

Research article

URBAN-RURAL DIFFERENCES IN GROSS MOTOR COORDINATION AMONG 8-YEAR-OLD CHILDREN

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Abstract. *The aim of this study is to examine the differences in gross motor coordination between primary schoolchildren living in urban and rural areas. The study sample consisted of 120 healthy 8-year old children, equally divided into two groups based on their area of residence: 60 urban children (22 girls) and 60 rural children (20 girls). The urban group comprised children from schools in the city, while the rural group included children from schools in nearby villages. The results indicate no significant differences between urban and rural children in all tested motor coordination tasks and total motor coordination ($p > 0.05$). Although urban children showed slightly better results, these findings suggest that the geographical environment, while a contributing factor, may not be the sole determinant of children's motor coordination abilities. Further studies with larger and more diverse samples, as well as a deeper exploration of environmental and socio-cultural factors, are necessary to draw more definitive conclusions.*

Key words: *motor competence, preadolescents, environment, difference*

1. INTRODUCTION

Motor competence is considered to be fundamental to children's overall development, as they underpin physical activity participation, physical fitness, and long-term health outcomes (Stodden et al., 2008). These abilities facilitate engagement in various physical activities, which are critical for developing social, cognitive, and physical skills during childhood but also later in life (Robinson et al., 2015). However, recent decades have seen a decline in motor competence among children, primarily due to reduced physical activity and increased sedentary behaviors, which negatively affect their overall physical

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and developmental health (Koolwijk et al., 2024). Addressing this decline is essential to mitigate its impact on physical and psychosocial health trajectories. While the decline in motor competence among children is a pressing concern, it is equally important to examine other factors influencing motor development, such as urban-rural differences.

Numerous test batteries are available for assessing motor competence in children, each designed to measure specific aspects of motor performance. Among these, the Körperkoordinationstest für Kinder (KTK) is a widely recognized and validated tool, particularly for evaluating motor coordination in children aged 5 to 14 years (Kiphard, & Schilling, 2007). The KTK test's standardized protocol and focus on gross motor coordination make it a popular choice in both research and practical settings.

There are relatively few studies that specifically examine differences in gross motor coordination between children in urban and rural environments. For instance, Milošević et al. (2022) examined motor coordination in children based on their area of residence and found that children in urban areas displayed slightly better motor coordination. This difference was attributed to better access to sports facilities and structured physical activities compared to rural areas, where opportunities for organized sports may be limited but unstructured play is more prevalent. Further, Marta, Oktarifaldi, and Wisma (2023) also reported that children in urban settings show better motor coordination than their rural counterparts. However, they emphasized that rural children might excel in tasks requiring endurance or strength due to their engagement in daily activities. Amraei and Azadian (2021) conducted a study on girls aged 7-11 and observed significant differences in motor competence based on living environments. Urban girls generally performed better in tasks requiring fine motor skills, while rural girls excelled in gross motor activities, indicating a variation in skill development shaped by environmental demands. Amador-Ruiz et al. (2018) reported from the MOVI-KIDS study that developmental coordination disorders were more prevalent in rural Spanish children. This was attributed to the limited availability of extracurricular physical activities and motor skill training programs. Most recently, Samodra et al. (2024) explored gender-specific differences in gross motor skills in rural areas, finding no significant disparities between boys and girls but noting overall lower competence compared to urban populations. Their findings reinforce the role of reduced access to structured physical education in rural regions. Collectively, these studies suggest that environmental factors, including access to sports infrastructure and differing daily physical demands, significantly influence motor competence. To bridge these gaps, interventions tailored to rural settings that promote motor skill development and organized physical activity are essential.

Despite growing interest in motor competence, limited research examines urban-rural differences in gross motor coordination, particularly in the context of environmental and socio-cultural factors that shape motor skill development. Existing studies often focus on either urban or rural settings in isolation, leaving a gap in understanding the comparative influences of these environments. Additionally, while some studies address gender disparities within rural areas, further exploration is needed to clarify how these differences manifest across diverse geographic contexts. This highlights the need for comprehensive, cross-sectional studies to provide a nuanced understanding of motor competence disparities. The aim of this research is to examine the differences in gross motor coordination between primary school children living in urban and rural areas.

