Acta Facultatis Educationis Physicae Universitatis Comenianae
Vol. 57 No 1 2017

THE SWIMMING ABILITY OF CHILDREN WITH ASTHMA

Ľubomíra Benčuriková, Matúš Putala

Department of Outdoor Sports and Swimming, Faculty of Physical Education and Sport, Comenius University in Bratislava

Summary: This paper reports on findings of a pilot research to determine the level of swimming ability of children with weak respiratory system aged between 10 – 11 years, who attended special classes for asthmatics. Swimming ability was assessed by 25 m free style swimming test. The results of asthmatics were compared with healthy peers (Benčuriková 2006; Kováčová 2010; Labudová 2011). The results confirmed that the level of swimming capability of asthmatic children, despite their handicap, is significantly higher than their healthy peers.

Keywords: asthma, asthmatic children, common children population, swimming, swimming ability

Introduction

Physical activity of our ancestors for thousands of years was natural because their existence was to a large extent dependent on physical activity. As a result of the development of the means of production and social consciousness, there is a gradual change from the originally prevailing specific work - physical activities for leisure activities, closely linked to entertainment and sport. Awareness of the benefit of physical activity for maintaining optimal health necessary to fulfil the basic needs was continuously carried over and influenced the lifestyle of a human being. The development of different types of physical activities was closely related to material conditions and the environment in which he has been living.

DOI 10.1515/afepuc-2017-0003

Today, a lot of young people in their spare time paradoxically spend hours in front of the television or computer screen, neglecting any physical activity. Lack of physical activity comfortable life becomes the most significant component of spending their free time. In addition, for most of them, school physical and sport education remains as the only option to keep in motion and often the only opportunity to compensate the negative effects of their unhealthy lifestyle.

Lack of exercise is one of the main causes of many civilization diseases, mainly related to functional disorders of the musculoskeletal system, metabolic disorders - obesity, including respiratory weakness and various allergies. The incidence of these diseases was initially characterized by the older generation, but today these factors are constantly shifting to lower age groups.

In this context, one of the ways to improve the physical activity of the younger population is to focus on health-oriented physical education and sports activities. Among them, swimming plays an important role for a long period of time, in terms of width of interest in different age groups as well as social and health groups. Based on the described problem above, the efforts to improve the quality of the physical system of a human are still a problem.

Physical activities in terms of importance of their function and tasks which are involved in the health development of the children population belong to long lasting issues among number of experts and researchers, but with little interest in population with health impairments. According to the authors Kováčová & Medeková (2006) and others, children with respiratory physical weakness were observed with significant problems which ensure the conditions for their physical exercise. These were solved only on marginally because for the difficulty. According to these authors, low undemanding physical activities (watching TV, listening to the music, computer games) dominates in youth asthmatics children's as a spending their free time, more significant than in healthy youth population. Preference of sport disciplines is mostly similar as healthy kids. Among the sporting interests of boys and girls, regardless of health status dominates swimming. Preference swimming in 80 % of asthmatic children is attributed to the effort of doctors who have this physical activity for children with weakened respiratory system recommends as appropriate.

In terms of health importance of aquatic environment for the musculoskeletal system and respiratory system of asthmatics, swimming occupies one of the most important places of

the recommended resources for recreational activities of these weakened populations (Kováčová & Medeková 2006). Swimming in fact meets all the basic requirements of an appropriate body burden of aerobic character. During overcoming the resistance of the water adequate intensity of the cyclic swimming movements stimulates the cardiovascular and respiratory systems of the body. Because of effect of the water pressure on chest and abdomen muscles which is involved in breathing more muscle groups is involved than in normal condition. Resistance to sudden temperature changes in the environment is insufficient in asthmatics and temperature changes pose for asthmatic children organism considerable burden. Low threshold of tolerance to cold is usually resulting to the frequent colds and pneumonia. The movement in the aquatic environment helps develop thermoregulatory abilities, and also harden the body. Most asthmatics tolerate humidity of the indoor pool and warmer air without problems. Breathing air above the water is usually clean, dust-free, with a high concentration of water vapour and contains almost no bronco tropic of exogenous factors.

