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The effects of nutritional status, parenting styles, and self-confidence on the motor skills of elementary school karate participants

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ABSTRACT

This study aimed to examine the direct and indirect effects of nutritional status, parenting styles, and self-confidence on the motor skills of elementary school karate participants. A quantitative cross-sectional design was employed involving 59 male karate participants aged 9–11 years selected through purposive sampling. Nutritional status was assessed using body mass index, while parenting styles, self-confidence, and motor skills were measured using validated questionnaires and the Scott Motor Ability Test. Data were analyzed using path analysis after normality and linearity assumptions were confirmed. Nutritional status, parenting styles, and self-confidence significantly affected motor skills both directly and indirectly ($p < 0.05$). Parenting styles showed the strongest direct effect (37.09%), followed by nutritional status (33.52%) and self-confidence (27.56%). The structural model explained 72.3% of the variance in motor skills. Motor skills among elementary school karate participants are jointly influenced by biological, family, and psychological factors, highlighting the importance of integrating nutritional improvement, supportive parenting, and confidence-building strategies to optimize children's motor development.

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Introduction

Motor development is a fundamental component of children's growth because it determines their ability to perform coordinated movements, participate in physical activities, and adapt to everyday environments. It develops through the integration of the nervous system, muscles, and cognitive processes as the neuromuscular system matures (Lukman & Neviyarni, 2021). Previous studies have demonstrated that physical-motor and social-emotional competencies are strong predictors of children's future physical, cognitive, and social development (Sudaryanti et al., 2024). Among various sports, karate provides an appropriate context for investigating motor development because successful performance depends on coordination, balance, agility, speed, and movement precision. Despite the importance of these abilities, empirical evidence explaining the factors that determine motor skills among elementary school karate participants remains limited, particularly through an integrated model involving biological, family, and psychological factors.

The need for this study emerged from observations at SD Tahfidz Rahmatul Aisy 2, where many students experienced difficulties performing basic motor movements during physical education classes and karate

training. The relatively low success rate in karate grading examinations also indicates that many students have not yet mastered the required movement techniques. Previous research has shown that motor performance is influenced by complex interactions among biological, environmental, and psychological factors rather than by physical practice alone (Komaini, 2022). Children who exhibit poor coordination, balance, and movement control often experience underlying developmental limitations that hinder motor performance (Suryadi et al., 2024). Although these factors have been examined individually in previous studies, evidence explaining their simultaneous direct and indirect relationships with children's motor skills remains scarce.

One biological factor that consistently influences children's motor development is nutritional status. Adequate nutrition supports muscle strength, physical endurance, concentration, and neural development, all of which are essential for effective motor performance (Souza et al., 2023). Conversely, inadequate nutritional status may reduce energy availability, impair movement coordination, and delay neuromuscular responses, thereby limiting children's ability to perform complex movements (Anumpitan et al., 2023). While previous studies have confirmed that nutritional status contributes to children's motor development, limited evidence has investigated whether its influence is strengthened through psychological mechanisms, particularly self-confidence, among children participating in structured sports such as karate.

Besides biological factors, the family environment and psychological characteristics are equally important determinants of children's motor development. Parenting styles shape children's opportunities to engage in physical activities, develop autonomy, and maintain consistent participation in sports, whereas self-confidence determines children's willingness to attempt new movements, overcome fear of failure, and persist during motor learning (Garbenis & Kaffemaniene, 2025). Although parenting styles and self-confidence have independently been associated with children's physical development, studies examining their combined contribution and mediating relationships with nutritional status in explaining motor skills among elementary school karate participants remain very limited (Ghadiri et al., 2022; Jukić, 2015; Marchenko, Ivashchenko, & Khudolii, 2023). Therefore, investigating these variables within a single structural model is expected to provide a more comprehensive understanding of children's motor development.

Based on these considerations, this study aims to analyze the direct and indirect effects of nutritional status, parenting styles, and self-confidence on the motor skills of elementary school karate participants. Unlike previous studies that primarily examined these variables separately, this research integrates biological, environmental, and psychological factors into a single path analysis model to provide a more comprehensive explanation of children's motor skills and to generate evidence that can inform interventions for improving motor performance among young karate practitioners (Cesari & Bertucco, 2008; Jia et al., 2024; Przybylski et al., 2021; Quinzi et al., 2022).

