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Associations between Fundamental Movement Skill Competence, Physical Activity and Psycho-social Determinants in Hong Kong Chinese Children

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Abstract

Associations between fundamental movement skills (FMS), perceived competence, enjoyment and physical activity (PA) have not been widely investigated among Chinese school children. We hypothesised that FMS would be directly related to self-reported and objectively measured PA, and indirectly related to these outcomes via perceived physical and movement skill competence, and enjoyment. Participants were 763 primary school children (age = 9.3 ± 1.7 years; 474 girls) across grades. FMS were measured for a subsample (n = 603) using Test of Gross Motor Development-2. PA using accelerometers was obtained from this subgroup (n = 238). All participating children completed a questionnaire measuring their PA participation, enjoyment, and perceived physical and movement skill competence. Structural equation modelling revealed positive associations between locomotor skills and perceived movement skill competence (β = .11, 95% CI [.001, .22]), and between perceived movement skill competence and objectively measured PA (β = .59, 95% CI [.04, 1.14]). Perceived physical competence and enjoyment mediated the association between locomotor skills and self-reported PA (β = .08, 95% CI [.02, .12]), but not objectively measured PA. Given inconsistent findings for subjective and objective measures of PA, further mediation analyses of the association between FMS and PA may be warranted.

Keywords: fundamental movement sills; perceived physical competence; perceived movement skill competence; enjoyment; physical activity

Introduction

Physical inactivity is a global public health issue (Kohl et al., 2012). Fundamental movement skills (FMS) are the “building blocks” of more advanced, complex movements, including locomotor, object control and stability skills (Logan, Ross, Chee, Stodden, & Robinson, 2017). Proficiency in FMS is one of the most important predictors of children’s physical activity (PA) (Holfelder & Schott, 2014). Increasing evidence indicates that being competent in FMS is associated not only with multiple health benefits (Lubans, Morgan, Cliff, Barnett, & Okely, 2010; Robinson et al., 2015a), but also cognitive and academic outcomes (Haapala, 2013). A growing body of research supports a positive relation between FMS and PA in children and adolescents, but the strength of the association during childhood and adolescence has yet to be conclusively demonstrated (Logan, Webster, Getchell, Pfeiffer, & Robinson, 2015; Robinson et al., 2015a). Using an experimental design, Cohen, Morgan, Plotnikoff, and Lubans (2015) showed that improving children’s FMS competency mediated increases in PA. According to Harter’s competence motivation theory (Harter, 1978), actual competence precedes perceived competence, with perceived competence more directly affecting motivation than actual competence. Therefore, children who have high levels of perceived competence are more likely to enjoy PA, exert greater effort and persistence, and continue PA involvement (Harter, 1978).

Stodden et al. (2008) suggest that motor skill competence and PA are associated indirectly via perceived competence. Nonetheless, some studies exploring these associations have been limited by focusing only on a more general perception of physical competence (Barnett, Morgan, Van Beurden, Ball, & Lubans, 2011; Crane, Naylor, Cook, & Temple, 2015; De Meester et al., 2016) rather than assessing perceptions of the same movement skills that clearly align with the actual movement skills being measured. Recent studies have investigated the association between actual and perceived movement skill competence, and moderate-to-vigorous PA (MVPA) assessed via accelerometry in English speaking children younger than 8 years old (Barnett, Ridgers, & Salmon, 2015; Slykerman, Ridgers, Stevenson, & Barnett, 2016). Although these two studies used matched assessments did not find perceived skill competence to be associated with MVPA in young children, further investigation on the specificity of these associations across childhood may help understand the contribution of different types of physical self-perceptions to children's (lifelong) activity levels (Robinson et al., 2015a).

