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ORIGINAL RESEARCH

Correlation Between Motor Coordination and Running Speed with Hurdle Running Ability in Students of SMAN 5 Binjai City

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ABSTRACT

Objectives: Hurdle running is a complex athletic discipline requiring optimal coordination between motor skills and running velocity. This study investigates the relationship between motor coordination, running speed, and hurdle running performance in high school students. To examine the correlation between motor coordination and running speed with hurdle running ability in students of SMAN 5 Binjai City, North Sumatra, Indonesia.
Methods: This correlational study involved 40 high school students (aged 15-18 years) from SMAN 5 Binjai City. Motor coordination was assessed using standardized coordination tests, running speed was measured through sprint performance evaluations, and hurdle running ability was evaluated using specific hurdle clearance assessments.
Results: Strong positive correlations were found between motor coordination and hurdle performance ($r = 0.807$, $p < 0.001$), running speed and hurdle performance ($r = 0.869$, $p < 0.001$), and motor coordination and running speed ($r = 0.756$, $p < 0.001$). Motor coordination scores averaged 71.59 ± 12.80, running speed scores 81.23 ± 10.14, and hurdle performance scores 85.83 ± 8.69.
Conclusion: Motor coordination and running speed significantly correlate with hurdle running ability, with running speed showing the strongest relationship. These findings support the importance of developing both coordination skills and sprint capacity for optimal hurdle performance in high school athletes.

Keywords: motor coordination, running speed, hurdle running, athletic performance, high school students.

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INTRODUCTION

Hurdle running represents one of the most technically demanding disciplines in track and field athletics, requiring athletes to maintain high running speeds while negotiating barriers at regular intervals. Success in hurdle events depends on the complex integration of multiple motor abilities, including coordination, speed, rhythm, and technical proficiency. The ability to efficiently clear hurdles while maintaining horizontal velocity is fundamental to performance in this discipline.

Motor coordination, defined as the harmonious interaction of muscle groups to produce smooth and efficient movement patterns, plays a crucial role in athletic performance. In hurdle running, athletes must demonstrate exceptional coordination to execute the precise timing and body positioning required for optimal hurdle clearance. Research indicates that coordination abilities are essential for maintaining rhythm and technical consistency throughout the race.

Running speed serves as another fundamental component of hurdle performance, as athletes must achieve and maintain high velocities between hurdles. The relationship between sprint speed and hurdle performance is well-established in elite athletes, where the ability to accelerate rapidly and maintain speed directly impacts race outcomes. Previous research has demonstrated significant relationships between motor coordination and athletic performance across various sports. Studies utilizing multichannel electromyography have shown that professional athletes exhibit greater stability in movement repetition (>83%) and higher symmetry in muscle efforts (>81%) compared to recreational athletes. This suggests that superior coordination is characteristic of advanced athletic performance.
In hurdle-specific research, biomechanical analyses have identified key factors determining performance, including horizontal velocity maintenance, vertical displacement minimization, and optimal hurdle clearance techniques. Elite hurdlers demonstrate the ability to clear hurdles with minimal deceleration, maintaining horizontal speeds throughout the race.

Motor coordination assessment in athletic populations has utilized various standardized instruments, including the Movement Assessment Battery for Children (MABC-2) and Körperkoordinationstest für Kinder (KTK). These tools have proven effective in identifying coordination differences between athletic and non-athletic populations.

Despite extensive research on individual components of hurdle performance, limited studies have specifically examined the relationship between motor coordination, running speed, and hurdle ability in high school populations. Most existing research focuses on

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elite adult athletes, leaving a gap in understanding how these relationships manifest in developing athletes. Indonesian athletic research, particularly in track and field disciplines, remains underrepresented in international literature. This study addresses the need for region-specific data on motor performance relationships in Southeast Asian student populations.

Understanding the relationship between motor coordination, running speed, and hurdle performance in high school students is essential for developing effective training programs and talent identification protocols. Early identification of coordination and speed capacities can inform coaching strategies and athlete development pathways.

