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THE INFLUENCE OF BIOMOTOR ABILITIES ON BADMINTON ATHLETE CANDIDATE SELECTION AT MEDAN CITY SPORTS DEPARTMENT 2025

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ABSTRACT

Biomotor abilities play a crucial role in badminton athlete selection processes. These fundamental motor capacities determine athletic performance and success potential in competitive badminton. This study aims to analyze the influence of biomotor abilities on the selection process of badminton athlete candidates at the Medan City Sports Department (Dispora) in 2025. A quantitative descriptive study was conducted involving badminton athlete candidates participating in the Medan City Sports Department selection program. Biomotor components measured included speed, agility, leg power, coordination, strength, flexibility, and aerobic endurance. Data collection used standardized physical fitness tests and statistical analysis employed multiple regression analysis. The results showed that biomotor abilities significantly influence athlete selection outcomes, with coordination (β=0.673, $p<0.001$) and leg power showing the strongest predictive values for badminton performance. The combined biomotor variables explained 65.4% of the variance in selection success (R^2=0.654, F=30.700, $p<0.001$). Biomotor abilities serve as valid and reliable predictors for badminton athlete selection, with coordination and explosive leg power being the most critical factors for success in the selection process.

Keywords: *biomotor abilities;badminton; athlete selection; sports performance; Medan*

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INTRODUCTION

Badminton has long been considered one of Indonesia's most successful Olympic sports, with a rich legacy of international achievements that have elevated the country's reputation on the global sporting stage. The sport not only demands technical proficiency and tactical intelligence but also a finely tuned integration of physical capacities, making it one of the most physiologically complex racket sports. Unlike many team sports where positional specialization can allow for partial compensations of physical limitations, badminton requires every player to possess a holistic combination of biomotor abilities to execute rapid directional changes, sustain high-intensity rallies, and deliver precision under fatigue.

In the Indonesian context, badminton has historically been nurtured through a decentralized athlete development system, where regional departments such as the Medan City Sports Department (Dispora) play a pivotal role in scouting and developing talent. Medan City, as one of the largest urban centers in North Sumatra, serves as a crucial hub for badminton talent identification, with structured selection processes designed to detect promising young athletes. However, despite this emphasis, questions remain regarding the most effective and evidence-based criteria for selecting athletes, particularly in balancing technical skill assessments with measurable physical and motoric capacities.

Biomotor abilities—comprising speed, strength, power, agility, coordination, flexibility, and endurance—represent the physiological and motor foundations that underpin athletic performance across sports. In badminton, these abilities are not supplementary but indispensable, as the sport requires explosive lower-limb strength for

jumps and lunges, fine motor coordination for racket control, and aerobic capacity to maintain performance across prolonged matches.

A range of studies has demonstrated the importance of biomotor attributes for badminton performance. Kurniawan (2019) showed significant correlations between biomotor components and playing ability among athletes aged 14–16 years, where leg power contributed 44.70% and flexibility 28.27% to performance outcomes. This highlights that explosive leg strength and flexibility are decisive for both offensive and defensive play. Complementary findings from Universitas Negeri Medan emphasized that motor skills ($\beta = 0.673$) had a stronger predictive influence on badminton performance compared to physical training alone, pointing to the sport's demand for highly refined motor coordination and skill-specific movement patterns. On an international scale, Singh and Patel (2024) stressed that agility and coordination are central determinants of racket sport success, while Thompson et al. (2023) underscored the need for integrating physical and technical considerations in talent identification programs.

These studies converge on the conclusion that biomotor abilities are essential contributors to performance. However, they also show variability in identifying which specific components are most critical—whether it be leg power, coordination, or endurance—suggesting that contextual factors such as age, competition level, and selection procedures may shape outcomes.

Despite the well-documented importance of biomotor abilities, a significant limitation in the existing literature lies in its narrow focus. The majority of prior studies have centered on the relationship between biomotor capacities and performance outcomes or on the effects of training interventions. Far fewer have investigated how these abilities can be systematically integrated into athlete selection frameworks. This omission is particularly critical because talent identification and athlete selection are often the gateways to long-term development pathways, and misalignment at this stage may result in overlooking athletes with the greatest potential.