Children find PA fun and challenging when they are provided with opportunities to master skills and experience success (Weiss, 2000). Under these circumstances they will likely develop positive feelings toward PA and maintain their motivation to be active over time (Dishman et al., 2005; Owen, Smith, Lubans, Ng, & Lonsdale, 2014). Indeed, children’s perceptions of competence and enjoyment of PA are essential influences on their PA participation (Fairclough, 2003). The association between FMS and PA over time may be mediated by the combined effect of these psycho-social variables. There has been research elucidating the association between FMS and PA among children and adolescents in Western countries (Holfelder & Schott, 2014). Less work has been conducted with primary school children across levels and almost none have examined the associations between FMS, perceived competence (both general perception of physical ability and specific perception relative to FMS), enjoyment and PA simultaneously in

Asian children. Given that popular sports in Western and non-Western contexts may lead to potential differences in children's experiences with some movement skills measured in existing assessment batteries (Bardid et al., 2016; Spessato, Gabbard, Valentini, & Rudisill, 2013), these cultural influences on motor development may affect the association between FMS and PA.

Considering more than half of the Hong Kong children and youth did not meet the recommended PA level (Huang et al., 2016), an enhanced understanding of the association between FMS and PA and the psychosocial variables among Chinese children will augment current literature with valuable information about the prevention of physical inactivity. This study aimed to examine associations between FMS, perceived physical and movement skill competence, enjoyment, and PA among Hong Kong Chinese primary school children using structural equation modelling (SEM). Based on Harter's competence motivation theory (Harter, 1978), and previous research (Barnett, Morgan, van Beurden, & Beard, 2008; Crane et al., 2015), it was hypothesised that FMS would be directly associated with self-reported and objectively measured PA, while perceived physical competence, perceived movement skill competence, and enjoyment of PA would mediate the association between FMS and PA.

Method

Participants and setting

A total of six primary schools from six (i.e., Central & Western; North; Sha Tin; Tsuen Wan; Wanchai; and Yuen Long) of 18 Hong Kong districts returned written principal consent to participate in the study (75% consent rate). Participants in the study were 763 primary 1 to 6 students (62% girls; mean age = 9.3 years, *SD*=1.7 and mean BMI = 17.5, *SD*=3.4). Their parents provided written consent for the child to be included in the research and the child provided verbal assent. The university ethics committee granted ethical approval prior to the commencement of the project. Anthropometric data (height and body weight) collected by physical education teachers were used to compute the body mass index (BMI) for each participant. All of the 763 students completed questionnaires measuring PA level, enjoyment and perceived physical and movement skill competence. For FMS measurements conducted during scheduled PE classes, 603 children were randomly selected from the entire sample based on their student ID numbers. A total of 571 children (40.5% boys; mean age = 9.3 years, SD=1.7) completed all 12 FMS tests. A random sample from this subset of FMS sample was asked to wear an accelerometer device. Among those 238 agreed, 191 (40.3% boys; mean age = 9.2 years, SD=1.6) had valid data. No differences were found between the groups in terms of their basic characteristics. The Chinese version of the questionnaire was administered by a trained research assistant in a classroom setting to guide children through each question in each section.

Measures

Fundamental movement skills

The Test of Gross Motor Development, second edition (TGMD-2; Ulrich, 2000) was used to measure FMS competency. The test is comprised of assessments for six locomotor skills: horizontal jump, run, leap, hop, slide and gallop; and six object control skills: overhand throw, kick, underarm roll, strike, catch and dribble. The TGMD-2 is a validated standardized test, commonly used to assess the qualitative aspects of FMS of children aged between three and ten (Ulrich, 2000). Measurements took place at the child's school during the scheduled PE lessons in accordance with the testing procedure outlined in the TGMD-2 Examiner's Manual (Ulrich, 2000). The test examiner assessed the 12 FMS in small groups (3-4 children) in the field and the group rotated around the stations (1 skill per station) until the assessment was completed. Five hundred and seventy-one (94.7%) students completed all 12 FMS tests. Participants who were unable to take the entire test battery were excluded from the analysis.