2. METHODS

2.1. Participants

The study sample consisted of 120 healthy children, equally divided into two groups based on their area of residence: 60 urban children (22 girls) and 60 rural children (20 girls). All of the participants were 8 years old (mean age \pm SD = 8.2 ± 0.6 decimal years; Height = 130.45 ± 5.27 cm; Body mass = 29.36 ± 5.45 kg). The urban group comprised children from schools in the city, while the rural group included children from schools in nearby villages. The parents provided informed consent for their children's participation, and only healthy children meeting the inclusion criteria were enrolled in the study.

2.2. Procedures

The testing process began with the measurement of basic anthropometric data for all the participants, including height and weight. These measurements were collected in accordance with standard protocols to ensure accuracy and consistency across participants. Following anthropometric assessment, the children underwent testing using the Körperkoordinationstest für Kinder (KTK). The Körperkoordinationstest für Kinder (KTK), developed by Kiphard and Schilling (2007), is a standardized battery of motor coordination tests designed to assess whole-body coordination in children aged 5-14 years. The KTK consists of four subtests that evaluate dynamic balance, motor control, and body coordination: Walking backwards, Hopping for height, Jumping sideways, Moving sideways. The test was conducted in a school gym with a flat, non-slippery surface. Each test requires minimal but specific equipment, such as beams, foam blocks, a stopwatch, and wooden platforms. Testing was conducted by trained examiners familiar with the KTK protocol. Before testing, children were given practice trials to familiarize themselves with each task. Scores were recorded in raw form. However, as noted by Kiphard and Schilling (2007), KTK provides normative data for comparison, which are used for research purposes.

The first task, Walking Backward, involves walking backward across beams of decreasing widths (6 cm, 4.5 cm, and 3 cm). Each child attempts to complete the task on each beam three times, aiming for a maximum of eight backward steps per trial. The total score is the sum of successful steps across all trials, with a maximum of 72 points.

In the second task, Hopping for height, participants perform single-leg jumps over sponge obstacles of increasing height (0 to 60 cm). Each successful jump awards points based on the number of attempts (3 points for the first attempt, 2 for the second, and 1 for the third), with a maximum total of 78 points across both legs.

The third task, Jumping sideways, requires children to jump sideways over a wooden slat as many times as possible within 15 seconds. Each child completes two trials, and the total score is the sum of all successful jumps across both attempts.

Finally, the Moving sideways task assesses agility and dynamic balance. Children move two platforms alternately, stepping on each as they transfer the opposite platform to the other side. The number of platform transfers within 20 seconds is recorded across two trials, and the total score is the sum of both trials.

2.3. Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics software (version 23). The primary objective was to determine differences in motor coordination performance (KTK) between urban and rural children. Descriptive statistics, including means and standard deviations, were calculated for all variables. To test for group differences, an independent samples t-test was conducted for normally distributed variables, while the Mann-Whitney U test was employed for non-normally distributed variables. Statistical significance was set at $p < 0.05$. Additionally, effect sizes (Cohen's d) were calculated to quantify the magnitude of differences between the urban and rural groups. This approach ensured a robust and comprehensive analysis of the data, allowing for meaningful interpretation of the observed differences.

3. RESULTS

The results, presented in Table 1, indicate differences between urban and rural children in all tested motor coordination tasks and total motor coordination. However, none of these differences reached statistical significance ($p > 0.05$). Urban children displayed slightly better performance in Hopping for height, Jumping sideways and Moving sideways, while rural children demonstrated marginally higher scores in Walking backwards. Finally, the total KTK score was slightly better in urban (88.23) compared to rural children (86.12).