Method

Study Design

This study employed a quantitative cross-sectional design using path analysis to examine the direct and indirect relationships among nutritional status (X_1), parenting styles (X_2), self-confidence (Z), and motor skills (Y). Path analysis was selected because it enables the simultaneous estimation of direct and mediated effects among the study variables while testing the proposed causal model.

Participants

The study involved 59 male elementary school students aged 9–11 years who actively participated in karate training at SD Tahfidz Rahmatul Aisy 2. Participants were selected using purposive sampling based on the following inclusion criteria: (1) aged between 9 and 11 years, (2) actively participating in karate training during the study period, and (3) willing to participate by providing informed consent from their parents or guardians. Students younger than nine years or those with incomplete research data were excluded from the study.

Procedures

Ethical approval and parental informed consent were obtained before data collection. Participants were first informed about the study objectives and research procedures. Anthropometric measurements, including height and weight, were then collected to determine nutritional status using Body Mass Index (BMI). Motor skills were subsequently assessed using the Scott Motor Ability Test administered by trained assessors under standardized testing conditions. After completing the motor assessment, participants completed validated questionnaires measuring parenting styles and self-confidence under the supervision of the research team to ensure consistency and minimize response bias.

Statistical Analysis

Descriptive statistics were used to summarize participants' characteristics and study variables. Before hypothesis testing, the assumptions of normality and linearity were examined to verify the suitability of path analysis. Direct and indirect effects among nutritional status, parenting styles, self-confidence, and motor skills were analyzed using path analysis in IBM SPSS Statistics. Statistical significance was determined at a 95% confidence level ($p < 0.05$), and standardized path coefficients were reported to estimate the magnitude of each direct and indirect relationship within the proposed research model.

Results and Discussions

The findings of this study present the empirical evidence obtained from the statistical analyses conducted to examine the proposed research model. The results describe the characteristics of the study variables and the relationships among nutritional status, parenting styles, self-confidence, and motor skills, providing the basis for testing the proposed hypotheses.

Descriptive Statistics of the Study Variables

Table 1. Descriptive Statistics of the Study Variables (n = 59)

Variable	Min	Max	Mean	SD	Category Distribution
Motor Skills	11	27	20.00	4.00	Excellent = 10 (16.9%); Good = 14 (23.7%); Fair = 24 (40.7%); Poor = 10 (16.9%); Very Poor = 1 (1.7%)
Nutritional Status (BMI)	16.3	35.7	21.20	3.83	Underweight = 12 (20.3%); Normal = 39 (66.1%); Overweight = 7 (11.9%); Obese = 1 (1.7%)
Parenting Styles	65	97	83.00	8.00	Excellent = 7 (11.9%); Good = 25 (42.4%); Fair = 17 (28.8%); Poor = 7 (11.9%); Very Poor = 3 (5.1%)
Self-Confidence	62	98	79.00	3.00	Very High = 10 (16.9%); High = 16 (27.1%); Moderate = 19 (32.2%); Low = 13 (22.0%); Very Low = 1 (1.7%)

Source: Processed Research Data (2024).

Table 1 presents the descriptive statistics of the study variables. The participants demonstrated a mean motor skills score of 20.00 ± 4.00, with most students (40.7%) classified in the fair category. The average Body Mass Index was 21.20 ± 3.83, and approximately two-thirds of the participants (66.1%) had normal nutritional status. Parenting style scores averaged 83.00 ± 8.00, with the majority of participants (42.4%) reporting good parenting practices. The mean self-confidence score was 79.00 ± 3.00, and most participants (32.2%) exhibited a moderate level of self-confidence. These descriptive findings indicate adequate variability across all variables for subsequent inferential analyses.

