

# Gender Differences of Preschool Children in Fundamental Movement Skills

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## Abstract

*The aim of this research was to determine whether there are significant differences between preschool-aged boys and girls (4 - 4.5 years old) in locomotor skills and object control skills. The research included a total of 67 children, of which 34 boys (average body height  $107.61 \pm 4.43$  cm; body weight  $18.19 \pm 4.43$  kg) and 33 girls (average body height  $107.31 \pm 4.76$  cm; body weight  $19.00 \pm 3.08$  kg). All subjects were measured by four motor tests to estimate the balance, flexibility, coordination and frequency of movement (standing on one leg, bend and reach, polygon backwards and hand tapping). Motor skills were estimated by the Test of Gross Motor Development, which includes seven locomotor skills (run, gallop, hop, leap, standing long jump, slide, skip) and four object control skills (stationary bounce, catch, kick, overhand throw). Univariate analysis of variance showed significant differences in motor test polygon backwards in favor of boys ( $p=.001$ ). The total locomotor score was higher for girls than boys ( $p=.01$ ), although the differences are significant only in gallop ( $p=.02$ ), hop ( $p=.02$ ) and skip ( $p=.03$ ). There were no statistically significant differences in total score of object control skills ( $p=.43$ ), while girls had higher average values in stationary bounce and catch ( $p=.01$ ), and boys in overhand throw ( $p=.03$ ) and kick. The small-size effect ( $f=0.10$ ) and Power at 0.12 observed in object control skills indicated that approximately  $N=842$  would be needed to obtain statistical power at the recommended 0.80 level. In total fundamental movement skills girls scored higher on a level of significance ( $p=.02$ ). In this sample, girls have a noticeably higher level of motor skills compared to boys of the same age.*

**Key words:** locomotor skills; object control skills; preschoolers.

## Introduction

Biotic motor knowledge is an important factor in a human being's development during phylogeny and ontogeny, and it enables effective mastering of space, obstacles,

resistance, and performing manipulation of various sizes and shapes (Findak, Metikoš, Mraković, Neljak, & Prot, 1998). Preschool and the early elementary school years are critical to children's development and mastery of gross motor skills (Hardy, King, Farrell, Macnivan, & Howlett, 2010). These skills provide the infrastructure for learning more complex games, sports, and dance skills in later life (Branta, Haubenstricker, & Seefeldt, 1984). Also, acquired object control skills during the preschool and primary education contribute to increased habitual and organized physical activities, thus reducing the risk of obesity in children and adolescents (Gabbard, 2007). Furthermore, research shows a positive correlation between knowledge in manipulation of objects and level of physical activity of children (Raudsepp & Päll, 2006), participation in organized physical activities of children (Okely, Booth, & Patterson, 2001) and inverse correlation with body mass index (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006).

Previous studies show that the level of physical activity and motor competences are determined by gender. Thus, studies (Barnett, Morgan, van Beurden, & Beard, 2008; Robinson, 2011) show a significantly higher level in boys compared to girls in object control skills. Locomotor proficiency of boys has been reported as lower (van Beurden, Zask, Barnett, & Dietrich, 2002), equivalent to (Goodway & Rudisil, 1997) or higher (Robinson, 2011) than girls'. Researchers (Okely & Booth, 2004) found that the prevalence of mastery and near mastery on a sample of 7-year-old children was low, with boys performing better in object control skills and girls performing better in skipping.

Studies cited numerous reasons that explain better performance of preschool boys in object control skills, such as more involvement of boys in organized sport, a greater level of physical activity or involvement of fathers who emphasize ball games. Besides the numerous factors that affect the level of acquired motor skills, it can be stated that organized physical activity during Physical Education lessons in kindergartens is the main place where preschoolers are sure of having the right experience for motor skills development.

The aim of this research was to determine whether there are significant differences between boys and girls, preschool children in locomotor skills and object control skills.

Considering the results of previous studies, it is expected that girls will achieve a significantly higher level in the locomotor skills, and boys in object control skills.