Even in the recent past, children with bronchial asthma due to concerns about possible complications after the stress was recommended to steer clear up sport. Even at the request of the parents they were relieved the hours of school physical education and sports, because after exercise them "piped in the bronchi," and thus increasing the risk of choking and coughing. The children had often been taken out of children's 'sports' collective, decreasing their condition; many were obese, what their disposition to move even more determined. This creates a vicious circle from which it was difficult to break.

There was talk of "asthmatic personality" - a child living in constant fear of suffocation. Such a child happened to be a loner that only passively looked on the friends those sports outside or in the gym. Collective physical exercise in schools, in the countryside, military exercises, summer camps, skiing was taboo for him.

To understand the mechanisms that trigger an asthma attack (increasing the body burden induced asthma EIA "Exercise-induced asthma") and the subsequent development of treatment brought turnover in the approach to the problem of asthma and sports activities. These were in particular inhaled anti-inflammatory drugs (commons, corticosteroids), and combinations. Long - acting beta - mimetics that managed in an appropriate combination to prevent pathological bronchial response to physical exercise. This requires regular and often lifelong medication. Today has various oral forms of new drugs (antileucotrienes) which

control exercise induced asthma. Using these modern set correctly treatment will allow more patients not only a silent period, but also sport (Mesko 2005).

This is evidenced by the many successful athletes who despite their disability are involved in top sports events. E.g. Slovak canoeist Škantár L., Czech tennis player Kvitova P., Czech decathlete Šeberle R., English footballer Beckham D., English marathon runner Radcliffe P., Norwegian runner jumping Bjørgen M. et al. At the Summer Olympics in London 2012 had the 10,000 participating athletes and 7 % of diagnosed asthma (www.zdravie.sk 2013).

We are currently witnessing great boom of new approaches to sport medically fragile population at the top and recreational levels. Similarly, as developed views on sports asthma, the selection of suitable sports activities for these weakened health population, gradually began to diagnose sports performance of asthmatic athletes.

The deficit of physical activity most children and young people with their negative consequences affect not only the reduction of physical fitness but it may be recorded in the pattern of decline in the swimming capabilities (Macejková & Benčuriková 2007). Swimming - in terms of its high popularity in the population yet represent an important means for improving exercise regimen in promoting health. At the same time the involvement of children and youth, including the physically disadvantaged, swimming expands the potential opportunities for sports and children at a higher performance level.

Aim

The goal was to improve understanding of the level of abilities of the swimming children with weakened respiratory system and the differences with the common population peers. The level of the swimming abilities of children with weakened respiratory system compared with peers of the general population will be significantly lower. Tasks: 1. Find the swimming abilities level of children with weakened respiratory system. 2. Compare the level of swimming abilities of children with weakened respiratory system with common childhood population.

Methodology

The subjects of our research were 4 groups of children from Bratislava basic school students aged 10 – 11 years. 1 file at number 74 (40 boys and 33 girls) were Paediatric asthma who were compared with 3 groups of healthy general population in the same age (Kovacova

2010; Benčuriková 2006; Labudová 2011). Set of two healthy children formed the number 107 (56 boys and 51 girls). Groups 1 and 2 participated in public education event organized by the Association of asthmatics Slovak Republic on the occasion of the International Day of asthma (MDA) in r. 2011. Its aim was to motivate healthy and also children with weakened respiratory system to do sports on regular bases. Third group (Benčuriková 2006) consisted of 214 children (126 boys and 88 girls) who participated in the research as part of monitoring the level of the swimming capabilities of children in Slovakia. Fourth group (Labudová 2011) were 53 children (21 boys and 32 girls) who underwent testing in the evaluation of the swimming capacity of primary school pupils in the year 2009.