The primary researcher provided a total of six hours of training on the procedures and techniques necessary to score and interpret the TGMD-2 to the test examiners prior to research. They practiced scoring pre-recorded video clips of children's common performance patterns at different ages to compare with the ratings by the primary researcher until reaching a high degree of agreement determined by Intra-class correlation coefficient (ICC $\geq$ .90) (Landis & Koch, 1977). Inter-rater reliability for each individual skill using ICC was assessed following completion of training. A total of 90 video-clips with different performance levels were reviewed under conditions similar to those of the actual data collection procedures. The test examiners were instructed to rate one skill trial after viewing each vignette for once or up to a maximum of twice. The ICCs across the 12 skills ranged from 0.91 (for strike) to 0.99 (for slide).

Preceding actual measurement of each skill, the test examiner provided a standardized demonstration video clip on a smartphone or tablet to the group of children. The use of multimedia was to ensure the accurate demonstration of the skills, thus minimising discriminatory practice commonly faced in live demonstrations (Robinson et al., 2015b). Each of the 12 skills was evaluated twice on three to five performance criteria. The children performed individually the 12 skills tested. For each criterion, and for each trial, students' performance was marked as one (behavioural component presented) or zero (not presented). Scores of all criteria for the skill, and across both trials, were summed to obtain a raw score for each skill. The skill scores were then summed to obtain a locomotor subtest score (range 0-48), and an object control subtest score (range 0-48).

Perceived physical competence

The physical competence subscale of the Pictorial Scale of Perceived Competence and Social Acceptance for First-Second Grades (PSPCSA) (Harter & Pike, 1984) and the athletic competence subscale of the Self-Perception Profile for Children (SPPC) (Harter, 1985) were administrated to children attending Primary 1-2 and Primary 3-6 respectively. These scales, each with six items, measure a general perception of competence in the physical domain (e.g. general motor performance, and feel good about themselves in athletic ability). The range of scores for each item on the subscale is one to four. A score of four reflects highest perceptions of physical competence and a score of one reflects the lowest perceptions of physical competence.

Perceived movement skill competence

Children's perceived movement skill competence was assessed using 12 items specifically related to the actual skill competence test battery (Jones, Okely, Caputi, & Cliff, 2010; Southall, Okely, & Steele, 2004), and written in an identical format to that of the SPPC items (Harter, 1985), except that skill illustrations were also provided alongside to assure that students understand what was asked in each item. For example, 'Some kids are good at dribbling or bouncing balls', but 'Other kids don't feel that they are good at dribbling or bouncing balls'. Items were scored the same as the Harter's SPPC (Harter, 1985), on a one to four scale (from low to high perceived skill competence, respectively). It was considered a valid measure to assess children's perceived FMS competence and internal consistency (α = 0.87) has been documented (Southall et al., 2004).

Enjoyment in physical activity

Enjoyment in PA was measured by a 16-item (PACES) using a 5-point Likert-type scale (1 = "Never"; 2 = "Almost never"; 3 = "Occasionally / sometimes"; 4= "Almost every time"; 5 = "Every time"). The PACES was found to be a valid and reliable measure of enjoyment of PA in children and adolescents (Eather, Morgan, & Lubans, 2011; Liang, Lau, Huang, Maddison, & Baranowski, 2014; Motl et al., 2001). The 16 bi-polar statements begin with the stem "when I am physically active …" and end in statements regarding affective responses (e.g. "… I enjoy it"; "… I feel bored"). The responses were summed to give a total score ranges from 16 to 80. Higher PACES scores reflect greater levels of enjoyment.