High school represents a critical period for athletic development, where fundamental motor patterns become established and refined. Research during this developmental stage provides valuable insights for optimizing training interventions and performance outcomes. The primary objective of this study was to examine the correlation between motor coordination and running speed with hurdle running ability in students of SMAN 5 Binjai City. Specific aims included: 1. To assess motor coordination levels in high school students using standardized measurement protocols; 2. To evaluate running speed performance through sprint-based assessments; 3. To measure hurdle running ability using sport-specific performance indicators; 4. To determine the strength and significance of correlations between these variables; 5. To provide evidence-based recommendations for hurdle training program development.

METHODOLOGY

Participants

The study involved 40 high school students (20 males, 20 females) from SMAN 5 Binjai City, North Sumatra, Indonesia. Participants ranged in age from 15-18 years (mean age 16.5 ± 0.8 years), with mean height of 165 ± 8 cm and mean weight of 58 ± 10 kg. All participants were enrolled in regular physical education classes and had basic familiarity with track and field activities. Exclusion criteria included any current injuries that would prevent participation in running activities, previous diagnosis of developmental coordination disorders, or inability to complete the full assessment protocol.

Study Organization

This cross-sectional correlational study was conducted over a 4-week period at the athletic facilities of SMAN 5 Binjai City. All testing was performed during regular school hours with appropriate supervision and safety protocols. The study received approval from the school administration and informed consent was obtained from all participants and their parents/guardians prior to data collection.

Testing sessions were organized across three separate days to prevent fatigue effects, with each session separated by minimum 48-hour recovery periods. Motor coordination assessments were conducted on day 1, running speed evaluations on day 2, and hurdle performance testing on day 3. Environmental conditions were standardized across all testing sessions, with assessments conducted on the same track surface during similar time periods.

Assessment Protocols

Table 1. Assessment Protocols

Assessment Type	*Protocol Description*	*Scoring Method*
Motor Coordination Assessment	Dilakukan dengan rangkaian tes standar yang diadaptasi dari protokol koordinasi motorik, termasuk balance beam tasks, latihan koordinasi bilateral, dan evaluasi kontrol motorik halus.	Skor dinormalisasi ke skala 100 poin, skor lebih tinggi menunjukkan kemampuan koordinasi lebih baik.
Running Speed Assessment	Kecepatan lari diukur melalui sprint 100 meter dengan sistem timing elektronik. Peserta melakukan pemanasan standar (dynamic stretching & progressive acceleration runs) sebelum tes.	Performa sprint dikonversi ke skor standar untuk analisis korelasi, skor lebih tinggi = lebih cepat.
Hurdle Performance Assessment	Kemampuan lari gawang diukur dengan lintasan 5 gawang (tinggi disesuaikan usia peserta). Penilaian mencakup waktu tempuh, teknik, dan konsistensi ritme.	Skor komposit distandardisasi ke skala 100 poin.

Statistical Analysis

Data analysis was conducted using IBM SPSS Statistics version 25.0. Descriptive statistics were calculated for all variables, including measures of central tendency and variability. Data normality was assessed using the Shapiro-Wilk test. Pearson product-moment correlations were computed to examine relationships between motor coordination, running speed, and hurdle performance variables. Statistical significance was set at $p < 0.05$ for all analyses. Effect sizes were interpreted using Cohen's conventions: small ($r = 0.10$), medium ($r = 0.30$), and large ($r = 0.50$) effects.

RESULTS

Descriptive Statistics

The descriptive statistics for the three main study variables are presented in Table 1. Motor coordination scores ranged from 41.8 to 95.0 points, with a mean of 71.59 ± 12.80. Running speed scores demonstrated a range of 57.7 to 95.0 points (mean = 81.23 ± 10.14). Hurdle performance scores showed the narrowest range at 67.0 to 95.0 points, with a mean of 85.83 ± 8.69.

