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Original Article

GEOGRAPHICAL AND GENDER DIFFERENCES IN THE DEVELOPMENT OF MOTOR SKILLS IN PRESCHOOL CHILDREN[1]

DIFERENÇAS GEOGRÁFICAS E DE GÉNERO NO DESENVOLVIMENTO DAS CAPACIDADES MOTORAS DAS CRIANÇAS EM IDADE PRÉ-ESCOLAR[1]

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RESUMO
O desenvolvimento motor durante a infância é fundamental para a aquisição de competências perceptivas e cognitivas avançadas, desempenhando um papel fulcral no desenvolvimento pessoal e na aquisição de competências mais tarde na vida. Este estudo tem como objetivo investigar as diferenças nas capacidades motoras de crianças entre os 3 e os 5 anos de idade, com base na sua localização geográfica (urbana ou rural) e género. Foi selecionada para o estudo uma coorte de 94 crianças portuguesas com idades compreendidas entre os 3 e os 5 anos (48 meninos e 46 meninas). A recolha de dados foi efectuada em 8 escolas diferentes e as capacidades motoras foram avaliadas utilizando o teste MOBAK-KG. Verificou-se que as crianças das zonas urbanas superavam as das zonas rurais nas capacidades motoras relacionadas com o controlo do corpo e dos objectos. Pelo contrário, as capacidades motoras das raparigas não apresentaram diferenças significativas em função da sua localização geográfica. Embora o ambiente geográfico influencie o desenvolvimento motor das crianças, outros factores, tais como os factores socioeconómicos e culturais, podem ter um maior impacto nas raparigas. Estes resultados sublinham a importância de nos concentrarmos no desenvolvimento motor das raparigas e de examinarmos a forma como as expectativas culturais e de género podem ter impacto nas suas capacidades motoras.
Palavras-chave: Infância, MOBAK-KG, Habilidade Motoras, Rural, Urbano

ABSTRACT
Motor development during childhood is fundamental for acquiring advanced perceptual and cognitive skills, playing a pivotal role in personal development and skill acquisition later in life. This study aims to investigate differences in the motor skills of children between the ages of 3 to 5, based on their geographic location (urban or rural) and gender. A cohort of 94 Portuguese children between the ages of 3 and 5 years old (comprising 48 boys and 46 girls) were selected for a study. Data collection was conducted within 8 different schools, and motor skills were assessed utilizing the MOBAK-KG test. It was observed that children from urban areas outperformed those from rural areas in motor skills related to body and object control. On the contrary, girls' motor skills did not show significant differences according to their geographical location. Although the geographical environment influences children's motor development, other factors, such as socio-economic and cultural factors, may have a greater impact on girls. These findings emphasise the significance of focusing on the motor development of girls and examining how cultural and gender expectations can impact their motor skills.
Keywords: Childhood, MOBAK-KG, Motor Skills, Rural, Urban

Introduction

Child development is a series of physical, linguistic, mental and emotional changes that occur from birth to early adulthood. These changes include areas such as gross and fine motor skills, speech, language, cognition, social interaction and emotional regulation. In particular, motor development in infancy is crucial as it lays the foundation for more advanced perceptual and cognitive skills[2]. These basic motor skills are essential for personal development and the acquisition of more complex skills needed in everyday life[3].

Several factors, both biological and environmental, influence children's motor development [3,4,5]. For example, Özal et al.[5] highlight the significant influence of family and environmental variables on gross motor function during the preschool years. Specifically, their study suggests that maternal education level appears to be most influential between the

first 8 and 16 months, and socioeconomic level between the next 10 and 60 months. Students with higher socioeconomic status have been found to have some advantages in motor development compared to their peers with lower socioeconomic status[6].

Geographical context, particularly the urban-rural divide, plays a key role in motor development. Although the exact relationship between geographic location and motor performance is not fully defined, several studies suggest that children in rural areas have a healthier profile of cardiorespiratory and muscular fitness than their urban counterparts [2,3,7]. However, the study by Xia et al.[3] found conflicting results, highlighting the need to consider socioeconomic and family factors for a deeper understanding. The discrepancy in results could be due to factors such as higher outdoor exposure and lower participation in organised sports in rural areas[8].

It is important to consider the differences between urban and rural environments when analysing motor development. For example, the availability of open spaces in rural areas and the tendency for children to walk to school may contribute to better motor skills[2,4]. In contrast, urban children, particularly those with access to adequate facilities and resources, have better development of object control skills[2].