## **Methods**

The research included a total of 67 preschool children, 4-4.5 years old, from a kindergarten in Čakovec, Croatia, of which 34 boys (average body height  $107.61 \pm 4.43$  cm; body weight  $18.19 \pm 4.43$  kg) and 33 girls (average body height  $107.31 \pm 4.76$  cm; body weight  $19.00 \pm 3.08$  kg). With prior consent of children's parents and after the measuring of body height and body weight, all subjects were measured by four motor tests to estimate balance (standing on one leg), flexibility (bend and reach), coordination (polygon backwards) and frequency of movement (hand tapping).

Motor skills are estimated by the Test of Gross Motor Development (TGMD) (Ulrich, 1985) for age 3-10 years, which includes 7 locomotor skills (run, gallop, hop, leap, standing long jump, slide, skip) and 4 object control skills (stationary bounce, catch, kick, overhand throw). The two-handed strike, as a control skill, was not evaluated because this motor movement is not included in the Physical Education curriculum in kindergartens and, besides, is not popular in Croatia. The TGMD is a process-oriented measure, assessing the components of each skill rather than the outcome or product of the skill execution. The skip, leap and bounce have three components and other skills have four components. The protocol involved children being given a demonstration of the correct technique before the assessment. Afterwards, children were asked to perform the skill twice. Each attempt was scored with each component receiving a score 1 if correctly executed or score 0 if not. The components for the two trials were then summed for each skill and the scores for the seven locomotor skills were summed for a composite locomotor score, and scores for the five object control skills were summed for a composite object control score. The performance of children was video-recorded and afterwards evaluated by one observer. Differences between genders were calculated using the univariate analysis of variance (ANOVA).

## Results

Boys achieved better average values in motor tests standing on one leg (by 2.10 sec) and polygon backwards (by 5.24 sec), which was also the only test that showed a statistically significant difference between genders. In tests for assessing the flexibility and frequency of movement, almost equal average values were achieved. In locomotor skills, significant differences in favor of girls were observed in gallop ( $F=5.73$ ;  $p=.02$ ), hop ( $F=5.66$ ;  $p=.02$ ) and skip ( $F=4.83$ ;  $p=.03$ ), while the average values for boys were higher only in running (Table 1). In object control skills, significantly higher average values were obtained for boys in overhand throw ( $F=4.45$ ;  $p=.03$ ), and for girls in catch ( $F=6.68$ ;  $p=.01$ ). Higher average values are evident for girls in stationary bounce ( $M=1.57$  vs  $M=0.94$ ), and for boys in kick ( $M=3.82$  vs  $M=3.36$ ). Total score of locomotor skills showed significant differences ( $F=6.62$ ;  $p=.01$ ;  $\eta^2=.092$ ) with average values in favor of girls ( $M=31.45$  vs  $M=24.91$ ). The estimated eta squared ( $\eta^2=.092$ ) indicated that approximately 9.2% of the total variation in the average score of locomotor skills can be attributed to gender differences. There was no significant difference in the total object control score between genders ( $F=0.62$ ;  $p=.43$ ;  $\eta^2=.009$ ). To check whether our non-significant results were due to a lack of statistical power, we conducted post hoc power analyses using Gpower. The small-size effect ( $f=0.10$ ) (Cohen, 1977), observed in object control skills indicated that approximately  $N=842$  would be needed to obtain statistical power at the recommended 0.80 level (Cohen, 1988). In total score of fundamental movement skills significant gender differences were obtained ( $F=5.06$ ;  $p=.02$ ;  $\eta^2=.072$ ) with higher average values achieved by girls ( $M=42.15$  vs  $M=34.47$ ) (Table 1).

Table 1

Central and dispersive parameters of locomotor skills and object control skills of preschool girls and boys and the results of ANOVA