Self-reported physical activity

The Physical Activity Questionnaire for Older Children (PAQ-C) (Kowalski, Crocker, & Donen, 2004) has been identified as a valid instrument to assess PA during the last seven days in children (8–14 years of age) from culturally diverse populations (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997; Janz, Lutuchy, Wenthe, & Levy, 2008; Wang, Baranowski, Lau, Chen, & Pitkethly, 2016). PAQ-C comprises of nine items, each question is scored between 1 (low) and 5 (very high PA) and the average score of all items constitutes the PAQ summary score that can be compared between groups or time points. PAQ-C is designed to provide a general estimate of PA levels in children's participation in different physical activities, as well as activity during PE, lunch break, recess, after school, in the evenings and at weekends. PAQ-C serves as a cost-effective and easy-to-use instrument for gaining insight into PA types and domains, but it does not directly capture the absolute level of PA or specific estimates of time spent across different levels of PA intensity (Voss, Dean, Gardner, Duncombe, & Harris, 2017). It is common to establish its validity against objective measures of PA such as accelerometers (rho = 0.47 for total PA and rho = 0.49 for MVPA) (Janz et al., 2008). PAQ-C score was related to accelerometry-based MVPA (r = 0.33) in Hong Kong Chinese children (Wang et al., 2016).

Moderate-to-vigorous physical activity (MVPA)

MVPA was objectively measured for seven consecutive days using ActiGraph GT3X+ accelerometers. Following standardized accelerometer protocols (Trost, McIver, & Pate, 2005), a total of 238 participants were randomly selected to wear the devices. Accelerometers enable the collection of real-time data on the frequency, duration and intensity of all activities. They are relatively small and lightweight, provide a reliable and valid measure ideal for assessing children's PA (Corder, Ekelund, Steele, Wareham, & Brage, 2008; Loprinzi & Cardinal, 2011). Accelerometer data was collected and stored in 15-s epochs (Evenson, Catellier, Gill, Ondrak, & McMurray, 2008), and the Evenson et al.'s MVPA cut-point (≥2296 counts·min^{-1}) was used to categorize children's PA into moderate-to-vigorous intensity activity and minutes spent in this activity intensity. The Evenson cut points provided acceptable classification accuracy to estimate time spent in MVPA in children (Area under the receiver operating characteristic curve [ROC-AUC = 0.90]) (Trost, Loprinzi, Moore, & Pfeiffer, 2011). Participants were included in the analysis if they had valid data, defined as a minimum of three days including a weekend day with at least ten hours (600 minutes/day) of total wear time recorded. Non-wear time was defined as strings of consecutive zeros equating to 20 minutes (Cain, Sallis, Conway, Van Dyck, & Calhoon, 2013). A total of 191 (80.3%) students met wear-time criteria.

Data analysis

The hypothesised structural relations between multiple independent and dependent variables were tested using SEM. It was deemed an appropriate technique for testing the fit of a hypothesised model with the observed data through goodness-of-fit statistics (Byrne, 2013). Before performing SEM, covariance and correlation matrices were obtained to allow better estimate the direct and indirect effects among the variables in the model (Table 1).

****Table 1 near here****

The analyses were conducted using MPLUS 7.0. The root mean square error of approximation (RMSEA), with associated 90% confidence interval, the comparative fit index (CFI), and the standardized root mean square residual (SRMR) were calculated to evaluate model fit (Byrne, 2013). The interpretation of what constitutes good fit varies across studies (Marsh, Hau, & Wen, 2004). In the current study, RMSEA less than or equal to .08, and CFI greater than .90 were considered indicative of adequate fit (Byrne, 2001). The chi-square statistics ($\chi2$) for model fit was also presented in the manuscript. However, this test is sensitive to sample size and therefore was not used to determine model fit.

Random assignment of items to parcels was conducted with the perceived movement skill competence (three four-item parcels) and enjoyment in PA (four four-item parcels), in order to reduce the number of parameters that would be estimated (Figure 1). Parcelling of items in SEM is common, and can have important impact on parameter estimation and statistical conclusions (Bandalos & Finney, 2001). By summing together two or more items and using the resulting sum as the basic unit of analysis is desirable since more than about four items per latent variable in SEM often creates serious problems of model fit (Bandalos & Finney, 2001).