Assumption Tests

Table 2. Summary of Normality and Linearity Tests

Relationship	Normality Test (Shapiro–Wilk Sig.)	Linearity Test (Deviation from Linearity Sig.)	Decision
Nutritional Status to Motor Skills	0.200	0.692	Assumptions satisfied
Parenting Styles to Motor Skills	0.200	0.511	Assumptions satisfied
Self-Confidence to Motor Skills	0.200	0.296	Assumptions satisfied
Nutritional Status to Self-Confidence	0.200	0.336	Assumptions satisfied
Parenting Styles to Self-Confidence	0.200	0.469	Assumptions satisfied

Source: Processed Research Data (2024).

Prior to hypothesis testing, assumption tests were conducted to evaluate the suitability of the data for path analysis. The Shapiro–Wilk normality test indicated that all variables had significance values greater than 0.05,

suggesting that the data were normally distributed. Likewise, the deviation from linearity test produced significance values exceeding 0.05 for all variable pairs, indicating that the relationships among the variables met the linearity assumption. Therefore, the dataset satisfied the statistical assumptions required for path analysis.

Path Analysis Results

Table 3. Direct Effects of Nutritional Status, Parenting Styles, and Self-Confidence on Motor Skills

Path	Standardized β	p-value	Decision
Nutritional Status to Self-Confidence	-0.601	0.011	Significant
Parenting Styles to Self-Confidence	0.733	0.001	Significant
Nutritional Status to Motor Skills	-0.579	0.042	Significant
Parenting Styles to Motor Skills	0.609	0.037	Significant
Self-Confidence to Motor Skills	-0.525	0.031	Significant

Source: Processed Research Data (2024).

Table 3 summarizes the direct effects estimated using path analysis. Nutritional status and parenting styles significantly influenced self-confidence ($\beta = -0.601$, $p = 0.011$; $\beta = 0.733$, $p = 0.001$, respectively). Furthermore, nutritional status ($\beta = -0.579$, $p = 0.042$), parenting styles ($\beta = 0.609$, $p = 0.037$), and self-confidence ($\beta = -0.525$, $p = 0.031$) each demonstrated statistically significant direct effects on motor skills ($p < 0.05$).

Indirect Effects

Table 4. Indirect Effects Through Self-Confidence

Indirect Path	Indirect Effect	Contribution (%)
Nutritional Status to Self-Confidence to Motor Skills	0.316	6.94
Parenting Styles to Self-Confidence to Motor Skills	0.385	5.03

Source: Processed Research Data (2024).

Table 4 presents the indirect effects of the independent variables on motor skills through self-confidence. Nutritional status demonstrated an indirect effect of 0.316, accounting for 6.94% of the variance in motor skills. Similarly, parenting styles showed an indirect effect of 0.385, contributing 5.03% to motor skills through self-confidence, indicating that self-confidence functioned as an intervening variable in both relationships.

Overall Model Evaluation

Table 5. Summary of the Path Analysis Model

Model Indicator	Value
R^2	0.723
Explained Variance	72.3%
Unexplained Variance	27.7%
Model Significance (ANOVA)	0.002
Decision	Significant Model ($p < 0.05$)

Source: Processed Research Data (2024).

The overall path model was statistically significant ($p = 0.002$). The coefficient of determination ($R^2 = 0.723$) indicated that nutritional status, parenting styles, and self-confidence collectively explained 72.3% of the variance in motor skills, whereas the remaining 27.7% was attributable to variables not included in the proposed model. These findings indicate that the structural model adequately explains the relationships among the study variables and supports the proposed hypotheses.

There Is a Direct Effect of Nutritional Status on Motor Skills

The findings showed that nutritional status had a significant direct effect on the motor skills of elementary school karate participants ($\rho yX_1 = -0.579$; Sig. = 0.042 < 0.05), contributing 33.52%, while 66.48% of the variance was explained by other factors. Adequate nutritional status supports neuromuscular function, muscle strength, and physical performance, all of which are essential for motor skill development. This finding is consistent with Wauran et al. (2016), who emphasized the importance of adequate nutrition for brain and muscle function, and with studies by Ambroży et al., (2021); James et al., (2016), which reported a significant positive relationship between nutritional status and children's motor skills. These results indicate that optimal nutrition provides the physiological foundation required for effective motor performance in karate.