Variables		Total (N=67)	Boys (N=34)	Girls (N=33)	F	p	Effect size $\eta^2$ (Eta squared)	% of the change in DV that can be accounted to IV
Standing on one leg	M SD	14.57 (6.72)	13.54 (5.91)	15.64 (7.40)	1.61	.20	.025	2.5
Bend and reach	M SD	32.48 (6.87)	32.20 (6.85)	32.78 (6.99)	0.12	.72	.002	0.2
Polygon backwards	M SD	24.43 (6.48)	21.85 (5.80)	27.09 (6.13)	12.87	<b>.00</b>	.165	<b>16.5</b>
Hand Tapping	M SD	10.58 (2.65)	10.67 (2.98)	10.48 (2.30)	0.08	.77	.001	0.1
Run	M SD	6.79 (1.56)	6.82 (1.76)	6.75 (1.34)	0.03	.86	.000	0
Gallop	M SD	3.91 (2.84)	3.11 (2.63)	4.72 (2.86)	5.73	<b>.02</b>	.081	8.1
Hop	M SD	3.19 (3.14)	2.32 (2.87)	4.09 (3.19)	5.66	<b>.02</b>	.080	<b>8</b>
Leap	M SD	1.67 (1.78)	1.58 (1.43)	1.75 (2.10)	0.15	.70	.002	0.2
Standing long jump	M SD	4.46 (2.03)	4.03 (1.89)	4.90 (2.09)	3.24	.07	.048	4.8
Slide	M SD	4.85 (2.71)	4.26 (2.82)	5.45 (2.48)	3.34	.07	.069	6.9
Skip	M SD	3.25 (1.90)	2.76 (1.70)	3.75 (1.98)	4.83	<b>.03</b>	.049	<b>4.9</b>
Stationary bounce	M SD	1.25 (1.69)	0.94 (1.30)	1.57 (1.98)	2.40	.12	.036	3.6
Catch	M SD	3.40 (2.33)	2.71 (1.76)	4.12 (2.64)	6.68	<b>.01</b>	.093	<b>9.3</b>
Kick	M SD	3.60 (1.89)	3.82 (2.19)	3.36 (1.53)	0.98	.32	.015	1.5
Overhand throw	M SD	2.25 (2.42)	2.85 (3.02)	1.63 (1.36)	4.45	<b>.03</b>	.064	<b>6.4</b>
Total score locomotor skills	M SD	28.13 (10.84)	24.91 (9.23)	31.45 (11.48)	6.62	<b>.01</b>	.092	<b>9.2</b>
Total score object control skills	M SD	10.18 (5.27)	9.67 (5.67)	10.69 (4.86)	0.62	.43	.009	0.9
Total score fundamental movement skills	M SD	38.25 (14.39)	34.47 (13.37)	42.15 (14.55)	5.06	<b>.02</b>	.072	<b>7.2</b>

Note. F-test, p-level of significance, DV-dependent variable, IV-independent variable

## Discussion

According to the obtained results, the hypothesis was partially confirmed, because girls showed significantly higher levels of locomotor skills, and boys are

not significantly better in object control skills. Comparing the average values of this sample with a sample of 7-year-old children (Nikolić, Mraković, & Rastovski, 2014) in object control skills, a lower level of knowledge ( $M=15.36$  vs  $M=10.18$ ) is noticeable, which is natural, because by the end of the sixth year most children acquire at least some features of the mature movement pattern (Gabbard, 2007). Gender differences in locomotor skills are consistent with the results of previous studies (Okely & Booth, 2004; van Beurden et al., 2002), which indicate that motor patterns of jumping, gallop and others are more frequent in activities such as dance, gymnastics, etc., which girls prefer more. In total object control skills significant differences were not obtained, but on an individual basis, boys were better only in overhand throw, while girls showed more success in catch. The reason that there were no differences in object control skills can be partially attributed to the sample of this study, since organized Physical Education lessons were carried out with these kindergarten groups in the previous two years. Therefore, both genders had equal opportunities to conduct various games and contents with balls.

Numerous research studies emphasize the importance of regular and guided physical activity in the preschool age. Thus, in the longitudinal study Zask et al. (2012) indicated that through organized form of exercise in kindergartens, girls significantly improved their object control skills compared to the control group which was not involved in organized exercise, except in free play. Accordingly, authors indicated that girls should be targeted more intensively to improve their object control skills than locomotor, since they gained object control skills, the improvement of which can be retained through elementary school. The 12-month experimental research (Salmon, Ball, Hume, Booth, & Crawford, 2008) showed evidence to support the statement that an intervention program can significantly increase motor z-scores of girls than boys. Also, Okely and Booth (2004) suggested that the differences in object control skills were likely to be environmental and that if girls were provided with the same opportunities for instruction, feedback, practice and encouragement, the differences in skills between genders could be reduced. Barnett, Hickey, Okely, and Salmon (2013) emphasize that the level of object control skills depends on the instructions and demonstrations of parents, while locomotor skills are less susceptible to that. It is assumed that the support, for example in catching, is much higher, where a child needs to throw the ball to master the catching motor pattern, although the degree of support needed is unknown (Clark, 2007). The same author states that motor skills do not develop miraculously from one day to the next or through maturation; they must be nurtured, promoted, and practiced. The importance of the development of object control skills at the preschool age is also emphasized by a longitudinal study (Barnett, van Beurden, Morgan, Brooks, & Beard, 2010) which found little relationship between locomotor proficiency in childhood and in adolescence, whereas childhood object control proficiency does help to explain subsequent object control skills. One of the reasons is that locomotor skills are more variable compared to object control