Empirical data were processed by basic statistical methods. To detect differences between the monitored indicators, we used Student's t-test. To assess the degree of statistical significance we used Cohen's effect coefficient "d" according to Cohen (1992). The null hypothesis was tested by one-way ANOVA analysis of variance. Subsequent pairwise comparison of groups was calculated using the IBM SPSS (post hoc Bonferroni test on the 1 % level significance). Variability of performance was visualized by box plots.

Taking account of the physical weakness and age structure of children participating, for the evaluation of the power components of the swimming abilities across all categories, we used a swimming test 25 m any style. Asthmatics can during testing at the first signs of breathlessness stand up and relax. For security reasons, we reserved the swimming lane on the side of the pool for children who are afraid of difficulties arising from their weakness.

Results

Differentiated levels of fitness for 25 m free style swimming for these groups is presented in Table 1. In the group 1 in terms of gender, we found almost the same average performance. Asthmatic boys swim in average (33.99 s) girls (34.33 s). The best time swam by girl was (18.20 s), which was also the best of all children. The best time for boys was 3.1 s weaker.

Healthy boys in second group swam 25 m in average 38.8 s, which is 4.84 s slower than in group of asthmatics. In group of healthy girls was even higher difference of disadvantage (45.7 s). Asthmatics girls average swam performance was 11.37 s faster than average time in group of healthy girls (Table 1).

By analysing basic statistical data we can say that in terms of average times of 10 to 11 y. asthmatic boys and girls swam on qualitatively higher level than healthy peers. We

found that asthmatic boys and girls, in contradiction with our preconditions have been 4.84 to 11.37 s faster than normal healthy population. Between asthmatic and healthy boys we have found a difference in favour of asthmatics in the group 2 (Kováčová 2010) and group 3 (Benčuriková 2006), almost 5 s and in the group 4 (Labudová 2011) by 9.11 s. Like the boys also healthy girls in groups 2, 3 and 4 were slower than the asthmatic peers. Group 2 was in average 11.37 s (45.70), group 3 – 4.96 s (39.29) and group 4 – 8,37 s (42,70) slower (Table 1; Figure 1, 2).

In assessing the differences between the swimming capabilities of asthmatics group with healthy general population groups, we confirmed the statistical significance of differences in swimming test 25 m in favour of asthmatics. This positive finding shows that, despite their disability, asthmatics are more engaged in physical activities in the aquatic environment as a healthy general population.

Table 1

Basic statistical performance indicators 10 – 11 year boys and girls 25 m swimming

Gender	Group	N	Mean	St.dev.	Min	Max	Vr
Boys	Group 1	40	33.99	8.42	52.30	21.30	31.00
	Group 2	51	38.83	12.16	69.90	22.50	47.40
	Group 3	126	38.59	8.82	83.00	20.40	62.60
	Group 4	21	43.10	9.57	57.22	28.24	28.98
	Total	238	38.27	9.84			
Girls	Group 1	33	34.33	11.64	55.11	18.20	36.91
	Group 2	55	45.70	15.64	68.90	19.40	49.50
	Group 3	88	39.29	10.26	70.00	19.07	50.93
	Group 4	32	42.07	6.91	51.05	28.79	22.26
	Total	208	40.62	12.26			

Legend: *Group 1 - Asthmatics, 2011; Group 2 - Kováčová, 2010; Group 3 - Benčuriková, 2006; Group 4 - Labudová, 2011;* ***N –*** *number;* ***Mean*** *– Mean Average;* ***St.dev.*** *– Standard deviation****; Min*** *- Minimal power;****Max*** *– maximal power;* ***Vr –*** *variation range between maximum and minimum power*

Table 2

ANOVA 25 m Swimming

Gender	Sum of	df	Mean	F	Sig

		Squares		Square		
Boys	Between Groups	1 252.24	3.00	417.41	4.50	.00
	Within Groups	21 716.88	234.00	92.81		
	Total	22 969.12	237.00			
Girls	Between Groups	2 948.51	3.00	982.84	7.11	.00
	Within Groups	28 188.13	204.00	138.18		
	Total	31 136.64	207.00			