Table 1 Standardized values for KTK tests and total score; values are mean \pm SD

	Urban	Rural	Mean diff (CI)	p	ES (CI)
Walking backwards	88.92 \pm 11.36	89.63 \pm 12.55	0.29 (-4.04, 4.62)	0.89	0.02 (-0.33, 0.38)
Hopping for height	90.34 \pm 11.95	88.36 \pm 11.48	1.98 (-2.26, 6.22)	0.36	0.17 (-0.19, 0.53)
Jumping sideways	98.38 \pm 17.34	94.43 \pm 15.43	3.95 (-1.98, 9.88)	0.19	0.24 (-0.12, 0.60)
Moving sideways	87.29 \pm 11.41	85.75 \pm 12.34	1.54 (-2.76, 5.84)	0.48	0.13 (-0.23, 0.49)
KTK total score	88.23 \pm 12.24	86.12 \pm 12.35	2.11 (-2.34, 6.56)	0.35	0.17 (-0.19, 0.53)

ES = effect size; CI = confidence interval

4. DISCUSSION

The aim of this study was to investigate differences in gross motor coordination between urban and rural 8-year-old children, assessed through the KTK battery. While urban children showed slightly higher performances on some of the tests, these differences were not statistically significant. Overall, the results suggest no meaningful disparity in total motor competence between the two groups, highlighting that environmental factors might not markedly influence motor coordination in this age group.

Gross motor coordination is crucial for children's physical development, impacting their ability to perform basic tasks like walking, running, and maintaining balance, which in turn affects their overall health and academic success (Robinson et al., 2015). Effective gross motor coordination also supports cognitive development by enhancing brain function and motor planning abilities (Fernandes et al., 2016). Several factors influence motor development, including genetic predisposition, physical activity levels, nutrition, and

environmental influences. One of the key determinants of gross motor skills is the environment, with urban and rural settings offering different opportunities for physical engagement (Stodden et al., 2008). Children in urban areas often have less access to open spaces and may spend more time indoors, reducing opportunities for free play and outdoor activities that are of great importance for motor development (Markevych, et al., 2014). On the other hand, children in rural areas, where outdoor play is more prevalent, tend to engage in more physical activities (Sandercock, Angus, and Barton, 2010). However, access to resources like playgrounds, sports programs, and health services also plays a significant role in shaping these developmental outcomes (Cohen, et al., 2007). Therefore, both environmental and socioeconomic factors are key to understanding the disparities in motor coordination across urban and rural populations.

The total motor quotient score of 88 for 8-year-old children in our research is within the typical range and slightly lower observed in similar studies conducted internationally. Specifically, the total KTK score observed in this study was comparable to that reported for children in Australia, with Australian children achieving an average KTK total score of approximately 90 across similar age groups. However, the scores were notably lower than those observed in Belgian children, where the average total score was 96, indicating a higher level of motor competence in the Belgian cohort. These variations may reflect cross-cultural differences in motor development opportunities, environmental factors, and physical activity practices, as suggested by Bardid et al. (2015). In addition, the total KTK score in this study was consistent with the findings for children in Italy, as reported by Giuriato et al. (2021). However, these scores were lower than the established reference values and earlier research outcomes, which highlighted higher motor competence levels in previous cohorts. This discrepancy underscores potential shifts in physical activity patterns and environmental influences over time, reflecting broader concerns about declining gross motor coordination among youth populations.

Our findings, which show no significant differences in gross motor coordination among 8-year-old children, in contrast with some studies that have compared urban and rural children, where environmental factors often play a role in motor development. This study aligns with findings by Walhain et al. (2016), who also did not observe significant differences in the total motor coordination scores between urban and rural children. However, notable differences emerged in specific subtests within the KTK test battery, highlighting distinct performance patterns influenced by environmental factors. These variations suggest that while overall coordination may be similar, certain motor skills could be more influenced by the contrasting physical activity opportunities or lifestyles in urban and rural settings. According to Milošević et al. (2022), rural children demonstrated better overall motor coordination scores compared to their urban peers. The results indicated that rural children outperformed most tasks in the test battery, which may be attributed to their engagement in more unstructured, outdoor physical activities that enhance gross motor skills. Conversely, urban children, despite potentially having access to more structured programs, may face limitations due to sedentary behaviors and reduced opportunities for free movement. On the contrary, although the differences were not statistically significant, our findings indicated that urban children demonstrated better results in most subtests of the KTK battery as well as in the total motor coordination score. This trend suggests that urban children may benefit from specific opportunities or programs that promote motor skill development, even though environmental constraints such as limited outdoor spaces could pose challenges.

