

Ana Božanić

Sunčica Delaš Kalinski

Frane Žuvela

Faculty of Kinesiology University of Split

Original scientific paper

CHANGES IN FUNDAMENTAL MOVEMENT SKILLS CAUSED BY A GYMNASTICS TREATMENT IN PRESCHOOLERS

INTRODUCTION

Learning is a process of acquiring the capability for producing skilled actions (Schmidt and Lee, 2005) and is a direct result of practice or experience. Motor learning, on the other hand, is not directly observable because the processes that underlie changes in capability are probably highly complex phenomena in the central nervous system. As such, they are rarely directly observable, and one must infer their existence from changes in motor behaviour. The term movement skill refers to the development of motor control, precision and accuracy in the performance of both fundamental and specialized movements (Gallahue and Donnelly, 2003). Movement skills are developed and refined to a point that children are capable of operating with considerable ease and efficiency within their environment. As children mature, the fundamental movement skills developed when they were younger are applied as specialized skills to a wide variety of games, sports and activities. Authors define fundamental movement skills as an organized series of basic movements that involve the combination of movement patterns of two or more body segments.

Generally, the differences between genders become noticeable in preschool period already. Boys' higher values of triceps muscle tissue and shoulder/hip ratio are well-known. Furthermore, boys score better at motor strength and endurance tests, as well as at running and jumping tests. On the other hand, girls outperform boys at rhythm-based and flexibility tests.

The differences in the fundamental movement skills learning dynamics are a topic of many researches (Burton and Miller, 1998; Goodway, Robinson and Crowe, 2010). As a rule, girls outperform boys at precise motor actions such as drawing, typing and tapping. They are also better at reaction speed (Burton and Miller, 1998), while the boys have an advantage in running, jumping and punching. Bruininks and Bruininks (2005) also found similar results: girls are better at precise motor actions and ambidexterity. Seefeldt and Haubenstricker's (1982) was the only research that focused on the fundamental movement skills learning throughout a period of time. The authors revealed that initially the girls were better than the boys in 4 out of 8

skills. Despite the initial advantage, the boys got ahead of girls in the acquisition of 5 out of 8 motor skills.

According to previously mentioned, the main aim of current research was to determine gender differences in fundamental movement skills acquisition under the influence of a specialized gymnastics treatment.

METHODS

A total of 58 preschool children (mean age 6 ± 0.5 years) took part in this research. Two experimental groups consisted of 34 boys and 24 girls. They were chosen only for their preschool status and their parents gave informed consent. They averaged 122.0 cm in height, 24.27 kg in weight and 16.2 in body mass index. All children had to attend at least 80% of the total number of lessons and they were not to participate in any other training programme or activity.

„Bruininks-Oseretsky Test of Motor Proficiency 2” (BOT-2) was administered prior to and after the 10-week gymnastics treatment. BOT-2 is a screening tool for fundamental movement skills assessment (Bruininks and Bruininks 2005). As a long period of time is required for the administration of the complete form of the test (approximately 60 minutes per child), a short form was used in this study. Opposed to a complete battery of 53 tests, the short form consisted of 14 tests that best represent certain motor area. The test is divided into 8 motor areas (*fine motor precision, fine motor integration, manual dexterity, upper-limb coordination, balance, bilateral coordination, running speed and agility, strength*) that result in total motor composite which summarizes the child’s overall motor proficiency. BOT-2 also includes score standardization according to the normative data separated by gender and age. The standardization was done and is displayed in this study.

The two experimental groups (boys and girls) underwent the same 10-week experimental treatment. They practiced 3 times a week for 35 minutes (according to the official preschool programme). The treatment was led by the same coach in the preschool gym and the groups consisted of 20 children. Six units (walking and maintaining balance; running; jumping and skipping; tossing, throwing, rolling; climbing and crawling; games) prescribed by the official preschool programme formed a part of the treatment. The other part consisted of specific gymnastics units. Each unit comprised 2 to 6 activities, while the total number of activities was 20.

Data were analyzed using the Statistica for Windows 7.0 package and the statistical significance was set at $p \leq 0.05$. Basic descriptive statistics were calculated separately for boys and girls (mean value and standard deviation). The independent-sample t-test was used to compare genders in all variables while dependent-sample t-test was used to analyze the differences between the initial and the final measurement.