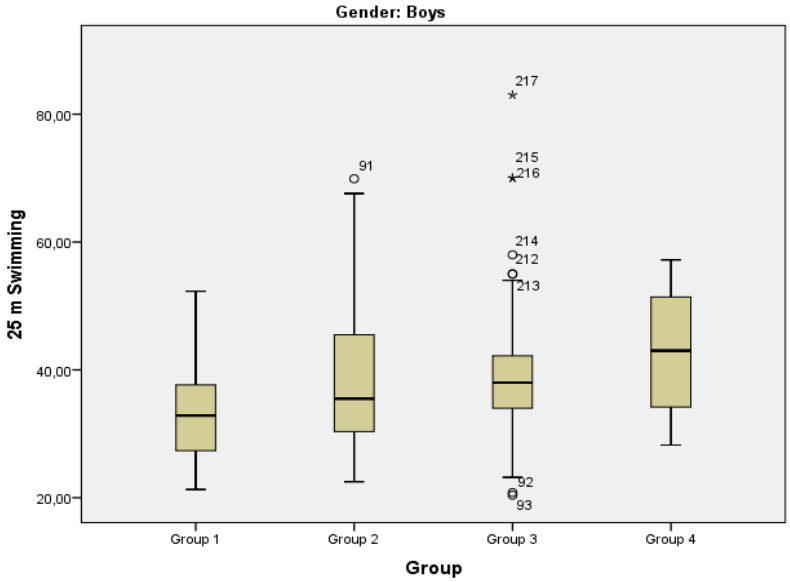

Figure 1

The comparison of the swimming ability of 10 to 11 y. boys with weakened respiratory system to normal healthy population in 25 m free style

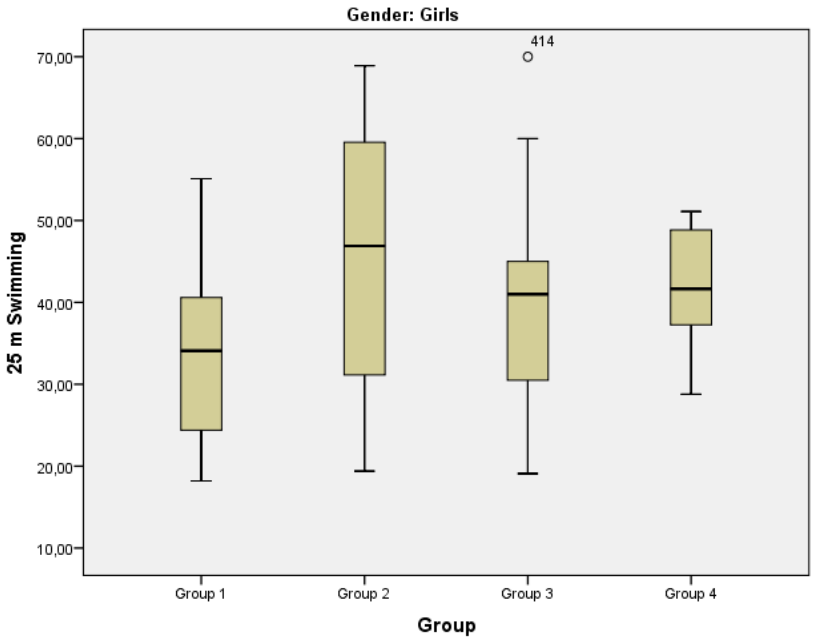

Figure 2

Table 3
Dependent Variable: 25 m swimming

Gender	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig	95 % Confidence Interval	
						Lower Bound	Upper Bound
Boys	Group 1	Group 2	-4.85	2.03	.11	-10.26	.57
		Group 3	-4.61	1.75	.05	-9.26	.05
		Group 4	-9.11	2.60	.00	-16.02	-2.20
Girls	Group 1	Group 2	-11.37	2.59	.00	-18.26	-4.47
		Group 3	-4.95	2.40	.24	-11.34	1.44
		Group 4	-7.74	2.92	.05	-15.50	.03

In a multivariate variation, we found significant differences between the groups at the level of the swimming performance. There is a significant difference ($p < 0.01$) between Boys Group 1 and Group 4 and in Girls Group 1 and Group 2. We found other significant difference ($p < 0.05$) between Boys Group 1 and Group 3 and also between Girls Group 1 and Group 4 (Table 2).