The discrepancy in the results could be explained by the fact that differences in motor coordination between urban and rural children are not solely attributable to living settings but are also significantly influenced by the geographical area, as highlighted by Gallotta et al. (2022). The authors stated that children's motor coordination can vary across different geographical regions due to factors such as climate, terrain, cultural practices, and regional socioeconomic characteristics. These influences might lead to variations within urban or rural settings, depending on the specific environmental and social conditions of the geographic area. Therefore, the interplay between living settings and geographic factors should be considered when evaluating differences in motor coordination among children. Moreover, some other observed reasons for discrepancies should be mentioned. Urban children often benefit from structured physical activity programs, access to sports facilities, and professional coaching, which may enhance their performance on standardized tests. Conversely, rural environments may promote unstructured play and daily physical tasks that develop functional motor skills in different ways. Socioeconomic disparities also play a role, as urban areas may provide more resources, while rural children may engage in more physically demanding routines. Additionally, geographic characteristics, cultural practices, and lifestyle differences shape the type and frequency of physical activities. Variability in the sampling methods, age groups, or testing conditions across studies may further influence the outcomes. Together, these elements underscore the complex relationship between living settings and motor coordination.

Certain limitations should be acknowledged that may impact the generalizability and robustness of our conclusions. The small sample size limits the generalizability of the results and prevents the analysis of potential differences between boys and girls. Additionally, due to the sample size, the study did not account for or present data on the physical activity levels of the children, which could influence gross motor coordination. Moreover, the study did not consider or control for differences in nutrition between the urban and rural groups, a factor that could impact children's physical development. These limitations should be kept in mind when interpreting the results, as they may affect the reliability and applicability of the findings, and further research is needed with larger samples and the inclusion of additional variables such as gender, physical activity, and nutrition.

5. CONCLUSIONS

In conclusion, no significant differences were found in motor coordination scores between urban and rural children, although urban children tended to show slightly better results across most of the tests, including the total motor coordination score. These findings suggest that the geographical environment, while a contributing factor, may not be the sole determinant of children's motor coordination abilities. Further studies with larger and more diverse samples, as well as a deeper exploration of environmental and socio-cultural factors, are necessary to draw more definitive conclusions. From a practical perspective, these results emphasize the need for targeted interventions and policies that support the development of motor coordination across all environments, regardless of the geographical setting. Although urban children showed slight advantages, efforts to improve physical activity and motor skills should be inclusive and accessible, addressing the unique needs of both urban and rural populations to ensure equitable development opportunities for all children.

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URBANE-RURALNE RAZLIKE U GRUBOJ MOTORIČKOJ KOORDINACIJI KOD OSMOGODIŠNJE DECE

Cilj ovog istraživanja je ispitivanje razlika u gruboj motoričkoj koordinaciji između dece osnovnoškolskog uzrasta koja žive u urbanim i ruralnim sredinama. Uzorak ispitanika obuhvatio je 120 zdravih osmogodišnjih učenika, podjednako podjeljenih u dve grupe na osnovu mesta stanovanja: 60 dece iz urbanih (22 devojčice) i 60 dece iz ruralnih sredina (20 devojčica). Urbanu grupu činila su deca iz škola u gradu, dok su ruralnu grupu činila deca iz škola u obližnjim selima. Rezultati pokazuju da nema značajnih razlika između dece iz urbanih i ruralnih sredina u svim testiranim zadacima motoričke koordinacije i ukupnoj motoričkoj koordinaciji ($p > 0.05$). Iako su deca iz urbanih sredina pokazala nešto bolje rezultate, ovi rezultati ukazuju na to da geografsko okruženje, iako utičen na rezultate, možda nije jedini faktor koji utiče na motoričke sposobnosti dece. Dalja istraživanja sa većim i raznovrsnijim uzorcima, kao i dublje proučavanje uticaja sredinskih i socio-kulturnih faktora, neophodna su za donošenje jasnijih zaključaka.

Ključne reči: motorička kompetencija, predadolescenti, okruženje, razlike