Furthermore, it is crucial to explore possible gender differences in preschool motor development. Several studies have identified gender-specific trends and disparities in motor skills [3,9,10]. Understanding these relationships and disparities is vital for designing effective interventions and strategies to optimise child development. In the study by Xia et al.[3], it was observed that children from diverse backgrounds showed notable differences in three self-movement skills and five object control skills. However, girls showed significant variations in only three skills. The study also highlights that children's motor skills were marked by regional and ethnic factors, indicating a confluence of cultural and environmental influences on their development. This trend was not observed in girls. Despite some existing evidence, there is a gap in the literature on differences in motor development between boys and girls in urban and rural contexts. Therefore, the aim of this study was to analyse the influence of the area of belonging (urban and rural) on the basic motor skills of children aged 3-5 years differentiated by gender.

Methods

Sample

The sample consisted of 94 Portuguese preschool children, aged between 3 and 5 years, of whom 48 were boys and 46 were girls. The selection of the participants was carried out through a non-probabilistic procedure, using a sampling by convenience and geographical closeness. The participants were selected from eight educational preschools located in various cities across the south of Portugal. Of these, five were urban and three were rural. According to their place of origin, 26 preschool children came from rural areas, while 68 came from urban areas. Urban schools, situated in cities or metropolitan areas, have high population density and access to a variety of services and infrastructure. However, rural schools, situated in less populated areas outside urban centres, encounter distinct challenges due to lower population density and limited access to comparable resources and services. Following our explanatory presentation of the research and procedures, the children’s legal guardians or parent signed a written informed consent. To participate in the study the children shouldn’t suffer from illness or difficulty that inhibits participation in the development of the MOBAK KG[11]. All participants were evaluated in their Physical Education (PE) gymnasiums.

Measures

Basic Motor Skills

The MOBAK-KG test battery is used to assess basics motor competence (BMC) in kindergarten[11,12], includes a total of eight test items and is systematized in two subscales of motor skills: self-movement (items: balancing, rolling, jumping, running) and control object (items: throwing, catching, bouncing, dribbling) and is designed for preschoolers, aged between four and six years. Each motor skill is evaluated using three to five criteria. The evaluator scores based on the number of successful attempts according to the criteria. If the skill is not completed, a score of "0" is allocated. Successful skill achievement corresponds to a specific score. Each test item on the scale is scored on a scale of "0 to 2" points. Therefore, in both MOBAK KG test subscales maximum scores of 8 points can be reached, resulting in a combined sum score ranging from 0 (lowest BMC) to 16 points (highest BMC).

Procedure

The MOBAK KG tests were conducted during the regular timetable of physical education sessions. This approach took advantage of the infrastructure available in the participating schools, allowing each class to be tested during its assigned timetable. This facilitated participation without interfering with the regular academic timetable. The assessments were conducted in various stations, strategically located in the designated physical education area, either in the gymnasium or on the school playground, depending on the resources available at each school. The assessment was performed as a group, with all students in a class participating simultaneously. Throughout the session the students rotated through four stations to ensure that each student completed all the planned tests. Firstly, four stations for object movement skills and then four stations for self-movement skills. Prior to each test, a demonstration and explanation of the test was given to each preschooler, following the MOBAK KG protocol[11]. Participants performed the tests included in the object movement subscale: single-handed throwing at a fixed target, two-handed catching a bouncing ball, two-handed clapping catch, and dribbling with feet around obstacles. After they performed the tests integrated in the self-movement sub scale: walking forward and backward on a balance beam, forward rolls on an incline, one-legged hopping back and forth, and running forward and backward. A score of 0 points was awarded for zero successful attempts, 1 point for one successful attempt, and 2 points for two successful attempts. The general procedures to assess BMC and the criteria for success or unsuccess are described elsewhere[11].

This study was approved by the Ethics Committee of the Polytechnic University of Beja (Portugal), reference n. º 1/2021. The design complies with Portugal regulations on clinical research in humans (Law 21/2014 of 16 April), with private data protection regulations (Law 58/2019, 59/2019 and Law 41/2004), and with the principles of the Declaration of Helsinki (2013, Brazil).