Based on the one-way analysis - ANOVA ($F (3,234) = 4,50$; $p = 0,00433$) we can conclude that from all groups of boys in 25 m freestyle swimming test group 1 achieve best average time (33.9 s), compared to average of grope 2 (38.83 s), group 3 (38.59 s) and group 4 (43.10 s). Similar to the boys, best average performance of girls groups was in group 1 (33.44 s) ($F (3,204) = 7.11$; $p = 0.00014$). Second best time was in Group 3 (39.29 s), third in group 4 (42.07 s). Worst average time was measured in group 2 (45.70 s).

It follows that the null hypothesis can be rejected (Table 2, 3; Fig. 1, 2). The results of boys and girls in swimming tests confirmed a significantly higher level of swimming performance of the children with weakened respiratory system compared to their peers of the general population.

To assess the degree of statistical significance we used Cohen's effect coefficient "d" according to Cohen (1992). From the standpoint of the coefficient effect size, we found medium (0.5 to 0.8) to great effect (0.8 and higher). Level for decision factor 'd' between asthmatics and other group reached a conventional value from 0.46 to 1.07 in favour of asthmatic boys and 0.47 to 0.81 in favour of girls asthma (Table 4).

Table 4

Effect Size Difference between two means in performance of 10 - 11 yr. boys and girls in swimming test 25 m

Boys	**Group 1 - 2**	**Group 1 -3**	**Group 1 - 4**
d	.46	.53	1.07
Girls			
d	.80	.47	.81

Legend: d - Coheno coefficient (small <.2; medium .2 to .8; large>.8)

In determining its levels was based not only on health weakness, but also on findings about motion performance of healthy population, on which are sufficient amount of findings publicized. Many authors (Benčuriková 2006; Fanelli et al. 2007; Berntsen et al. 2009; Goodman & Hays 2009; Wang et al. 2009; Labudová 2011; Macejková & Benčuriková 2001, 2014; Westergren et al. 2016 and others) were devoted to diagnostics of swimming abilities of healthy population more than diagnostic of healthy weakened population. Empirical track and compare of the swimming capability is even currently associated with methodological difficulties arising from the subject of research, a large non-uniformity of methodologies (mainly applied test battery), and also the conditions of a research organization. A wide range of approaches has led to the accumulation of varied considerably knowledge. In evaluating the level of the swimming capabilities of students in the past, the most commonly used tests of swimming 25 m, 50 m, 100 m any swimming style and the 5 minute swimming. Based on recent research papers, taking into account the current level of the swimming capabilities of the Slovak population are implemented swimming tests differentiated by age. For younger school age is a test - swimming to a distance of 25 m, for older school age 50 m and for secondary school swimming test - 100 m in any swimming style, eventually 5 min swimming.

Evaluation of swimming tests should monitoring qualitative and quantitative part of taken physical activity. Qualitative aspect of swimming is reflected in a swimming motion efficiency and overall positive impact on the physical condition of the school population. Quantitative criterion of power component of a swimming test is, achieved time to set distance or number of meter swim for a specified time. For reasons of saving human life is monitoring the level of the power components of the swimming capability in practice to not only common, but also the health weakened part of population. In the context of well-known trend of continuous reduction of physical activity of the majority of the population is currently teaching of swimming more focused on preventive health sphere (Macejková & Benčuriková 2014).

Our results are consistent with the results of the authors' (Kováčová & Medeková 2006; Fanelli et al. 2007; Berntsen et al. 2009; Goodman & Hays 2009; Wang et al. 2009; Westergren et al. 2016 and others) and knowledge of the positive impact of the swimming to asthmatic children.

