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A DYNAMIC CONNECTION EXISTS AMONG BODY MASS INDEX, ENGAGEMENT IN PHYSICAL ACTIVITY AND FUNDAMENTAL MOVEMENT SKILL PROFICIENCY

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ABSTRACT

This research investigated the connections between Body Mass Index (BMI), physical activity, and fundamental movement skills (FMS) in a cohort of 40 children aged 9 to 10 years. The assessment of fundamental movement skills was conducted using the Test of Gross Motor Development–2 (TGMD-2) as designed by Ulrich, while levels of physical activity were evaluated through the Physical Activity Questionnaire for Older Children (PAQ-C), formulated by Kowalski, Crocker, and Donen. BMI was derived from recorded measurements of height and weight. To analyze the relationships among the variables, Pearson's product–moment correlation was utilized. The results demonstrated significant negative correlations between BMI and both object control and locomotor skills, with particularly pronounced relationships evident in total locomotor skills ($r = –.722$, $p < .001$). In contrast, physical activity exhibited significant positive correlations with multiple locomotor skills and certain object control skills, including total locomotor performance ($r = .560$, $p < .001$).The findings suggest that a higher BMI correlates with reduced proficiency in motor skills, while increased physical activity is associated with enhanced fundamental movement skill performance in children. These outcomes underscore the necessity of fostering healthy body composition and encouraging regular physical activity in order to facilitate motor development throughout late childhood.

Keywords: Body Mass Index, Physical Activity, Fundamental Movement Skills, Locomotor Skills, Object Control Skills, Children.

BACKGROUND OF THE STUDY

Childhood is a pivotal phase for growth, physical advancement, and the development of fundamental movement skills (FMS). These fundamental movement skills encompass locomotor abilities-such as running, hopping, and jumping-as well as object control skills like catching, throwing, and striking, which are essential for engaging in sports, games, and maintaining physical activity throughout life. The advancement of these skills during middle childhood is crucial for fostering physical competence, self-assurance, and sustained participation in active lifestyles.

In recent years, mounting apprehensions regarding childhood overweight and obesity have highlighted the significance of Body Mass Index (BMI) in the physical development of children. BMI, calculated from an individual's height and weight, is a prevalent metric for

assessing body composition. Excess weight can create mechanical and physiological challenges that adversely affect movement efficiency, coordination, balance, and agility. Consequently, children with elevated BMI may encounter increased difficulties in executing fundamental movement skills, particularly those that demand speed, strength, and body control.

Physical activity is integral to the motor development of children. Consistent engagement in moderate-to-vigorous physical activities offers opportunities for practicing and enhancing movement patterns, which in turn augments motor competence. Active participation in physical activities not only bolsters cardiovascular health and muscular strength but also enhances coordination and neuromuscular control. Moreover, children who are more actively engaged in physical pursuits are typically exposed to a wider array of movement experiences, which may facilitate greater proficiency in fundamental movement skills.

The interplay between BMI, physical activity, and fundamental movement skills is characterized as dynamic and interdependent. On one hand, a higher BMI may diminish a child's willingness or capacity to participate in physical activities, potentially due to fatigue, decreased mobility, or diminished self-esteem. Conversely, insufficient physical activity can impede the acquisition of movement skills, thereby dissuading further engagement in physical pursuits. Conversely, children who possess well-developed motor skills are more inclined to actively participate in sports and recreational activities, subsequently promoting healthier body composition. This reciprocal relationship indicates that BMI, physical activity, and fundamental movement skills interact with one another rather than functioning in isolation.

It is particularly crucial to comprehend this dynamic relationship among children aged 9–10 years, a developmental period marked by the refinement of motor skills and an increase in both structured and unstructured physical activity participation. Analyzing the nature and strength of the relationships among these variables can yield valuable insights for educators, physical education instructors, and health practitioners in the formulation of effective intervention strategies aimed at enhancing motor competence and encouraging healthy lifestyles.

Thus, investigating the interrelationships among Body Mass Index, physical activity engagement, and proficiency in fundamental movement skills contributes to a more comprehensive understanding of child development and supports evidence-based initiatives designed to improve physical health and motor performance during late childhood.

