

Fundamental motor skills as potential physical talent indicators among indigenous, rural and urban children in Malaysian schools

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Abstract:

A prevalent practice among primary school teachers in certain areas within Malaysia is the selection of young children for sporting pursuits based on preference and the demographical characteristics of a child. This is due to the common perception that rural and indigenous children are engaged in more robust lifestyles compared to their urban counterpart and, hence, potentially possess better sports skills. To address the practicality of such practice, this study examined differences in fundamental motor skills between indigenous, rural and urban early school children in a selected district within peninsular Malaysia. A total of 180 early school children were randomly selected to represent the three demographic groups that participated in this study. Participants' fundamental movement skills were assessed using Ulrich Test of Gross Motor Development-2 (TGMD-2), which included measurements of locomotor and object manipulation skills. Based on both raw and standard TGMD-2 scores, the data revealed no significant differences among the three groups for locomotor skills development in both male and female participants. However, significant differences were observed for both males and females in terms of object manipulation skills development. Overall findings indicated that the urban groups recorded the lowest mean for both locomotor and object manipulation skills scores, accompanied by motor developmental delays of up to 12 months with respect to the mean chronological age. Regardless, comparison of overall gross motor development among the three groups did not achieve statistical significance. In sum, findings of the current study were consistent with the motor development literature of early school children where fundamental motor skills are reliable indicators for healthy lifestyles. However, it did not lend support to the practice of demographic-based selection for specific sporting pursuits among children of this age group.

Key Words: Fundamental movement skills, Gross motor development, Locomotor skills, Object manipulation skills, Primary school children

Introduction

Holistic physical development is crucial during early childhood. Recent trends point towards more focus attributed to adequate levels of involvement in physical activities and development of basic motor skills that will contribute to future engagement in healthy lifestyles. During early school, physical education (PE) plays a major part in this aspect of a child's educational process. The acquisition of physically active lifestyles and development of self-awareness regarding the positive benefits of such lifestyle choices are attained from positive body experiences and physical activities of a normal well-taught PE class. Consequences of appropriate motor stimulation through play during early school PE are two-fold: firstly, it provides a systematic foundation of fundamental movement skills development. Secondly, it stimulates children's cognitive, emotional and social developments as well (Suppiah et al., 2015). Developments of these domains provide the basis for acquisition of more complex movement skills, specifically sports skills, to the child.

Movement skills developed during childhood represent the building blocks for sport-specific movement patterns during their later years (Veldman et al., 2016). Typically, the focus of early school PE curriculum in mainstream Malaysian schools is to develop fundamental movement skills throughout the primary education level. Fundamental movement skills consist of locomotor and object manipulation skills, which are commonly developed throughout the primary school age. Locomotor skills refer to movements requiring body displacements such as running, walking or jumping, whereas object manipulation skills require skilled use of an object, such as throwing, kicking or catching a ball.

There is considerable literature support indicating that within a sport-specific environment, fundamental movement skills can reliably separate children with potential for sporting success. Here, the rationale is that fundamental movements underpin the development of more specialized sport skills that will be demanded for future success in any chosen sport. Suggestions have been put forth that without proper development of fundamental movement skills during childhood, future sport-specific success at competitive levels is unattainable. Based on this premise, it appears logical to implement a fundamental movement skills test for selecting potential young athletes, with the purpose of identifying early school children who may need to

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develop their fundamental movement skills to higher levels. One such test battery is the Ulrich Test of Gross Motor Development (Ulrich, 2000). This test has been applied to differentiate between selected and non-selected child artistic gymnasts (Salaj et al., 2019). This will identify early school children with potential in soccer, distinguish between those selected in first team and second team (Jukic et al., 2019), and assess gross motor skills in isolation by focusing on quality of performance (O'Brien et al., 2016). However, it remains uncertain whether differing levels of gross motor development can be a reliable indicator to distinguishing general sporting talents among early school children.

In recent years, talent development of young athletes has become a central issue among sports coaches and scientists. A notable consequence of heightened competitiveness in current high-performance sports is the increased focus on identifying and developing early sports talent. An approach commonly known as talent identification and development system (TIDS) has significantly grown within sports worldwide over the past two decades. Coaches, especially those focusing on building grassroots sports talent pools, are constantly experimenting effective ways to improve current practices of identifying and developing promising young athletes.