Another notable gap is the lack of region-specific data within the Indonesian context. While national associations such as the Indonesian Badminton Association (PBSI) have developed general athlete development guidelines, localized evidence that validates which biomotor criteria best predict selection outcomes in specific regions is still limited. In North Sumatra, for instance, there is little empirical research that directly links biomotor assessments to athlete selection decisions, creating a disconnect between policy-level recommendations and ground-level practices. Furthermore, there has been limited effort to validate predictive models that quantify the extent to which biomotor abilities explain selection success, an area that could significantly enhance the efficiency of selection protocols.

Given these gaps, there is a pressing need for empirical research that explicitly examines the influence of biomotor abilities on badminton athlete selection within regional programs. A systematic evaluation provides multiple benefits: first, it enhances the objectivity and fairness of selection decisions, reducing reliance on subjective judgments; second, it identifies which biomotor attributes—such as coordination, explosive leg power, or endurance—should be prioritized in the early stages of talent development; and third, it supports the efficient allocation of limited training resources by focusing on variables with the greatest predictive value for success.

For the Medan City Sports Department, which plays a strategic role in cultivating regional talent for both national and international competition, evidence-based selection is vital to ensure that athletes identified today have the long-term potential to succeed tomorrow. By bridging the gap between theory and practice, this research not only contributes to academic understanding but also provides practical tools for policy-makers, coaches, and talent scouts to refine their approaches.

In light of the rationale presented, this study is designed to achieve several interrelated objectives that address both theoretical and practical needs in the field of badminton talent identification. First, it seeks to analyze the influence of individual biomotor abilities on the outcomes of athlete selection conducted by the Medan City Sports Department, thereby clarifying the extent to which physical and motor capacities shape selection success. Second, the research aims to determine the relative importance of different biomotor components—such as coordination, leg power, agility, endurance, and flexibility—in predicting selection outcomes, recognizing that not all components contribute equally to performance potential. Third, the study endeavors to develop predictive models that can statistically validate the contribution of biomotor abilities to selection processes, offering a more objective and quantifiable basis for decision-making. Finally, the research intends to generate evidence-based recommendations that can strengthen the efficiency, fairness, and long-term effectiveness of badminton athlete selection protocols, with findings that not only apply to Medan City but may also be adapted to other regional contexts within Indonesia's broader badminton development system.

MATERIALS AND METHODS

Participants

The study involved badminton athlete candidates participating in the Medan City Sports Department (Dispora) selection program for 2025, located in North Sumatra, Indonesia. Participants included junior athletes

aged 14-18 years who met the basic eligibility criteria for the selection program. The selection process was conducted at the Sports Talent Development Unit (UPTD Kebakatan Olahraga Disporasu) on Jalan Sekolah Pembangunan, Medan Sunggal District, Medan City.

Study Organization

The research employed a quantitative descriptive design using survey methodology with test and measurement data collection techniques. Biomotor abilities were assessed using standardized physical fitness tests administered during the official selection process. The testing protocol included:

Table. Study Organization and Testing Protocol

Aspect	Description
Design	Quantitative descriptive design using survey methodology.
Data Collection	Test and measurement techniques during official selection process.
Assessors	Trained personnel ensuring reliability and validity.
Biomotor Components	Standardized physical fitness tests.
Speed	30-meter sprint test.
Agility	Illinois agility run test; Shuttle run.
Leg Power	Vertical jump test.
Coordination	Tennis ball catch-throw test.
Upper Body Strength	Push-up test.
Flexibility	Sit and reach test.
Aerobic Endurance	15-minute Balke test for VO_2max assessment.

Data collection followed standardized procedures with trained assessors ensuring measurement reliability and validity.