INTRODUCTION

Childhood represents a crucial period for both physical development and motor skill acquisition, during which essential movement competencies, known as fundamental movement skills (FMS), are formed. These skills are generally divided into two categories: locomotor skills, such as running, hopping, and jumping, and object control skills, which include throwing, catching, and striking. These foundational skills serve as the basis for executing more complex movements required in various sports. Ulrich (2000) contended that achieving proficiency in these skills during middle childhood is vital for effective participation in physical education and organized sports. Echoing this perspective, Gallahue, Ozmun, and Goodway (2012) underscored that the development of FMS lays the groundwork for sustained involvement in physical activity throughout one’s life.

Body Mass Index (BMI), a commonly used metric derived from an individual's height and weight, serves as a significant measure of body composition in children. The rising

prevalence of childhood overweight and obesity is a pressing global health issue. Excess body weight can adversely affect motor performance by reducing movement efficiency, balance, speed, and coordination. Numerous studies have established a correlation between higher BMI and lower levels of motor competence among children (D'Hondt et al., 2009; Lopes et al., 2012). The physical limitations imposed by excess weight may obstruct the ability to perform activities that demand agility, explosive strength, and dynamic balance.

Physical activity engagement is another critical determinant of motor skill development. Consistent participation in physical activity fosters improvements in muscular strength, cardiovascular health, coordination, and neuromuscular control (Strong et al., 2005). Stodden et al. (2008) proposed a conceptual framework illustrating a bidirectional relationship between motor competence and physical activity, children who demonstrate higher levels of motor competence tend to participate more frequently in physical activities, and ongoing engagement can further enhance their movement skills. This reciprocal relationship highlights how motor skill proficiency and physical activity mutually reinforce one another (Stodden et al., 2008; Robinson et al., 2015; Barnett et al., 2024; Liu et al., 2024).

The interplay among BMI, physical activity, and fundamental movement skills is complex and multifaceted. An elevated BMI may detrimentally impact motor skill performance, subsequently diminishing children's motivation to engage in physical activities. Conversely, insufficient levels of physical activity might lead to decreased motor competence and heighten the risk of unhealthy weight gain. Robinson et al. (2015) indicated that motor competence serves as a mediating factor in the relationship between physical activity and health-related outcomes in children. Grasping these interrelationships is especially crucial during late childhood (ages 9–10), a stage marked by significant refinement of motor skills and increased engagement in structured physical activities.

Despite the mounting evidence linking BMI, physical activity, and motor competence, there remains a necessity for additional research focused on specific age cohorts to elucidate the strength and directionality of these associations. Investigating these variables in tandem will yield valuable insights for educators, physical education professionals, and policymakers in devising targeted interventions aimed at enhancing motor proficiency and promoting healthy body composition in children.

OBJECTIVES OF THE STUDY

1. To assess the relationship between BMI and object control skills in children.
2. To assess the relationship between BMI and locomotor skills in children.
3. To assess the relationship between physical activity and object control skills in children.
4. To assess the relationship between physical activity and locomotor skills in children.
5. To assess the combined influence of BMI and physical activity on overall fundamental movement skill performance.

SIGNIFICANCE OF THE STUDY

1. It enriches the existing literature on the relationship between BMI, physical activity, and fundamental movement skills.
2. The results may aid physical education teachers in identifying children who are at heightened risk for poor motor competence.

3. The findings can inform intervention programs designed to enhance motor skills through organized physical activity.
4. This research provides empirical data for policymakers to emphasize the importance of maintaining a healthy weight and promoting active lifestyles within school curricula.
5. The study may also serve as a valuable resource for future researchers exploring motor development and child health.

METHODOLOGY

A descriptive correlation research design was utilized to investigate the associations between Body Mass Index (BMI), physical activity, and proficiency in fundamental movement skills (FMS) proficiency in children. The study sample consisted of 40 school children (N = 40) aged 9 to 10 years, recruited from various schools in Karnataka, the sample included an equal distribution of boys and girls to ensure gender balance.