The conventional process of identifying potential young children with athletic talents has been based upon viewing a child performing a series of physical tests or trials. During the process, apart from performance outcomes of the test, coaches (or selectors) usually exhibit tendencies to rely on their intuitive knowledge as well. Such intuitive knowledge is composed of socially constructed 'images' of the perfect athlete and talent, which conforms to their subjective logic. This statement once held true among Malaysian sports practitioners at the national level, where a TIDS for swimming talents was conducted with specific targets involving the population of Sabahan Bajau Laut. Such exercise was borne from the impression that the seafaring lifestyle of the said population nurtures the swimming talents among their young children naturally. This nature of talent identification practices is unfortunately still being applied by teachers in primary schools where the indigenous population resides within the particular school district. Here, young indigenous children usually receive preferential treatment from the teachers for sporting pursuits at school and district levels (Mohd, 2017). These practices are a consequence of the similar impression that the perceived 'robust lifestyle' of indigenous children naturally builds a strong foundation for these children to excel in physical activities and sports.

Overall, the aforementioned talent identification practice implies that the selection process of young athletes can be dependable on the selectors' personal taste, knowledge and social perception. Research has revealed that this approach can lead to repetitive misjudgments in talent identification. Talent identification and selection processes among young athletes, especially at an early school age, can be a daunting task for selectors. This is due to the varied dimension of multiple qualities associated with sports performance. These qualities include technical skills, tactical knowledge, physical traits, physiological characteristics and psychological and social factors (Hands, 2008). The complexity of a reliable selection process is further compounded by the fact that these qualities are dynamic, interact with one another, and are responsive to proper training. A progressive body of literature in this area of study revealed that certain motor skills may discriminate between skilled and less-skilled performances in youth (i.e., 11-17 years) athletes. The performance variables include various parameters such as anthropometric, physiological, psychological and perceptual-cognitive factors. Despite evident improvement in the body of knowledge on talent identification and selection process in specific sports such as soccer, basketball and artistic gymnastics, information is still scarce regarding these processes in younger children (i.e., less than 10 years old).

Given the pertinence of fundamental movement skills and the dearth of current literature in the aspects of objectiveness of selection processes among early school children for sports participation opportunities, it would be of great value to address this information gap in the literature. Therefore, this study aimed to determine whether the assessment of fundamental movement skills could define disparity in physical performance levels among early school (Year One) indigenous, rural and urban children who are all dependable on school PE classes for structured participation in physical activities. Here, we did not take into account any other formal participation outside school since there are no events that involve representing the school at this stage of enrolment. In some perspective, this may be relevant too in addressing the existing selection issues in Malaysian primary schools' situation, as described earlier. We hypothesized that the selected groups of children from three different demographics will not exhibit notable disparities in terms of their gross motor development levels.

Material & methods

A total of 180 participants with ages ranging from six to seven years old were randomly selected in this study. They were based on availability and the clustering of school areas within the state of Pahang. This state was chosen due to the sampling convenience of having the three targeted demographic groups within one district. The district is Maran, where a primary school for the indigenous population is available. In addition, the rural and urban primary schools' situation in this district are at par with similar-type schools in other states within Peninsular Malaysia. Of the selected participants, there were 60 children (30 males and 30 females) from each of the indigenous, rural and urban primary schools. All participants have never been subjected to any formal sports training program with their PE sessions in school as their sole form of structured participation in physical activities. Class teachers or parents of the participants signed informed consent on behalf of the

children's participation prior to data collection activities. Study measurements included the body mass index (BMI), information regarding mode of transport to school and assessment of fundamental movement skills. Body composition data is not a reliable measure among children aged between 6-7 years old because of dynamic changes due to growth and development. Nevertheless, the BMI information was recorded for the purpose of ensuring all subjects were in a similar normal category based on the BMI scale. The mode of transport to school provided the researchers some insight with regards to the children's potential engagement in non-structured physical activities. The checklist included walking and cycling to school only. It was assumed participants would travel in motorized vehicles if they did not engage in either of the modes of transport listed.