Statistical analysis

One factor analysis of variance (ANOVA) was used to determine whether the preschoolers' motor skills differed according to their place of origin. This statistical method allowed for the comparison of mean scores across groups, providing a rigorous approach to identifying variations in motor skills attributed to geographical differences. The data of belonging to a geographical area categorised as rural vs. urban were entered as a fixed factor and motor skills categorised as insufficient development (0), sufficient development (1) and good development (2) were entered as the dependent variable. All analyses were conducted separately for boys and girls. The significance level was set at $p< 0.05$. Analyses were performed using SPSS (v. 22.0 version for Windows, SPSS Inc., Chicago, IL).

Results

The study population consisted of preschoolers from urban (n=68) and rural (n=26) settings, aged between 3 and 5 years old. No other sociodemographic or anthropometric data of the participating children were included, as not authorized by their parents/guardians. Table 1 presents the demographic environment details of the participants.

Table 1. Biometric characteristics and geographical origin of participants segmented by gender.

	All (n = 94)		Boys (n = 48)		Girls (n = 46)		
Variables	N	%	N	%	N	%	*p*
Geographical environment							0.739
Urban	68	72.3	34	70.8	34	73.9	
Rural	26	27.7	14	29.2	12	26.1	

Note: N=Number of cases
Source: authors

Table 2 shows the results of the analysis of variance differentiated by gender and geographical location. The study found that urban boys outperformed their rural counterparts in motor skills. Despite this, urban girls demonstrated superior self-movement skills, but poorer object control skills compared to their rural counterparts. More specifically, regarding self-movement skills, boys from rural areas exhibited lower performance in "Jumping" (p=0.019) and "Rolling" (p=0.005) compared to their urban counterparts. However, girls from rural areas demonstrated better performance in "Rolling" than those from urban areas (p=0.034). In terms of object movement skills, preschoolers living in rural areas showed lower skills in "Bouncing" than those living in urban areas for both boys and girls (p=0.001 and p=0.002 respectively). In addition, rural boys had lower scores in "Catching" than their urban counterparts (p=0.013). Conversely, rural girls scored higher in "Throwing" than urban students (p=0.027). Also, there were some notable findings when analysing performance by skill in different settings. In urban areas, boys performed worst in the skill "Throwing", while girls performed worst in "Dribbling". On the other hand, the skills in which boys excelled were "running" and "jumping", while girls excelled only in "jumping". In contrast, in rural areas, both boys and girls had the lowest scores in "Jumping". However, the highest scoring skills differed between the genders, with "Running" being highest for boys and "Rolling" for girls.

Table 2. Comparison of motor skills by geographical origin differentiated by gender.

		Male					Female				
		Rural		Urban			Rural		Urban		
		Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*
Self-Movement Skills	Running	1.57	0.514	1.79	0.410	0.119	1.58	0.669	1.65	0.597	0.759
	Jumping	1.36	0.842	1.79	0.410	**0.019***	1.42	0.900	1.74	0.511	0.140
	Rolling	0.93	0.917	1.65	0.691	**0.005***	1.67	0.651	1.09	0.830	**0.034***
	Balancing	1.43	0.852	1.76	0.554	0.111	1.50	0.798	1.62	0.697	0.631
Control Object Skills	Catching	1.21	0.975	1.76	0.496	**0.013***	1.58	0.515	1.35	0.812	0.365
	Throwing	1.43	0.852	1.32	0.684	0.655	1.50	0.674	0.88	0.844	**0.027***
	Bouncing	0.64	0.842	1.59	0.657	**0.001***	0.50	0.674	1.29	0.784	**0.002***
	Dribbling	1.07	0.829	1.38	0.697	0.190	0.92	0.673	0.82	0.673	0.719

Note: SD=Standard Deviation
Source: authors

When examining the differences in self-movement and object control skills between preschoolers from rural and urban settings, the findings reveal that rural boys possess lower self-movement skills compared to their urban counterparts, with a significant difference (Figure 1, p=0.002). In contrast, rural girls show a similar level of self-movement skills to urban girls (Figure 1, p>0.05). Regarding object control skills, the analysis indicates that boys from rural areas generally underperform relative to those from urban areas, with this difference reaching statistical significance (Figure 2, p=0.013). Similar to the pattern observed in self-movement skills, rural girls do not demonstrate significant variations in object control skills based on their living environment (Figure 2, p>0.05). Finally, it should be noted that in rural areas, girls have slightly better motor skills than boys, which is the opposite of what happens in urban preschools, where boys tend to have better motor skills