Fundamental movement skills were evaluated using the Test of Gross Motor Development–2 (TGMD-2), as established by Ulrich (2000). This assessment focuses on two primary domains: locomotor skills (including running, galloping, hopping, leaping, horizontal jumping, and sliding) and object control skills (such as striking, dribbling, catching, kicking, throwing, and rolling). Each skill was assessed and scored based on standardized performance criteria. Physical activity levels were assessed through the Physical Activity Questionnaire for Older Children (PAQ-C), developed by Kowalski, Crocker, and Donen. The PAQ-C is a validated instrument utilizing a 7-day recall method, which yields a composite score reflecting general physical activity engagement throughout the school week.Height and weight were recorded following standardized measurement procedures, allowing for the calculation of BMI using the formula: weight (kg) divided by height (m^2).

Data collection occurred during school hours, adhering to established testing protocols. Descriptive statistics measures, such as the mean and standard deviation, were computed for each variable. To explore the relationships among BMI, physical activity, and FMS, Pearson's product-moment correlation coefficient was employed. A statistical significance threshold was established at $p < .05$ and $p < .01$.

RESULT AND ANALYSIS

A Pearson's product-moment correlation analysis was performed to investigate the relationships between Body Mass Index (BMI), physical activity, and fundamental movement skills (FMS) in children aged 9 to 10 years (N = 40). Statistical significance levels were established at $p < .05$ and $p < .01$.

CORRELATION

Table 1

BMI and Physical Activity with Object Control Skills

Variables	BMI (r)	Sig.	Physical Activity (r)	Sig.
Strike	-.379	.016	.109	.503
Dribble	-.077	.637	.091	.578
Catch	-.502	.001	.327	.039
Kick	-.246	.126	.107	.509
Throw	-.250	.120	.341	.032
Roll	-.358	.023	.323	.042
Total ObjectControl	-.396	.011	.217	.178

BMI and Object Control Skills

The results revealed significant negative correlations between BMI and various object control skills. Notable inverse associations were identified with strike ($r = –.379$, $p = .016$), catch ($r = –.502$, $p = .001$), roll ($r = –.358$, $p = .023$), and the overall object control score ($r = –.396$, $p = .011$). Conversely, no significant correlations were observed between BMI and dribble ($p = .637$), kick ($p = .126$), or throw ($p = .120$). These findings suggest that a higher BMI is linked to diminished proficiency in particular object control skills, most notably in catching.

Physical Activity and Object Control Skills

Positive significant correlations were found between physical activity and catch ($r = .327$, $p = .039$), throw ($r = .341$, $p = .032$), and roll ($r = .323$, $p = .042$). However, no significant relationships were detected concerning strike, dribble, kick, or the total object control score.This implies that increased levels of physical activity correlate with enhanced performance in specific object control skills.

Table 2

BMI and Physical Activity with Object Control Skills

Variables	BMI(r)	Sig.	Physical Activity (r)	Sig.
Run	-.357	.024	.142	.383
Gallop	-.567	.000	.374	.017
Hop	-.542	.000	.424	.006
Leap	-.579	.000	.511	.001
Horizontal Jump	-.497	.001	.464	.003
Slide	-.620	.000	.533	.000
Total Locomotor	-.722	.000	.560	.000

Correlation is significant at the 0.05 level

BMI and Locomotor Skills

BMI exhibited robust and significant negative correlations with all assessed locomotor skills. Significant inverse relationships emerged with run ($r = –.357$, $p = .024$), gallop ($r = –.567$, $p < .001$), hop ($r = –.542$, $p < .001$), leap ($r = –.579$, $p < .001$), horizontal jump ($r = –.497$, $p = .001$), slide ($r = –.620$, $p < .001$), and total locomotor score ($r = –.722$, $p < .001$). The most pronounced association was noted between BMI and total locomotor score, indicating a strong connection between increased BMI and reduced proficiency in locomotor skills.

Physical Activity and Locomotor Skills

Physical activity was positively correlated with gallop ($r = .374$, $p = .017$), hop ($r = .424$, $p = .006$), leap ($r = .511$, $p = .001$), horizontal jump ($r = .464$, $p = .003$), slide ($r = .533$, $p < .001$), and the total locomotor score ($r = .560$, $p < .001$). The association between physical activity and run was found to be non-significant ($p = .383$).These outcomes indicate that higher levels of physical activity are associated with moderate to strong improvements in locomotor skill performance.