The Ulrich Test of Gross Motor Development Version 2 (TGMD2) was used to assess participants' fundamental movement skills. This test battery consists of 12 items divided into six locomotor skills and six object manipulation skills. The locomotor skills include running, galloping, hopping, leaping, jumping and sliding. The object manipulation skills are stationary batting, dribbling, two-handed catching, kicking, overarm throwing and underhand rolling. All actions for object manipulation skills involve the use of a rounded ball with different and suitable sizes for the related task. Scoring procedures are based on performance criteria assigned to each test item. The presence or absence of a specific performance criterion is scored with either 1 or 0 respectively. This is a representation of the TGMD2 raw scores. Total raw scores will be in the range of 0 to 48 for each of the locomotor and object manipulation tests. These raw scores provide indication of age equivalents (based on TGMD2 Age Equivalent Table for Boys and Girls) in relation to a child's level of gross motor development (GMD). From these total raw scores also, standard scores of TGMD2 were computed based on the test groups, representing the adjusted values in accordance with age group and gender. Task items were demonstrated twice and participants were given two scoring trials for each of the items. All participant's trials were recorded using a video camera for backup and counter check for scoring motor skills by two data collectors. TGMD2 is standardized and widely utilized to assess fundamental movement skills of children aged 3-10 years old. This test battery is rated with Cronbach Alpha values ranging between 0.82 and 0.94, hence has been determined to have satisfactory measurement characteristics.

Comparisons involved the different school demographic factors only. Male and female participants were analyzed separately due to gender-specific differences in determining age equivalents to GMD, and during the conversion process from raw scores to standard TGMD2 scores. Differences in locomotor skills and object manipulation skills among indigenous, rural and urban participants based on standard scores were determined using a one-way analysis of variance (ANOVA). The Kruskal-Wallis test was used for a data set that violated the homogeneity of variance assumption. This assumption was tested using the Hartley Fmax test. Cohen's effect sizes with 90% confidence intervals were also used to determine the magnitude of difference, defined with criteria as follows: 0.2-0.5 (small), 0.5-0.79 (moderate) and >0.8 (large). Tukey post hoc procedure was applied for comparisons that yielded statistical significance. Further, a priori significance level was predetermined at $\alpha = 0.05$ for all comparisons.

Results

Table 1A and Table 1B presented the descriptive statistics for all main variables in the present study, whereas the inferential statistics findings are presented in Table 2A and Table 2B. For male participants, ANOVA results revealed no significant difference in terms of locomotor skills among the indigenous, rural and urban group, but yielded statistical significance for comparison of object manipulation skills [$F(2, 87) = 3.432$; $p = .037$]. Tukey post hoc further revealed that the source of significance was from the indigenous ($m = 39.63 + 3.764$) versus urban ($m = 36.57 + 5.042$) comparison ($p = .030$).

Table 1A: Descriptive statistics (means $\pm$ standard deviations where applicable) for test of locomotor and object manipulation skills among male participants.

Parameters/variables	Indigenous (n=30)	Rural (n=30)	Urban (n=30)
Age (years)	7 years 4 months	7 years 3 months	7 years 3 months
BMI (kg/m ²)	17.16 $\pm$ 5.715	17.37 $\pm$ 5.129	17.99 $\pm$ 3.667
Walking/cycling mode for school transportation (%)	100	73.3	40
Locomotor skills standard scores	39.70 $\pm$ 3.789	40.17 $\pm$ 4.850	38.33 $\pm$ 5.979
Object manipulation skills standard scores	39.63 $\pm$ 3.764	37.70 $\pm$ 4.843	36.57 $\pm$ 5.042
Age equivalent for locomotor skills	6 years 9 months	7 years 0 month	6 years 3 months
Age equivalent for object manipulation skills	7 years 0 month	6 years 10 months	6 years 3 months

Note: Age equivalent for both locomotor and object manipulation skills were derived from TGMD2 Table based on total raw scores of each participant

In terms of age equivalents, all three groups did not record any evidence of motor giftedness since none attained the level of GMD that exceeded their mean chronological ages. The GMD and age equivalents of indigenous and rural children were within an acceptable developmental range. However, the urban group exhibited GMD levels of a one-year delay compared to their mean chronological age.

