder and asthmatic symptoms taking part in the swimming therapy group after eighteen months:

- their result of the self-concept scale would be more favorable,
- their rhythm skill, spatial orientation, static balance ability and complex skilfulness would improve,

- their results of motor tests, and physical self-concept will be significantly better than those of the healthy control group,
- the complex sport-therapy with running, skiing and cycling camps (Group B) has a more favorable effect on physical self-concept and motor skills than the only swimming therapy (Group A).

Results

The examination repeated 18 months later showed more favorable changes in all motor tests in Group B (N=15). Static balance test differed significantly in both examinations (p<0,003). There was an even more significant difference in self-concept scale (p<0.002), and the greatest difference could be observed in the rhythm change running, obstacle course, and in boomerang running (p<0.000) (Table 1).

Table 1.

Comparison of examinations 1 and 2 results of the complex sport therapy group (Group B)(N=15)

Paired T-test						
Variables	**N**	**Mean**	**SD**	**t**	**df**	**p<**
Rhythm change running (sec) 1	15	5,50	0,27	-6,962	14	**0,000**
Rhythm change running (sec) 2	15	**5,11**	**0,78**			
Obstacle course (sec) 1	15	21,55	2,20	-6,977		**0,000**
Obstacle course (sec) 2	15	**17,07**	**4,25**			
Static balance (sec) 1	15	43,20	17,75	3,572		**0,003**
Static balance (sec) 2	15	**57,13**	**6,69**			
Boomerang running (sec) 1	15	19,65	2,95	-5,860		**0,000**
Boomerang running (sec) 2	15	**16,06**	**4,36**			
Self-Concept Scale: physical self-concept 1	15	27,40	4,03	3,777		**0,002**
Self-Concept Scale: physical self-concept 2	15	**31,60**	**3,96**			
Body Mass Index 1	15	18,34	3,25	-0,065		0,949 n.s.
Body Mass Index 2	15	19,19	2,80			

All scales in the two examinations correlate with each other significantly expect Self-Concept Scale (from p< 0.00 to 0.069) (Table 2).

Table 2.

Test-retest correlation of BMI, physical self-concept scale and motor skills for complex sport therapy group (N=15)

Variables		N	Correlation	Sig.
Pair 1	**Rhythm change running 1/2**	15	.971	.000
Pair 2	**Obstacle course 1/2**	15	.990	.000
Pair 3	**Static Balance 1/2**	15	.722	.002
Pair 4	**Boomerang running 1/2**	15	.962	.000
Pair 5	**Self-Concept Scale: physical self concept 1/2**	15	.481	.069
Pair 6	**Body Mass Index 1/2**	15	.951	.000

The swimming therapy group had significantly better results in all of the psychomotor tests: in rhythm change running ($p<0.000$), in obstacle course ($p<0.003$), in static balance ($p<0.014$) and in boomerang running ($p<0.000$) (Table 3).

Table 3.

Comparison of data of examinations 1 and 2 in swimming therapy group (Group A) (N=26)

Paired T-test						
Variables	**N**	**Mean**	**SD**	**t**	**df**	**p<**
Rhythm change running (sec) 1	26	5,98	0,54	-10,267	25	**0,000**
Rhythm change running (sec) 2	26	**4,88**	**0,63**			
Obstacle course (sec) 1	26	24,13	2,94	-3,314		**0,003**
Obstacle course (sec) 2	26	**22,48**	**2,13**			
Static balance (sec) 1	26	37,30	22,52	2,637		**0,014**
Static balance (sec) 2	26	**49,16**	**16,93**			
Boomerang running (sec) 1	26	20,06	3,28	-6,209		**0,000**
Boomerang running (sec) 2	26	**15,69**	**2,89**			
Self-Concept Scale: physical self-concept 1	26	29,07	3,64	1,663		0,109 n.s.
Self-Concept Scale: physical self-concept 2	26	30,23	3,31			
Body Mass Index 1	26	18,22	3,73	1,254		0,222 n.s.
Body Mass Index 2	26	18,70	3,59			

The positive change displaying all scales in the two examinations correlate with each other significantly (from p< 0. 00 to 0.014) (Table 4).

Table 4.

Test-retest correlation of motor skills, physical self concept and BMI for swimming therapy group (Group A)(N=26)

Variables		N	Correlation	Sign.
Pair 1	**Rhythm change running 1/2**	26	.584	.002
Pair 2	**Obstacle course 1/2**	26	.565	.003
Pair 3	**Static balance (seconds) 1/2**	26	.351	.009
Pair 4	**Boomerang running 1/2**	26	.337	.001
Pair 5	**Self-Concept Scale: physical self-concept 1/2**	26	.486	.014
Pair 6	**Body Mass Index (BMI) 1/2**	26	.869	.000

The total therapeutic swimming sample (N=41) (Group A + Group B) got statistically better results in obstacle course (p<0.004), and in self-concept scale point (p<0,018) than the control group (N=41) (Table 5).

Table 5.