DISCUSSION

The current study explored the intricate relationship among Body Mass Index (BMI), physical activity, and proficiency in fundamental movement skills (FMS) in children aged 9 to 10 years. The results indicated significant negative correlations between BMI and both locomotor skills and selected object control abilities, while physical activity exhibited

positive associations with various aspects of FMS. These findings emphasize the interconnected nature of body composition, movement competence, and physical activity engagement during late childhood.

The notable negative correlation between BMI and locomotor skills, especially total locomotor performance ($r = –.722$, $p < .001$), implies that children with higher body mass tend to exhibit lower levels of proficiency in skills that demand speed, balance, and dynamic body control. This observation aligns with prior studies suggesting that excess body weight can impose mechanical constraints that impede efficient movement execution (D'Hondt et al., 2009). Similarly, Lopes et al. (2012) found that elevated BMI is linked to diminished motor coordination and lower locomotor competence in school-aged children. The strong inverse relation noted in the present study reinforces the idea that increased body mass may adversely affect skill development during crucial developmental stages.

Regarding object control skills, there was a significant association between BMI and skills such as strike, catch, roll, and the overall object control score. However, these associations were generally less pronounced compared to locomotor skills. This trend is consistent with earlier research indicating that locomotor skills, which necessitate whole-body movement and weight-bearing actions, may be more sensitive to variations in body composition than specific object control tasks (Cattuzzo et al., 2016). Consequently, BMI appears to exert a more substantial influence on movement patterns that involve propulsion and body displacement.

Physical activity revealed moderate to strong positive correlations with both locomotor skills and selected object control skills. Notably, total locomotor score demonstrated a significant association with physical activity ($r = .560$, $p < .001$). These findings corroborate the developmental model proposed by Stodden et al. (2008), which posits a reciprocal relationship between motor competence and physical activity. Children who engage in higher levels of physical activity are likely to have more opportunities to practice and refine their motor skills, leading to enhanced proficiency. In turn, superior motor competence may bolster confidence and foster ongoing participation in physical activities.

The positive correlation between physical activity and skills such as leap, slide, and horizontal jump further supports existing evidence that regular engagement in physical activity contributes to improved neuromuscular coordination and muscular strength (Robinson et al., 2015; Strong et al., 2005). However, the absence of a significant relationship between physical activity and certain object control skills (e.g., strike and dribble) indicates that not all movement skills are influenced equally by general activity levels. Some competencies may necessitate structured instruction or sport-specific practice for proficiency development.

In summary, the findings illustrate a complex and interconnected relationship among BMI, physical activity, and fundamental movement skills. Higher BMI appears to correlate with decreased motor proficiency, while increased participation in physical activity is associated with enhanced movement competence. These results highlight the significance of fostering regular physical activity and maintaining healthy body composition during late childhood to promote optimal motor development.

The study contributes to the expanding body of evidence suggesting that initiatives aimed at enhancing physical activity and managing weight may play a pivotal role in improving fundamental movement skills. Future research should consider employing longitudinal designs to further elucidate these relationships.

CONCLUSION

This research examined the correlation between Body Mass Index (BMI), physical activity, and the proficiency of fundamental movement skills (FMS) among schoolchildren aged nine to ten years. The results distinctly reveal that BMI has a significant negative correlation with both locomotor skills and select object control skills. Notably, locomotor skills exhibited strong inverse associations with BMI, indicating that an increased body mass may hinder movement efficiency and overall motor performance.

In contrast, physical activity demonstrated significant positive correlations with locomotor skills as well as certain object control skills. Children who reported higher levels of physical activity were more likely to display enhanced motor skill proficiency, particularly in total locomotor performance. These findings reinforce the notion that regular participation in physical activity is beneficial for motor competence during late childhood.

In summary, this study substantiates the presence of a dynamic and interconnected relationship between body composition, physical activity, and fundamental movement skills. Sustaining a healthy BMI and fostering consistent engagement in physical activity are critical elements for promoting optimal motor development in children. These conclusions underscore the necessity for interventions at both school and community levels aimed at increasing physical activity participation and supporting healthy growth trajectories during childhood.

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