Results from female participants reflected similar trends of no significant difference for the comparison of locomotor skills among the three groups yet yielded significant difference for object manipulation skills comparison [$df(2) = 8.379$; $p = .015$]. However, the female object manipulation skills data did not satisfy the homogeneity of variance assumption. Hence, the Kruskal Wallis test was conducted to determine the statistical significance. Post hoc analysis showed that this statistical significance was from the rural ($m=39.27 + 3.216$) versus urban ($m=32.70 + 6.439$) comparison ($p = .011$).

Table 1B: Descriptive statistics (means $\pm$ standard deviations where applicable) for test of locomotor and object manipulation skills among female participants.

Parameters/variables	Indigenous (n=30)	Rural (n=30)	Urban (n=30)
Age (years)	7 years 3 months	7 years 4 months	7 years 4 months
BMI (kg/m ²)	18.14 $\pm$ 3.661	18.85 $\pm$ 2.795	19.24 $\pm$ 4.544
Walking/cycling mode for school transportation (%)	100	66.7	23.3
Locomotor skills standard scores	37.40 $\pm$ 7.946	37.63 $\pm$ 4.860	36.90 $\pm$ 6.925
Object manipulation skills standard scores	35.03 $\pm$ 7.968	36.27 $\pm$ 3.216	32.70 $\pm$ 6.436
Age equivalent for locomotor skills	6 years 2 months	6 years 3 month	6 years 3 months
Age equivalent for object manipulation skills	7 years 3 month	7 years 6 months	6 years 9 months

Note: Age equivalent for both locomotor and object manipulation skills were derived from TGMD2 Table based on total raw scores of each participant.

Table 2A: Results of one-way analysis of variance for locomotor skills and object manipulation skills test for male and female participants

ANOVA	Male participants		Female participants	
VARIABLES	F	p	F	p
Locomotor	1.110	.334	1.042	.959
Object manipulation	3.432	.037*		

Table 2B: Results of Kruskal Wallis for object manipulation skills test among female participants: Standard Score Object Manipulation Female

Kruskal Wallis	Object manipulation skill
Chi-Square	8.379
df	2
Asymp. Sig.	.015*

Hartley's $F_{max} = 6.13$ (homogeneity of variance assumption violated)

Age equivalents in relation to GMD among female participants differed from the male group findings for object manipulation skills, where the rural group exhibited GMD levels that exceeded their mean chronological age by two months. The indigenous group showed a GMD level that was at par with the mean chronological age, whereas the urban group displayed a minor delay in terms of their GMD for this developmental parameter. All three groups displayed more than one year of motor developmental delay for GMD pertaining locomotor skills.

Discussion

Findings of the present study showed that both male and female participants did not significantly differ in GMD of locomotor skills. Here, it suggested that the extent of unstructured involvement in physical activities appeared to have no crucial bearing on the rate of gross locomotor skills development among early school

children. The more than 60% mode of physical activity involvement with either walking or cycling (which are locomotor skills) to school among both male and female indigenous and rural school children in this study, did not result in any notable developmental advantage compared to the urban children who reported more than 60% engagement of using motorized vehicles as a mode of school transport, especially among the female children. Nevertheless, variables derived from the TGMD-2 test battery for fundamental movement skills still manage to descriptively differentiate the observed groups, although not to a large extent, with the indigenous and rural groups (for both males and females) recording higher mean values, despite these differences being statistically insignificant. It must be noted that this observation is consistent with findings of the GMD-age equivalent relation where both male and female urban groups revealed 12 to 13 months locomotor development delays as compared to their indigenous and rural counterparts who exhibited acceptable developmental levels with respect to their chronological age for gross locomotor skills.

For object manipulation skills, significant differences observed in both male and female groups were intriguing yet insightful. However, the female data were subjected to a non-parametric analysis thereby the findings were applicable to describing the study sample only. In both situations, the lower gross developmental levels of the related skill parameter among the urban groups were also accompanied by a notable motor development delay. In the male group, this delay is one year based on chronological age, which is usually deemed to be substantial for further reassessment of GMD. We may provide a hypothetical explanation relating to perceived daily lifestyles of urban early school children to account for this finding, but the absence of relevant data warrants further research to specifically address this matter.