Comparison of the total STH group (N=41) and the control group (N=41) in the 2nd examination

Two-Tailed T-test						
Variables	**N**	**Mean**	**SD**	**t**	**df**	**p<**
Rhythm change running (sec) STH group	41	4,97	0,69	1,945	80	*0,055 n.s.*
Rhythm change running (sec) control group	41	4,68	0,65			
Obstacle course (sec) STH group	41	**20,50**	**4,02**	-2,994		**0,004**
Obstacle course (sec) control group	41	22,95	3,39			
Static balance (sec) STH group	41	52,08	14,49	0,773		0,442 n.s.
Static balance (sec) control group	41	49,58	14,75			
Boomerang running (sec) STH group	41	15,83	3,45	-0,864		0,390 n.s.
Boomerang running (sec) control group	41	16,42	2,65			
Physical self-concept Scale STH group	41	**30,73**	**3,58**	2,419		**0,018**
Physical self-concept Scale control group	41	28,71	3,99			
Body Mass Index STH group	41	18,88	3,29	-0,196		0,845 n.s.
Body Mass Index control group	41	19,04	3,91			

The time of the obstacle course (p<0.002), and self-concept scale points shows an even greater statistical difference (p<0.011) for the complex sport therapeutic swimmers compared to the control group in examination 2. (Table 6)

Table 6.

Comparison of complex sport therapeutic group (Group B) (N=15) and the control group (N=15) in the 2nd examination

Paired T-test						
Variables	**N**	**Mean**	**SD**	**t**	**df**	**p<**
Rhythm change running (sec) STH group	15	5,11	0,78	1,300	28	0,204 n.s.
Rhythm change running (sec) control group	15	4,75	0,74			
Obstacle course (sec) STH group	15	**17,07**	**4,25**	-3,386		**0,002**
Obstacle course (sec) control group	15	22,28	4,18			
Static balance (sec) STH group	15	57,13	6,69	1,424		0,169 n.s.
Static balance (sec) control group	15	51,73	12,99			
Boomerang running (sec) STH group	15	16,06	4,36	-0,359		0,722 n.s.
Boomerang running (sec) control group	15	16,53	2,64			
Physical self-concept Scale STH group	15	**31,60**	**3,96**	2,727		**0,011**
Physical self-concept Scale control group	15	27,67	3,94			
Body Mass Index STH group	15	19,19	2,80	0,104		0,918 n.s.
Body Mass Index control group	15	19,06	4,01			

There was no statistically significant difference between the swimming therapy group (N=26) and the non-swimming control group (N=26) selected by decimal age, gender and body mass index in the motor tests and self-concept scale point (Table 7).

Table 7.

Comparison of swimming therapy group (Group A) (N=26) and the control group (N=26) in the 2nd examination

Paired T-test						
Variables	**N**	**Mean**	**SD**	**t**	**df**	**p<**
Rhythm change running (sec) STH group	26	4,88	0,63	1,433	50	0,158 n.s.
Rhythm change running (sec) control group	26	4,64	0,60			
Obstacle course (sec) STH group	26	22,48	2,13	-1,240		0,221 n.s.
Obstacle course (sec) control group	26	23,34	2,85			
Static balance (sec) STH group	26	49,16	16,93	0,185		0,854 n.s.
Static balance (sec) control group	26	48,32	15,79			
Boomerang running (sec) STH group	26	15,69	2,89	-0,841		0,404 n.s.
Boomerang running (sec) control group	26	16,35	2,70			
Physical self-concept Scale STH group	26	30,23	3,31	0,910		0,367 n.s.
Physical self-concept Scale control group	26	29,31	3,97			
Body Mass Index STH group	26	18,70	3,59	-0,309		0,759 n.s.
Body Mass Index control group	26	19,03	3,92			

Conclusions

The examination after 18 months swimming therapy showed positive changes in motor tests and in self-concept scale result in the examination groups. Group A had better results in psycho-motor tests, the self-concept score didn't change in the second measurement. The complex sport therapy program had more favorable effect than the only swimming therapy, because Group B had better results not only in all of the motor tests, also in self-concept scale. So the first hypothesis proved only in part, but the second hypothesis is certified without limitations.

The total sample (Group A + Group B) got statistically significantly better results in the obstacle course and in the physical self-concept scores compared to the control group. There was no statistically significant difference between Group A and its control group. The complex sport therapy group showed significantly better results in obstacle course and physical self-concept scores than the control group after the 18 months therapy, even took the obstacle course test longer time for Group B before the therapeutic program. The relevant hypothesis was partially justified.

Both the swimming therapy's and the complex sport therapy's aim to help of the development of health-consciousness and personality of children, in most cases, with serious diseases. The joy of the play and exercise is enhanced by the swimming therapy and sport as well. *(www.eduvital.hu/2013.04.03.)*

The exercise is a basic component of the intensive and complex enrichment of the developmental processes in the period of preadolescence. The physically active lifestyle is the fundament of the primer and secondary prevention of diseases such asthma and different orthopedic problems. The collective swimming therapy program has favorable effect on the motor development of the 8-11-year-old school children with functional spinal cord disorders.

In the complex sport therapy group, there was a significant improvement of all examined motor tests in our study. The exercise program was more complex, the improvement of different motor skills shown more expressed development. The spinal cord disorder children's regular attendance the complex sport therapy sessions resulted in complex skillfulness and the positive change of the physical self-concept. The 4th hypothesis was totally proved.

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