Table 2. Descriptive Statistics of Study Variables (N = 40)

Variable	Mean ± SD	Range
Motor Coordination	71.59 ± 12.80	41.8 - 95.0
Running Speed	81.23 ± 10.14	57.7 - 95.0
Hurdle Performance	85.83 ± 8.69	67.0 - 95.0

Correlation Analysis

The correlation matrix revealed significant positive relationships between all three variables (Table 2). The strongest correlation was observed between running speed and hurdle performance ($r = 0.869$, $p < 0.001$), indicating a large effect size. Motor coordination demonstrated strong positive correlations with both hurdle performance ($r = 0.807$, $p < 0.001$) and running speed ($r = 0.756$, $p < 0.001$).

Table 3. Pearson Correlation Matrix

Variables	1	2	3
1. Motor Coordination	1.000	0.756	0.807
2. Running Speed	0.756	1.000	0.869
3. Hurdle Performance	0.807	0.869	1.000

Note: All correlations significant at $p < 0.001$

Statistical Significance and Effect Sizes

All correlation coefficients exceeded the large effect size threshold ($r > 0.50$), indicating substantial relationships between the studied variables. The correlation between running speed and hurdle performance ($r = 0.869$) explained approximately 75.5% of the shared variance, representing the strongest relationship observed. Motor coordination accounted for 65.1% of variance in hurdle performance and 57.2% of variance in running speed.

Visual Representation of Relationships

The scatter plot matrix (Figure 1) illustrates the linear relationships between all variable pairs, with clear positive trends evident in each comparison. The strength of correlations is visually apparent through the tight clustering of data points around the trend lines

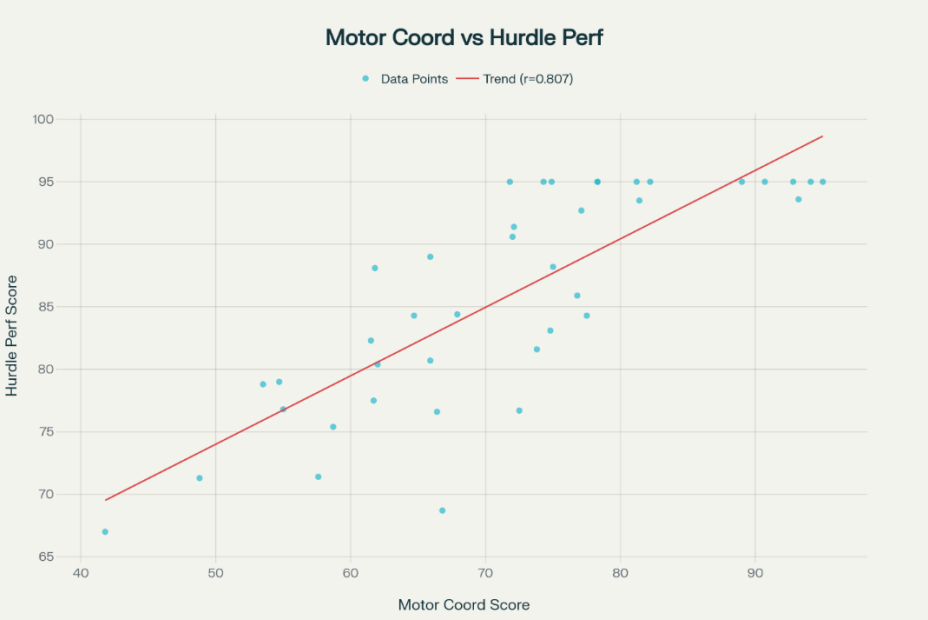

Figure 1. Scatter plot matrix showing correlations between motor coordination, running speed, and hurdle performance in high school students (N = 40)

The chess intervention produced statistically significant improvements in critical thinking abilities. Post-intervention scores ($M = 65.47$, $SD=13.89$) were significantly higher than pre-intervention scores ($M = 56.38$, $SD = 11.32$), $t(39) = -9.251$, $p < 0.001$. The effect size (Cohen's $d = 1.35$) indicates a large practical significance, suggesting that the intervention produced meaningful cognitive improvements.