Overall, our findings are congruent with the motor development literature pertaining preschool and early school developmental levels. Gross motor developmental levels were exhibited to be within an acceptable range, except for the developmental delay observed among the male urban group pertaining to locomotor skills development. Data trends suggested a profound influence of daily lifestyle contributing to the performance scores during this study.

As the TGMD-2 is recommended for children from 3 to 10 years of age, this test should possess a sufficient level of sensitivity to detect total differences in gross motor skills (if any) within the middle section of the test's accepted age range, especially among Year One primary school children who are dependable on their PE classes as their sole form of engagement in structured physical activities. None of the study participants are enrolled in a sports academy or formal sports-specific coaching activities. Hence, our data firmly suggest that the absence of structured physical activity involvement outside the school program contributed to the findings that early school children GMD levels cannot be distinguished for their locomotor proficiency under normal developmental circumstances.

Previous studies in similar domains largely investigated fundamental movement skill levels in prepubertal or older children at the upper end of the test age range, hence there is still the scarcity of research with regards to comparisons among early school children. Therefore, it might be necessary to evaluate our results with those of children who are given a reasonable level of exposure and participated in structured sports during their primary school years. For example, findings of a study revealed that selected young soccer players outperformed non-selected players in both locomotor and object manipulation tests.

Similar findings were reported among prepubertal female gymnasts, with the level of participation in competition being positively associated with fundamental movement skills test, but not with anthropometric and physical characteristics. Such findings collectively suggest that motor proficiency seems to be related to the performance levels of primary school athletes across a wide range of sports and is linked to long term athlete development. Apart from sports achievements, scientific evidence has confirmed the role of physical activity in disease prevention and quality of life improvement and stressed the importance of integrated educational programs promoting physical activity and healthy lifestyles. A key priority mentioned is to identify and provide opportunities and methods of motor learning to increase the daily physical activity levels of children by reducing sedentary time and promoting active play.

In retrospect, findings of the current study did not lend scientific support to the prevalent practices of primary school teachers in Malaysian schools regarding the selection process of potential young athletes and providing opportunities toward more advanced participation in sports or athletic pursuits based on intuition and demographic preferences. Our overall findings are consistent with the body of literature that suggest: (a) sports-oriented talent identification is carried out too early and is inaccurate when conducted among children who are seven years old or younger, and (b) motor competence and physical talent indicators among early school children undergoing normal physical development are not reliably distinguished via fundamental movement skills assessment.

Previous studies also affirmed the contribution of systematic exposure towards structured involvement in physical activities towards the acquisition of more advanced skills in sports. Hence, for all early school children with normal motor development, equal opportunities must be provided to promote engagement in increased physical activity participation so as to not deny further development of their potential motor competencies.

Conclusions

This study provided substantial insight with regards to the influence of fundamental motor skills development towards the attainment of better physical performance levels among early school children. Based on results of the present study, it can be concluded that there were no notable disparities in terms of fundamental movement capabilities pertaining locomotor skills across the three groups. This is a crucial finding since locomotor skills form the basis for children to acquire more complex motor skills as they approach puberty. Therefore, with adequate exposure towards physical activities, our results suggested that children of an early school age possess similar potential to be nurtured into competitive sports regardless of their demographic background. To account for the significant differences observed for object manipulation skills, further studies are recommended that emphasize more detailed data regarding daily physical lifestyles and specific routine activities of the children within a similar age group and demographic diversities. These routine activities should focus upon movements that accentuate manual and finger dexterities. Employing a more comprehensive instrument of measure, such as the Bruininks-Oseretsky Test of Motor Proficiency, will provide a better account of fundamental motor skill differences that might exist among early school children with diverse lifestyles. Further, the inclusion of a more encompassing parameter, such as physical literacy, may also provide a better perspective in terms of revealing actual sports talent as the children develop further with age. Finally, although the indigenous and rural early school children recorded higher mean scores across the GMD assessment, the findings did not infer support to the prevalent practice of selection for higher sports involvement based on demographic preferences. The key priority here, is the provision of equal opportunities for children of every background toward increased participation in structured physical activities in school, as advocated by the body of literature.

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