Figure 1. Differences in self-movement skills between urban and rural schoolchildren aged 3 to 5 years. One factor analysis of variance (ANOVA) was conducted with geographical location as a fixed factor and self-movement skills as the dependent variable

Source: Authors

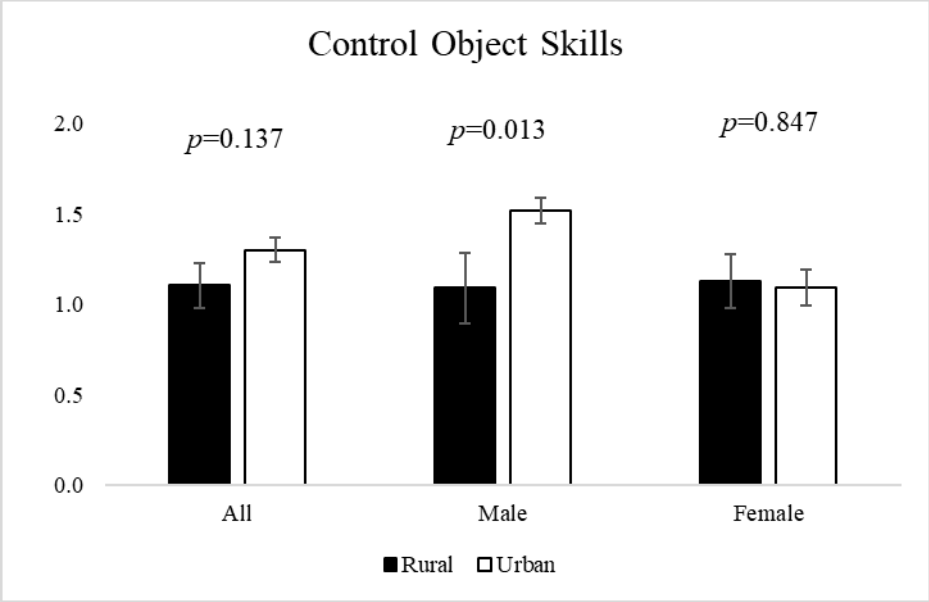

Figure 2. Differences in object movement skills between urban and rural schoolchildren aged 3 to 5 years. One factor analysis of variance (ANOVA) was conducted with geographical location as a fixed factor and object movement skills as the dependent variable

Source: Authors

Discussion

The aim of this study was to analyse the differences in motor skills of children aged 3-5 years according to their geographical origin and differentiated by gender. The results show that boys from rural areas have poorer body and object control than those from urban areas. However, no significant differences in these skills were found for girls. When assessing motor skill items, both boys and girls from rural areas had lower scores for the "Bouncing" skill. Boys from rural areas also had lower scores for the skills: "Jumping", "Rolling", "Catching" and "Bouncing". However, girls from rural areas showed higher scores for "Rolling" and "Throwing" skills. These results are in line with previous studies[13], which show that urban children have better motor skills than rural children. However, there are studies that show different results, where pre-school children from rural areas have better physical fitness and coordination skills[14,15] or find no significant differences between the two contexts[16]. The varying results may be attributed to several factors, including the accessibility of play areas and organised physical activities, cultural norms, socio-economic status, and the role of parents or caregivers in encouraging physical activity[14,15]. Adriyani et al.[14] conducted a study to investigate the impact of area of residence on motor coordination, cardiorespiratory fitness levels, and agility in children. The results showed significant differences in motor coordination and cardiorespiratory fitness between urban and rural children, but not in agility. Specifically, rural children exhibited lower gross motor coordination than their urban counterparts, while their cardiorespiratory fitness was higher. These differences suggest that environmental factors, such as access to play spaces and structured activities, may influence motor skill development differently in urban and rural settings[14].

Alternatively, several studies have shown significant differences in motor skills between the genders, as observed in the present study. In particular, it has been found that boys generally show higher competence in basic motor skills between the ages of 3 and 6[17]. One possible explanation for this phenomenon is that preschool girls in urban areas often

have fewer opportunities to engage in ball games or similar activities that promote the development of these motor skills, in contrast to boys who tend to spend more time in these practices[17]. On the other hand, in rural areas, the activities in which both boys and girls participate tend to be more similar than in urban areas. This environment contributes to a differentiating role for girls' early maturational development, resulting in slightly better performance in motor skills, as found in the present study[18].