Conclusions

Based on the analysis of the results on the level of abilities of the swimming children with asthma compared to their healthy peers, has not confirmed our assumption. We found that asthmatic children group achieved significantly better results than their healthy peers. Based on past experience, we believe that non-confirmation of established hypotheses may lie in the limited choice of physical activity in respiratory weakened population and the recommendations of medical specialists and the preference of sports in swimming exercise programs of weakened children. We realize that the results of our pilot research and founds have limited validity and require further research and verification. Nevertheless, we believe that the findings confirmed the positive impact of swimming as right sports activities for children with weakened respiratory system. It also points to lack of swimming abilities of normal healthy population of children.

References

1. BENČURIKOVÁ, Ľ., 2006. *Úroveň plaveckej spôsobilosti školskej populácie na Slovensku.* 1. vyd. Bratislava: ICM Agency. ISBN 80-969268-8-8.
2. BERNTSEN, S. et al., 2009. Norwegian adolescents with asthma are physical active and fit. allergy;64:421–6. doi:10.1111/j.1398-9995.2008.01845.x [*PubMed*]
3. COHEN, J., 1992. A Power Primer. *Psychological Bull.* **112(**1).
4. FANELLI, A. et al., 2007. Exercise training on disease control and quality of life in asthmatic children. *Med Sci Sports Exerc.* **39**:1474-80. Doi:10.1249/mss.0b013e3180d099ad [PubMed].
5. GOODMAN, M. & S. HAYS, 2009. Asthma and Swimming: A Meta-Analysis. Pages 639-647. Published online: 02 Jul 2009. http://dx.doi.org/10.1080/02770900802165980
6. KOVÁČOVÁ, E. & H. MEDEKOVÁ, 2006. Diferenciácia výskytu funkčných porúch pohybového systému s rôznym programom pohybovej aktivity u detských alergikov. In *Vybrané aspekty pohybovej aktivity*. Zborník prác Vega 1/2512/05. Bratislava: Peter Mačura – PEEM, pp. 81-87.

7. LABUDOVÁ, Jana, 2011. Úroveň plaveckej výkonnosti žiakov základných škôl na Slovensku. In ZAPLETALOVÁ, L. et. al. *Sekundárny trend v ukazovateľoch telesného rozvoja a pohybovej výkonnosti 11- až 18-ročnej školskej populácie na Slovensku.* Vedecká monografia z GÚ VEGA 1/0048/08. Bratislava: PEEM. ISBN 978-80-811-042-7.
8. MACEJKOVÁ, Y. & Ľ. BENČURIKOVÁ, 2007. Plávanie na školách - Pohľad do minulosti a súčasnosti. In 4th FIEP European Congress "*Physical Education and Sports - Teachers´ Preparation and Their Employability in Europe*". Bratislava: UK FTVŠ UK a SVS pre TvŠ, pp. 432-437. ISBN 978-80-89324-00-2.
9. MACEJKOVÁ, Y. & Ľ. BENČURIKOVÁ, Ľ., 2014. *Plávanie. U*čebné texty. Bratislava: STIMUL. ISBN 978-80-8127-100-7.
10. MEŠKO, D., 2005. Bronchiálna astma a športová aktivita. *Via pract.* **2**(1): 40-43.
11. WANG, J. et al., 2009. The effects of a swimming intervention for children with asthma. Respirology. Aug;**14**(6):838-42. doi: 10.1111/j.1440-1843.2009.01567.x.
12. WESTERGREN, T. et al., 2016. Active play exercise intervention in children with asthma: a pilot study. *BMJ Open*. **6**(1): e009721. Published online 2016 Jan 5. doi: 10.1136/bmjopen-2015-009721.
http://www.viapractica.sk/index.php?page=pdf_view&pdf_id=1641&magazine_id=1
http://www.pluska.sk/izdravie/zivotny-styl/sportovci-astmatici-ledva-dychaju-vyhravaju.html