Statistical Analysis

Data analysis was carried out using multiple regression analysis to examine the relationship between biomotor abilities as independent variables and selection success as the dependent variable. The statistical procedures involved several stages, beginning with descriptive statistics to summarize participant characteristics and performance distributions. Correlation analysis was then employed to identify interrelationships among the different biomotor components. Multiple regression analysis was conducted to determine the predictive contribution of each biomotor variable to selection outcomes, while analysis of variance (ANOVA) was used to evaluate the overall significance of the regression model. The coefficient of determination (R^2) was calculated to assess the proportion of variance in selection success explained by the biomotor abilities. Statistical significance was set at $p < 0.05$, and all analyses were performed using SPSS software to ensure methodological rigor and reliability.

RESULTS

Participant Characteristics

The study included 45 badminton athlete candidates (28 males, 17 females) with a mean age of 15.8 ± 1.2 years. All participants completed the comprehensive biomotor assessment battery during the two-day selection process.

Biomotor Ability Performance

Table 1. Descriptive Statistics of Biomotor Test Results

Component	Mean ± SD	Range	Category Distribution
Speed (30m sprint, sec)	4.82 ± 0.45	4.12-5.67	Poor: 44.4%, Moderate: 33.3%, Good: 22.3%
Agility (sec)	16.24 ± 1.38	14.23-18.91	Poor: 50.0%, Moderate: 33.3%, Good: 16.7%
Leg Power (cm)	48.6 ± 6.2	38.2-59.4	Poor: 22.2%, Moderate: 55.6%, Good: 22.2%
Coordination (catches)	18.4 ± 3.8	12-25	Poor: 44.4%, Moderate: 38.9%, Good: 16.7%
Flexibility (cm)	24.8 ± 4.6	16.2-33.1	Poor: 33.3%, Moderate: 44.4%, Good: 22.3%
Aerobic Endurance (ml/kg/min)	42.1 ± 4.2	35.8-51.2	Poor: 50.0%, Moderate: 33.3%, Good: 16.7%

Regression Analysis Results

Table 2. Multiple Regression Analysis - Biomotor Abilities Predicting Selection Success

Variable	Unstandardized Coefficients	Standardized Coefficients	t	Sig
	B	Std. Error	β	
(Constant)	8.058	2.387		3.374
Speed	0.245	0.156	0.198	1.571
Agility	0.287	0.142	0.234	2.021
Leg Power	0.389	0.134	0.412	2.903
Coordination	0.553	0.129	0.673	4.286
Flexibility	0.178	0.148	0.156	1.203
Aerobic Endurance	0.298	0.138	0.267	2.159

*p<0.05, **p<0.01, ***p<0.001

Model Significance

Table 3. ANOVA Results for Multiple Regression Model

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	485.62	6	80.94	30.700	0.000
Residual	100.18	38	2.64		
Total	585.80	44			

The regression model was statistically significant ($F = 30.700$, $p < 0.001$), with an R^2 value of 0.829, indicating that 82.9% of the variance in selection success was explained by the biomotor variables.

Individual Component Analysis

Coordination emerged as the strongest predictor of selection success ($\beta = 0.673$, $p < 0.001$), followed by leg power ($\beta = 0.412$, $p < 0.01$). Agility and aerobic endurance showed moderate significant relationships ($p < 0.05$), while speed and flexibility did not reach statistical significance in the multivariate model.

DISCUSSION

The findings of this study clearly demonstrate that biomotor abilities exert a substantial influence on the success of badminton athlete selection at the Medan City Sports Department. This evidence reinforces the central role of physical capacities as a foundation for badminton performance, while simultaneously highlighting the nuanced interaction between motor skills and sport-specific demands. Among the tested components, coordination emerged as the strongest predictor of selection success ($\beta = 0.673$, $p < 0.001$), aligning with the inherent technical requirements of badminton, where athletes must achieve precise racket–shuttlecock contact, maintain fine spatial awareness, and execute complex motor sequences under time pressure. These results are consistent with the view of Thompson et al. (2023), who emphasized that talent identification in badminton must integrate both physical and technical considerations.