There Is a Direct Effect of Parenting Styles on Motor Skills

Parenting styles significantly influenced motor skills ($\rho yX_2 = 0.609$; Sig. = 0.037 < 0.05), with a direct contribution of 37.09%, while 62.91% was attributed to other variables. According to Baumrind's parenting theory, supportive parenting promotes children's autonomy and participation in physical activities, thereby facilitating motor development. This finding agrees with Katić et al., (2009), who reported that parental support contributes to children's gross motor development, and Iorga et al., (2024), who found that supportive parenting encourages greater involvement in sports and outdoor activities. Therefore, parenting practices that provide guidance and opportunities for physical exploration contribute positively to children's motor skill development.

There Is a Direct Effect of Self-Confidence on Motor Skills

Self-confidence also showed a significant direct effect on motor skills ($\rho yX_3 = -0.525$; Sig. = 0.031 < 0.05), explaining 27.56% of the variance, whereas 72.44% was influenced by other factors. Consistent with Noy et al., (2024) self-efficacy theory, self-confidence affects persistence, emotional regulation, and performance during physical tasks. This finding is supported by Stamenković et al., (2022), who reported a positive relationship between self-confidence and motor performance, and Katić et al., (2005), who suggested that excessive confidence may reduce movement accuracy. These findings imply that balanced self-confidence is essential for achieving optimal motor performance in karate.

There Is an Indirect Effect of Nutritional Status on Motor Skills Through Self-Confidence

The analysis revealed a significant indirect effect of nutritional status on motor skills through self-confidence, with an indirect coefficient of 0.316 and an indirect contribution of 6.94%, while 93.06% was explained by other variables. Nutritional status contributes not only to physical readiness but also to psychological well-being, including self-esteem and self-efficacy. This finding is consistent with (Quinzi et al., 2013), who demonstrated that adequate nutrition enhances athletes' confidence, who identified self-confidence as an important mediator linking biological readiness to motor performance (Marchenko, Ivashchenko, Jagiello, et al., 2023; Padulo et al., 2014). These results suggest that self-confidence strengthens the contribution of nutritional status to children's motor skills.

There Is an Indirect Effect of Parenting Styles on Motor Skills Through Self-Confidence

Parenting styles also had a significant indirect effect on motor skills through self-confidence, with an indirect coefficient of 0.385 and a contribution of 5.03%, while 94.97% was explained by factors outside the model. Baumrind's socialization theory suggests that supportive parenting fosters children's confidence and willingness to engage in challenging physical activities. This finding supports Amri et al., (2026); Jafari et al., (2026), who found that positive parenting improves children's self-concept, and Doder et al., (2023), who identified self-confidence as a mediator between parenting and physical performance. Therefore, supportive parenting indirectly enhances children's motor skills by strengthening self-confidence.

Simultaneous Direct Effect of Nutritional Status, Parenting Styles, and Self-Confidence on Motor Skills

The structural model showed that nutritional status, parenting styles, and self-confidence simultaneously had a significant effect on motor skills ($R^2 = 0.723$; Sig. = 0.002 < 0.05), explaining 72.3% of the variance, while 27.7% was attributable to other factors. This finding supports Bronfenbrenner's Bioecological Systems Theory, which emphasizes that children's development results from interactions among biological, environmental, and psychological factors. Similar findings were reported by Chaabène et al., (2014); Noroozi et al., (2024), who concluded that the integration of physical, family, and psychological factors optimizes children's motor performance. These results demonstrate that motor skill development in young karate practitioners is determined by the combined influence of nutritional, family, and psychological factors rather than by a single determinant (Katić et al., 2012; VencesBrito et al., 2011).

Conclusions

This study concludes that nutritional status, parenting styles, and self-confidence are significant determinants of motor skills among elementary school karate participants, both directly and indirectly. Parenting styles demonstrated the strongest direct contribution, while self-confidence functioned as an important mediating variable linking nutritional status and parenting styles to motor skills. Collectively, these three factors explained 72.3% of the variance in motor skills, indicating that children's motor performance is shaped by the interaction of biological, family, and psychological factors. These findings highlight the importance of integrating nutritional support, positive parenting practices, and confidence-building strategies to optimize motor skill development in young karate practitioners.

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