RESULTS

Table 1. Basic descriptive statistics (mean value \pm standard deviation) separately for groups and measurements; t-test results between groups and between measurements

	INITIAL		FINAL	
	B (n=34)	G (n=24)	B (n=34)	G (n=24)
<i>Fine motor precision</i>	7.65 \pm 2.73	9.79 \pm 2.73*	9.35 \pm 2.27¥	10.54 \pm 2.65
<i>Fine motor integration</i>	5.74 \pm 2.14	7.58 \pm 1.93*	7.21 \pm 2.51¥	7.75 \pm 1.89
<i>Manual dexterity</i>	3.56 \pm 1.13	4.33 \pm 1.24*	4.24 \pm 1.30¥	4.67 \pm 0.92
<i>Upper-limb coordination</i>	6.24 \pm 3.10	6.04 \pm 2.22	7.97 \pm 3.30¥	7.25 \pm 1.70¥
<i>Balance</i>	6.76 \pm 1.10	7.42 \pm 1.02*	6.79 \pm 1.17	7.38 \pm 0.77*
<i>Bilateral coordination</i>	5.97 \pm 1.27	6.46 \pm 0.78	6.65 \pm 0.73¥	6.96 \pm 0.36¥
<i>Running speed and agility</i>	3.82 \pm 1.99	5.46 \pm 2.28*	6.91 \pm 2.01¥	7.92 \pm 1.18*¥
<i>Strength</i>	3.68 \pm 2.47	3.29 \pm 2.12	5.65 \pm 2.46¥	5.83 \pm 1.40¥
Total motor composite	43.41 \pm 9.71	50.38 \pm 6.68*	54.76 \pm 9.98¥	58.29 \pm 6.56¥
STANDARDIZED RESULT	47.38 \pm 7.72	47.62 \pm 6.84	58.15 \pm 9.48¥	57.17 \pm 7.20¥

Legend: * differences between groups ($p < 0.05$); ¥ differences between measurements ($p < 0.05$)

Results (Table 1) show initial differences between genders in 5 out of 8 variables (motor areas) as well as in the total motor composite in favour of girls. Nevertheless, when observing the standardized score, the difference does not exist. Analyzing the influence of the treatment on the fundamental movement skills learning, the boys improved in all motor areas except *balance* while the girl's improvement was noted in only 4 motor areas. The final testing showed gender differences in *balance* and *running speed and agility* in favour of girls while no differences were found in the rest of the variables. Standardized results show that the boys got ahead of girls but with no significant differences according to t-test.

DISCUSSION

According to presented standardized scores, these groups of boys and girls can be classified in the group of average fundamental movement skills children considering that results of the participants fall in the range of 68% of the population that have one standard deviation of the mean score in either direction.

Initially, results indicate the girls' advantage in 5 out of 8 variables including the total motor composite. Their advantage in *fine motor precision*, *fine motor integration* and *manual dexterity* was expected according to previous research (Bruininks and Bruininks, 2005; Burton and Miller, 1998). It is assumed that these results represent

normal differences in motor development and do not reflect any difference between females and males in the prevalence of motor impairment in the population. Girls' higher scores in *balance* confirm previous research results. However, it is important to emphasize that only one test was used for balance assessment (standing on one leg on balance beam – eyes open) which is, in authors' opinion, not enough for quality judgment, so further interpretations could be doubtful. Girls' advantage in the test of *running speed and agility* was not expected due to the studied literature where boys precede in speed. The probable reason is the test itself which is used in the BOT-2 short form (one-legged stationary hop). The task was to perform as many one-legged hops as possible in 15 seconds maintaining the proper form. Girls performed the hops with minimal height and therefore scored better. This can be interpreted by culture differences. Girls from this region spend most of their outdoor free time in a traditional game of „rope jumping” which can be the reason of better test results. Finally, authors are of the opinion that this test is probably valid but not for our region. Therefore, it is advisable to substitute it with a test that can assess the area of *running speed and agility* more accurately.

The differences in the final testing occurred in two variables: *balance* and *running speed and agility*. So, comparing these results with the results of initial testing, girls kept their domination in two mentioned variables. However, the absence of significant differences in *fine motor precision*, *fine motor integration* and *manual dexterity* areas proves that the boys caught up with the girls. Additional evidence is the absence of significant differences in the total motor composite. The results of the study by Seefeldt and Haubenstricker (1982), where the boys' results exceeded the girls' results, are not totally consistent with the results from this research. However, it is important to emphasize that the current research consisted of 2.5-months treatment.