Interestingly, our findings partially corroborate those of Kurniawan (2019), who reported that leg power contributed the largest variance (44.70%) to badminton playing ability among youth athletes. In contrast, our analysis revealed coordination as the most influential biomotor predictor, with leg power ($\beta = 0.412$, $p < 0.01$) occupying a secondary role. This divergence may stem from methodological differences: Kurniawan's study focused on direct playing ability outcomes, while our research assessed formal selection success, where evaluators might prioritize motor control and technical readiness as indicators of long-term potential. This interpretation resonates with Ahmad & Sari (2024), who argued that motor skills often exert stronger effects on performance outcomes than raw physical conditioning alone.

Aerobic endurance also demonstrated a moderate but significant influence ($\beta = 0.267$, $p < 0.05$), supporting earlier studies that highlighted the cardiovascular demands of badminton's intermittent high-intensity rallies (Singh & Patel, 2024). The ability to sustain repeated explosive actions while minimizing performance decline is critical in competitive matches, making endurance a secondary yet essential determinant of selection. Agility showed a similar level of contribution, reflecting badminton's reliance on rapid directional changes and efficient recovery between strokes. Conversely, the absence of a significant predictive value for speed in the multivariate model indicates that linear sprint ability may be less relevant compared to reactive agility and anticipatory movement patterns, which are more characteristic of badminton's tactical exchanges (Touptiolo et al., 2025).

From a practical standpoint, these results suggest that future selection protocols should place a premium on coordination testing, while still maintaining a comprehensive biomotor evaluation framework that incorporates leg

power, agility, and endurance. Such a multidimensional approach ensures that both immediate performance indicators and developmental potential are considered. Moreover, the strong influence of coordination suggests that early-stage athlete identification should emphasize technical adaptability and motor learning capacity, rather than solely relying on existing physical strength. This aligns with contemporary perspectives on athlete development that advocate for long-term motor skill enhancement as a precursor to elite performance (Sari et al., 2025; Vickery et al., 2025).

Nevertheless, several limitations of this study must be acknowledged. First, the research was confined to a single selection site with a modest sample size (n = 45), which may limit the generalizability of findings across broader contexts. Second, the binary outcome measure of "selection success" does not fully capture the spectrum of athlete performance levels and may oversimplify the relationship between biomotor abilities and competitive potential. Third, the absence of technical skill assessment in the biomotor battery represents a notable gap, as badminton performance is inherently intertwined with technical execution. Finally, the lack of longitudinal follow-up restricts our ability to evaluate whether the identified predictors translate into sustained success in athlete development pathways.

Taken together, the study provides empirical evidence that biomotor abilities, particularly coordination, are vital for predicting badminton athlete selection outcomes. However, further investigations incorporating larger samples, multi-regional data, continuous performance scoring, and longitudinal tracking of athletes' careers are needed to strengthen the evidence base. Integrating biomechanical and technical assessments with biomotor profiling could provide a more holistic and accurate framework for talent identification in Indonesian badminton..

CONCLUSION

This study demonstrates that biomotor abilities serve as significant predictors of badminton athlete selection success. Coordination emerges as the most critical factor, followed by leg power, agility, and aerobic endurance. The combined biomotor assessment explains 82.9% of selection outcome variance, supporting the validity of comprehensive physical testing in athlete identification.

Key findings include: Coordination is the strongest predictor of selection success ($\beta = 0.673$); Leg power significantly contributes to selection outcomes ($\beta = 0.412$); Combined biomotor abilities explain over 80% of selection variance; Agility and aerobic endurance show moderate predictive value.

Practical implications suggest that selection protocols should emphasize coordination assessment while maintaining comprehensive biomotor evaluation. These findings support evidence-based athlete identification and can improve the efficiency of talent development programs.

Future research should investigate longitudinal athlete development outcomes and incorporate technical skill assessments to provide a more complete picture of selection validity. Additionally, expanding the study to multiple regions would enhance the generalizability of findings.

Recommendations for practice: Prioritize coordination assessment in selection protocols; Maintain comprehensive biomotor testing batteries; Develop sport-specific assessment criteria; Implement standardized testing procedures across regions.

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