DISCUSSION

The findings of this study demonstrate strong positive correlations between motor coordination, running speed, and hurdle performance in high school students from SMAN 5 Binjai City. These results align with established theoretical frameworks that emphasize the multifactorial nature of hurdle performance. The strongest correlation observed was between running speed and hurdle performance ($r = 0.869$), supporting previous research indicating that sprint capacity serves as a fundamental prerequisite for hurdle success. This relationship reflects the fact that hurdle events are essentially modified sprints, where the ability to maintain high horizontal velocity directly impacts performance outcomes.

The substantial correlation between motor coordination and hurdle performance (r = 0.807) underscores the technical complexity of hurdle running. Successful hurdle clearance requires precise timing, rhythm maintenance, and coordinated movement patterns that depend heavily on well-developed coordination abilities. This finding is consistent with research demonstrating that elite athletes exhibit superior coordination characteristics compared to their less skilled counterparts.

The correlation magnitudes observed in this study are comparable to those reported in previous athletic performance research. Studies examining motor coordination in athletic populations have consistently found moderate to strong relationships between coordination measures and sport-specific performance. Research on hurdle biomechanics has identified similar patterns, where technical proficiency (reflecting coordination) and speed capacity emerge as primary performance determinants. Elite hurdlers demonstrate superior ability to integrate these components, maintaining coordination under high-speed conditions.

The findings also align with developmental motor learning research, which indicates that coordination and speed capacities become increasingly integrated during adolescence. The strong correlations observed suggest that this integration process is well-established in the studied population. These findings have several important implications for athletic training and talent identification in high school populations. The strong relationships between variables suggest that training programs should address both coordination development and speed enhancement simultaneously rather than in isolation. For talent identification purposes, the results indicate that assessments of both motor coordination and running speed can provide valuable information about potential hurdle performance. Students demonstrating superior performance in these areas may be candidates for specialized hurdle training programs.

From a pedagogical perspective, physical education curricula should emphasize activities that develop both coordination and speed capacities, as these appear to be fundamental prerequisites for complex athletic skills like hurdle running.

Several limitations should be acknowledged when interpreting these findings. The cross-sectional design prevents causal inferences about the relationships between variables. Longitudinal studies would be needed to establish developmental patterns and causal directions. The sample was limited to students from a single school in Binjai City, which may limit generalizability to broader populations. Cultural, socioeconomic, and environmental factors specific to this region may influence the observed relationships.

The assessment protocols, while based on established principles, were adapted for the high school setting and may not fully capture the complexity of coordination and speed capacities. More sophisticated biomechanical analyses could provide additional insights into these relationships. Additionally, the study did not control for factors such as previous athletic experience, training history, or genetic predisposition, which may influence the strength of observed correlations.

CONCLUSION

This study provides compelling evidence for strong positive correlations between motor coordination, running speed, and hurdle running ability in high school students from SMAN 5 Binjai City. The findings demonstrate that running speed exhibits the strongest relationship with hurdle performance (r = 0.869), followed by motor coordination (r = 0.807), both representing large effect sizes that are statistically significant. These results reinforce the multifactorial nature of hurdle performance and highlight the importance of developing both coordination skills and sprint capacity in young athletes. The strong correlations observed suggest that training programs targeting hurdle development should emphasize integrated approaches that simultaneously address coordination refinement and speed enhancement. The evidence supports the implementation of comprehensive assessment protocols that evaluate both motor coordination and running speed when identifying students with potential for hurdle event participation. Physical education programs should prioritize activities that develop these fundamental capacities as prerequisites for complex athletic skills.

Future research should employ longitudinal designs to examine the developmental trajectories of these relationships and investigate the effectiveness of specific training interventions targeting coordination and speed integration. Additionally, expanding the research to include diverse populations and more sophisticated assessment methodologies would enhance our understanding of these important performance relationships. The findings contribute valuable insights to the limited body of research on athletic performance relationships in Indonesian student populations and provide evidence-based guidance for coaching and physical education practices in Southeast Asian contexts.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this research study.

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