Analyzing the differences between the measurements, we notice that the boys advanced in 7 out of 8 motor areas. The only exception was the *balance* area whose validity is questionable due to the earlier statement. Naturally, significant improvement occurred in the boys' total motor composite which proves the adequacy of the treatment. On the other hand, the girls' improvement seemed to be incomplete. They demonstrated an improvement in 4 out of 8 motor areas and the total motor composite as well. So the positive learning transformation is inevitable, but the change seemed to be considerably smaller than in boys. Mazzardo (2008) suggests that the main reason for the existing differences is the fact that in early age, boys choose activities that develop manipulative skills (soccer, basketball, handball) while girls choose activities with the potential of developing locomotor skills (gymnastics, dance). Considering the latter, the question of adequacy of treatment for both genders arises: was the content of the treatment appropriate for both boys and girls? The explanation can possibly be found in specific gender-based activities practiced by the

children in this region. The traditional games that boys and girls play outdoors are very much different and that could probably be the reason why they learn fundamental movement skills with different intensity and dynamics. The influence of parents is not to be excluded either, mostly in the physical activity and sport selection where polarizing the activities into „male” and „female” sports is a common phenomenon. It is possible to conclude that the treatment was too easy for the girls and therefore was not challenging enough. Boys, on the other hand, found it stimulating and encouraging and it served for development of the movement skills that have been neglected by choosing different activities.

CONCLUSION

The sample of 58 preschool children observed in this study can be defined by a sample of average fundamental movement skills of children according to their results in BOT-2. The same results showed the advantage of girls over boys in initial testing, especially in the fine motor skills areas. It was also shown that the test which measures running speed and agility was probably not valid because of cultural differences. After the 10-week treatment, the final testing showed significant improvement in the fundamental movement skills among boys, while the progress was less noticeable among girls. It can be concluded that the treatment was not adequate for the girls and that they could not fully improve their level of fundamental movement skills. Also, the difference probably occurred because of the different type of activities that boys and girls practice in their free time, gender-based activities, respectively. That could be the reason of different level of skill acquisition in this research.

REFERENCES

1. Bruininks, R.H. i Bruininks, B.D. (2005). *Bruininks-Osretsky Test of Motor Proficiency – Second Edition*. Minneapolis, MN. Pearson.
2. Burton, W. A. i Miller, D. E. (1998). *Movement Skill Assessment*. Champaign, IL. Human Kinetics.
3. Gallahue, D.L. i Donnelly, F.C. (2003). *Developmental physical education for all children*. Champaign, IL. Human Kinetics.
4. Goodway, J.D., Robinson, L.E. i Crowe, H. (2010). Gender differences in fundamental motor skill development in disadvantaged preschoolers from two geographical regions. *Research Quarterly for Exercise and Sports*, 81(1), 17-24.
5. Mazzardo, O. (2008). *The relationship of fundamental movement skills and level of physical activity in second grade children*. Doctoral dissertation, University of Pittsburgh.

6. Schmidt, R.A. i Lee, T.D. (2005). *Motor control and learning*. Champaign, IL. Human Kinetics.
7. Seefeldt, V. i Haubenstricker, J. (1982). Patterns, phases, and stages: an analytical model for the study of developmental movement. U: Kelso i Clark (Ur.) *The Development of Movement Control and Coordination*. John Wiley & Sons, New York.
8. Venetsanou, F., Kambas, A., Aggeloussis, N., Fatouros, I. i Taxildaris, K. (2009). Motor assessment of preschool aged children: A preliminary investigation of the validity of the Bruininks-Oseretsky test of motor proficiency-short form. *Human Movement Science*, 28, 543-550.

ABSTRACT

The aim of this research was to determine gender differences in fundamental movement skills acquisition under the influence of a specialized gymnastics treatment. A total of 58 preschool children took part in this research and were divided in two groups (34 boys and 24 girls). „Bruininks-Oseretsky Test of Motor Proficiency 2” (BOT-2) for fundamental movement skills assessment was administered prior to and after the 10-week gymnastics treatment. Results showed initial differences between genders where girls outperformed boys in 5 out of 8 variables while the final testing showed differences only in the *balance* and *running speed and agility* tests in favour of girls. It can be concluded that the treatment was not adequate for the girls and that they could not fully improve their level of fundamental movement skills. The difference probably occurred because of the different type of activities that boys and girls practice in their free time.

Key words: *BOT-2, motor proficiency, cultural differences, gender differences*