Self-Movement Skills

Urban boys were found to outperform rural children in self-movement skills. This finding is consistent with previous research suggesting that access to organised sports facilities and programmes in urban areas may influence better motor development[19]. However, it is observed that this dynamic changes with age; children from rural environments show a significant improvement in their motor skills. This suggests that the rural environment, where children gain greater independence and autonomy, may be more conducive to the development of these skills than urban areas[20]. For girls, on the other hand, no significant differences were found between rural and urban areas in the overall object control skills. These findings are consistent with previous research[3,21], although the underlying causes are still unclear. Nevertheless, significant differences were found in the ability to "Rolling" in particular, which may be due, as with boys, to the greater accessibility of specific resources for developing this skill in urban environments[22].

Object Control Skills

In terms of object control skills, rural children perform less well than their urban counterparts. In particular, urban children were found to be more skilled in skills such as "Catching" and "Throwing". Consistent with these findings, additional research corroborates that urban-dwelling children display superior dexterity in selected abilities, including explosive strength in the upper limbs and enhanced flexibility in the lower limbs[23]. This trend underscores the significant impact of urban environments, which are likely enriched with diverse resources and opportunities conducive to physical development, in the refinement of these motor skills[22]. For girls, no significant differences were found in general object control. However, in specific skills such as "Jumping" and "Throwing", rural girls outperformed urban girls. These findings may be consistent with Sääkslahti and Niemistö[24], who found that girls from metropolitan areas performed worse in object manipulation than girls from other areas.

The development of motor skills in preschool boys and girls in rural and urban contexts may be influenced by the social and environmental opportunities[25]. In urban context, girls may face social constraints and gender stereotypes that limit their participation in physical activities perceived as more aggressive or less feminine, such as throwing and catching[26]. These stereotypes may affect the expectations of parents, educators, and society at large regarding appropriate activities for girls, potentially inhibiting their willingness to engage in games that develop object control skills[26]. Conversely, rural settings typically provide more open spaces and fewer restrictions for play. This increased physical freedom, combined with a social context that may be less restrictive in terms of gender roles during play, could enable rural girls to explore a wider range of activities that develop object control skills[25,26].

Strengths and limitations

The main limitation of this study is the sample. The size is limited for a cross-sectional study and does not adequately reflect the diversity of the population, as it focuses on participants from a specific region of Portugal. This specificity prevents the

generalisability of the results to a wider context. In addition, certain covariates that could have an impact on the results, such as the socio-economic status of the participants' families or the facilities and resources available for preschool children's physical activity in and out of school, were not taken into account.

However, this study also has notable strengths. The strength and novelty of this study is the gender-differentiated analysis, an approach that has been overlooked in most previous studies. In addition, the instrument used to assess the participants' motor skills is highly reliable and has been validated in numerous research studies. Finally, it is important to mention that the research protocol, which was established prior to data collection, was strictly adhered to.

Future research

It is important that future research focuses on the gender differences observed in urban and rural settings. By taking into account the geographical context, together with other critical covariates such as family socio-economic status and additional social factors, the underlying causes of differences in motor development between boys and girls can be elucidated. In particular, it would be beneficial to pay particular attention to girls, as current research suggests that they may face particular challenges in their motor development. It would also be important to explore how cultural experiences and gender expectations in different settings may influence girls' motor development. By understanding these dynamics, more effective interventions and strategies can be designed to meet the specific needs of girls, taking into account the environment in which they live.

Conclusion

The present study has comprehensively examined the development of motor skills in children aged 3-5 years, taking into account geographical and gender factors. The data show that the environment, whether urban or rural, has a significant impact on the motor development of preschool children, especially boys. Urban boys showed superior performance in both self-movement and object control skills compared to their rural counterparts. However, girls did not show significant differences based on geography in general. Only in specific skills such as “Jumping” and “Throwing”, did rural girls obtain better scores than urban girls. This suggests that the social gender factor has a more significant influence than the geographical context.

The gender distinction in the study provided valuable insights. While boys showed differences based on their environment, girls showed no such differences, suggesting that cultural expectations and experiences may play a more important role in their motor development than area of origin. This suggests that special attention should be paid to girls, looking more closely at which variables are the most important determinants of their development in different contexts. This will enable more effective and tailored strategies and interventions to be developed to support the optimal motor development of all pre-school girls and boys.

Conflict of interest

The authors declare no conflict of interest. The study protocol followed the tenets of the Helsinki Declaration. Written informed consent was obtained from a parent and/or legal guardian.

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