ability and probably more influenced by other factors such as body weight (Okely, Booth, & Chey, 2004). From the aforementioned it can be stated that gaining object control skills in childhood is perhaps more important than gaining locomotor skills, as object control skills track through to adolescence.

## Conclusions

In conclusion, Physical Education in kindergarten must promote both physical activity and motor skill development. If we want children to become physically active for life, we need to help them acquire the motor skills that will allow them to participate in a wide range of physical activities. The results suggest that more attention should be paid to monitoring the level of development of fundamental motor skills at the preschool age and given information on gender differences which could help preschoolers and parents identify which skill should be targeted. In that way, boys and girls have the opportunity to practice and learn skill basics before starting primary school. Continuous monitoring and information should be conducted by educators in kindergartens and primarily through Physical Education lessons, followed by free play.

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# Spolne razlike predškolske djece u biotičkim motoričkim znanjima

## Sažetak

Cilj ovog istraživanja bio je utvrditi postoje li značajne razlike između dječaka i djevojčica predškolske dobi (4 – 4,5 godina) u lokomotornim motoričkim znanjima i manipuliranju objektima. Istraživanjem je ukupno obuhvaćeno 67 djece, od čega 34 dječaka (prosječne tjelesne visine  $107,61 \pm 4,43$  cm; tjelesne težine  $18,19 \pm 4,43$  kg) i 33 djevojčice (prosječne tjelesne visine  $107,31 \pm 4,76$  cm i tjelesne težine  $19,00 \pm 3,08$ kg). Svi ispitanici izmjereni su putem 4 motorička testa za procjenu ravnoteže, fleksibilnosti, koordinacije i brzine frekvencije pokreta (stajanje na jednoj nozi, pretklon na klupici, poligon natraške i taping rukom). Motorička znanja procijenjena su testom *Test of Gross Motor Development*, koji uključuje 7 lokomotornih (trčanje, galop naprijed, poskoci na jednoj nozi, skok s noge na nogu, skok u dalj iz mjesta, galop strance, niski skip) i 4 motorička znanja – manipuliranje objektima (vođenje lopte u mjestu, hvatanje lopte objema rukama, udaranje lopte nogom i bacanje loptice u dalj). Univarijatnom analizom varijance utvrđene su značajne razlike u motoričkom testu poligon natraške u korist dječaka ( $p=,001$ ). Ukupni rezultat lokomotornih znanja veći je kod djevojčica u odnosu na dječake ( $p=,01$ ), iako su razlike značajne samo kod galopa ( $p=,02$ ), poskoka ( $p=,02$ ) i niskog skipa ( $p=,03$ ). Ukupan rezultat u manipuliranju objektima ne pokazuje značajne razlike ( $p=,43$ ). Veće su prosječne vrijednosti kod djevojčica u vođenju lopte i hvatanju lopte objema rukama ( $p=,01$ ), a kod dječaka u bacanju loptice u dalj ( $p=,03$ ) i udaranju lopte nogom. S obzirom na detektiranu malu veličinu učinka ( $f=0,10$ ) i Power koeficijenta 0,12 ukupan broj ispitanika trebao bi se povećati na otprilike 842 da bi se postigla statistička snaga testa na preporučenoj razini od 0,80. U ukupnom rezultatu lokomotornih znanja djevojčice su postigle bolje rezultate na razini značajnosti ( $p=,02$ ). Na ovom uzorku ispitanika kod djevojčica je primjetna viša razina motoričkih znanja u odnosu na dječake iste dobi.

**Ključne riječi:** lokomotorna znanja; manipuliranje objektima; predškolci.