

# The Relationship Between Fundamental Movement Skills and Body Mass Index in Elementary-Age Children

Mariah Bolin<sup>1</sup> and Ovande Furtado Jr <sup>2</sup>

<sup>1</sup>Seneca High School

<sup>2</sup>Department of Kinesiology, California State University, Northridge

Mastery of fundamental movement skills (FMS) is considered a crucial component in securing physical activity participation and, in turn, decreasing the likelihood of obesity. This study aimed to investigate the relationship between body mass index (BMI) and FMS performance among children ages 5 to 7 years in a rural school system. Secondly, we intended to investigate BMI grouping and gender differences in FMS performance. Participants were 39 kindergarteners and 1st graders (20 boys and 19 girls) in an Eastern Illinois K–8 public school. BMI was calculated for each participant using CDC guidelines (CDC, 2008). FMS performance was assessed using the Furtado-Gallagher Computerized Observational Movement Pattern Assessment System (FG-COMPASS). Pearson correlation coefficients were calculated to examine the relationship between BMI percentile and FMS performance. A small but negative correlation that was not significant was found for FMS Locomotor,  $r(2) = -.26$ ,  $p > .05$ , and FMS Total  $r(2) = -.20$ ,  $p > .05$ . In addition, a Two-way Factorial MANOVA was conducted to determine the effect of BMI levels and gender on the performance of FMS. MANOVA results indicated that gender, Wilks' Lambda = .637,  $F(2,32) = 11.23$ ,  $p < .001$ , significantly affected the combined dependent variables. No significant main effect was detected for BMI levels. Univariate analysis of variance post-hoc tests revealed that the performance of manipulative FMS significantly differs for gender,  $F(1,33) = 16.08$ ,  $p < .001$ , with males ( $M = 12.38$ ,  $SD = 2.8$ ) overperforming females ( $M = 9.11$ ,  $SD = 2.21$ ). Performance of locomotor fundamental movement skills does not significantly differ for gender. These findings have implications for educators and health professionals working with rural children. Programs must ensure that boys and girls have equal opportunities to practice and master manipulative FMS.

*Keywords:* body mass index, fundamental movement skills, obesity, physical activity

According to the National Centers for Disease Control and Prevention (2022), childhood obesity has almost tripled since 1980. The occurrence of obesity in 1st-grade to 5th-grade students has increased from 6.5% in 1980 to 19.6% in 2008. In grades 6<sup>th</sup> through 12<sup>th</sup>, the percentage has risen from 5.0% to 18.1%. Obesity can be caused by several factors, including but not limited to low-energy supply, inactivity, and possible genetic pre-

disposition. Children who are overweight/obese have a greater chance of remaining overweight/obese throughout adolescence and into adulthood (Nader et al., 2006). In addition, health conditions such as diabetes, hypertension, and cardiovascular disease may be absent during childhood but may appear as the individual ages (Daniels, 2006). Thus, we must understand the relationship between obesity and other related variables, such as fundamental movement skills - FMS (e.g., skipping, galloping, hopping, overhand throwing, kicking, dribbling, etc.).

Evidence shows that overweight children may be less proficient in fundamental movement skills than non-overweight children. This relationship may be an extension of infant weight and motor activity relationships (Wrotniak et al., 2006). In addition, overweight children tend to engage less often in physical activities,

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 Mariah Bolin

 Ovande Furtado Jr

Correspondence concerning this article should be addressed to Ovande Furtado Jr, Department of Kinesiology, California State University, Northridge, 18111 Nordhoff St, Northridge, CA 91330-8287

preventing them from acquiring fundamental movement skills (Logan et al., 2011). Therefore, it is essential to study the relationship between children's weight and FMS levels in young children to learn when and how this relationship occurs (Logan et al., 2011). With this knowledge, practitioners can better address intervention practices in school settings.

Furthermore, previous studies have shown that children who become proficient in FMSs are more likely to be physically active and take part in physical activity when compared to their counterparts with a lesser level of motor skill proficiency (Wrotniak et al., 2006). In addition, FMS proficiency is considered the basis for developing more complex (specialized) motor skills (Barnett et al., 2008). However, the association between motor skill proficiency and regular participation in physical activity begins in early childhood, fully matures in the teenage years, and continues into adulthood (Stodden et al., 2008). Thus, children lacking fundamental movement skill development will likely have decreased participation in activities involving skills such as running, jumping, skipping, or specialized sport-related skills during the middle to late childhood, which could impact an active lifestyle as they age (Lopes et al., 2012).

It is commonly believed that fundamental movement skills solely develop with maturation and are not significantly impacted by environmental factors (Clark, 2007). However, while maturation does play a role in the development of these skills, it is not the only factor at play. The environment, chances for practice, reassurance, and teaching all contribute to developing fundamental movement skills (Gallahue & Ozmun, 1998). Studies have shown that there are notable gender differences in manipulative and locomotor skills. According to Barnett et al. (2008), males tend to excel in executing manipulative skills like catching, overhand throwing, and kicking when compared to females.

On the other hand, females scored slightly higher on locomotor skills, but the difference was not statistically significant. In another study, Wrotniak et al. (2006) found that males overperformed females on running speed, and agility and were more successful at the skill of overhand throw. Dissimilarities in males' and females' motor proficiency can be attributed to environmental factors and peer interaction. According to Wrotniak (2006), this could be due to the type of sports and games they are drawn to participate in, which may give males more opportunities to practice and refine motor skills. Males are drawn to more sports involving manipulative skills than locomotor skills.

Therefore, this study aimed to investigate the relationship between body mass index (BMI) and FMS per-

formance among children ages 5 to 7 years in a rural school system. In addition, we sought to investigate BMI grouping and gender differences in FMS performance.

We hypothesized a significant correlation between BMI and FMS performance (FMS locomotor, FMS manipulative, and FMS total). We also predicted that males would overperform females on manipulative skills but not on locomotor skills. Finally, we hypothesize that the performance of manipulative and locomotor skills would differ by BMI levels. Children categorized as "normal weight" would overperform their counterparts categorized as "overweight" and "obese."

## Method

### Participants

Twenty boys (mean age in months = 78.8, SD=8.17) and 19 girls (mean age in months = 79.0, SD=9.76) participated in this study. The sample came from a K-6 public school in Shelby County, Illinois. Most students were Caucasian (99%), and over 50% of the parents whose children attended the school were considered low-income families. Because prospective participants were required to perform various fundamental movement skills (e.g., skipping, running, throwing) as part of the research protocol, children with special needs were excluded from this study. A letter briefly explaining the study's purpose, along with the informed consent, was sent to parents. Two weeks after the initial contact, we emailed only those parents who still need to return the signed informed consent. Only those children whose parents signed and returned the informed consent were selected to be part of the study. Research procedures were approved through the Eastern Illinois University Institutional Review Board. To encourage student participation in the study, those who submitted their informed consent form on time were given a pedometer as a reward.

### Instrumentation and Procedures

#### *Anthropometry*

Eligible students had their height and weight measured. Mass was measured on a calibrated electronic scale (EatSmart Products Precision Digital) to the nearest 0.1 pounds before being later converted to kilograms. We measured students with shoes and heavy clothing removed. The scale was calibrated using a 10-pound weight after every 15 students were measured to ensure scale accuracy. Height was measured to the nearest millimeter using a tape taped to the wall. Students were barefoot and stood with their backs to the wall while