The hypothetical model in Figure 1 consisted of four observed variables - locomotor skills, object control skills, self-reported PA and MVPA; and three latent variables - perceived physical competence (six indicators: PPC1 - PPC6), perceived movement skill competence (three indicators: FM1- FM3), and enjoyment (four indicators: EN1 - EN4). The model included paths that emanated from locomotor and object control skills to each of the two latent variables (i.e. perceived physical competence and perceived movement skill competence), and from each of the three latent variables (i.e. perceived physical competence, perceived movement skill competence and enjoyment) to PA (i.e. self-reported PA and MVPA). In addition, locomotor skills or object skills were hypothesized to operate through perceived physical competence, perceived movement skill competence and enjoyment to influence on PA (i.e. indirect effects). The model included children's age, gender and BMI as covariates to account for their influence on all of the latent constructs and indicators.

****Figure 1 near here****

Results

The descriptive statistics of the sample are provided in Table 2. Hypothesized paths and standardized parameter estimates are shown in Figure 2. The model provided an adequate fit to the observed data, RMSEA = .047, 90% CI [.04, .05], CFI = .94, SRMR = .046. After adjusting for child age, gender and BMI, significant associations were found between (a) locomotor skills and perceived physical competence (β = .16, 95% CI [.08, .25]), and perceived movement skill competence (β = .11, 95% CI [.001, .22]); (b) perceived physical competence and enjoyment (β = .50, 95% CI [.10, .90]); (c) perceived movement skill competence and MVPA (β = .59, 95% CI [.04, 1.14]); and (d) enjoyment and self-reported PA (β = .02, 95% CI [-.35, .38]). FMS competency (both locomotor and object control skills) had no direct effect on children's PA (neither self-reported nor objectively assessed PA).

****Table 2 near here****

****Figure 2 near here****

After adjustments for age, gender and BMI, only the indirect effect of locomotor skills on self-reported PA through perceived physical competence and enjoyment was significant (β = .07, 95% CI [.02, .12]). Object control skills did not have an indirect effect on either self-report PA or MVPA through perceived physical competence, perceived movement skill competence and enjoyment.

Discussion

This study reported the associations between FMS, perceived physical and movement skill competence, enjoyment in PA, self-reported and objectively measured PA among Hong Kong Chinese children. While previous studies have found a positive association between FMS competency and PA in children (Cohen, Morgan, Plotnikoff, Callister, & Lubans, 2014; De Meester et al., 2016) and adolescents (Barnett et al., 2011), this direct relationship was not observed in the study sample. Alternatively, perceived competence and enjoyment mediated the association between movement skill competence and self-reported PA (but not objectively measured PA). There is little research in this area investigating the mediating effects of enjoyment or perceived competence among children (Cohen, Morgan, Plotnikoff, Hulteen, & Lubans, 2017). To the authors' knowledge, this study is the first to assess perceived physical competence, perceived movement skill competence, and enjoyment of PA as potential mediators of the association between FMS and PA among a large sample of Hong Kong primary-school aged children.

The findings generally indicate that being able to perform locomotor skills competently is important for enhancing perceptions and enjoyment experienced in PA, in turn increasing PA engagement in children. This confirms previous studies in the Western population that locomotor skills may have a greater influence on children's PA, in comparison to object control skills (Khodaverdi, Bahram, Stodden, & Kazemnejad, 2016; Williams et al., 2008). In the current study, this finding may reflect the cultural specificity of the skills included in the TGMD-2. For example, the locomotor skills (e.g., jump, hop, and run) included in the TGMD-2 are prominent in physical activities like running, dancing and jumping rope. They are more widely popular among Hong Kong school children than many team sports (e.g., cricket, baseball, and hockey) that often require object manipulation skills. A recent review of global data on child and adolescent participation in sport and leisure-time physical activities has demonstrated that there is diversity in popular sports and activities around the globe (Hulteen et al., 2017). Therefore, it is important to note that traditional FMS might not be appropriate or relevant across different cultures and countries. Further research in non-Western contexts is warranted.

In contrast with our findings, two longitudinal studies conducted with Australian children demonstrated that object control proficiency developed in primary schools predicted subsequent engagement in adolescent PA (Barnett, Beard, van Beurden, Brooks, & Morgan, 2009; Barnett et al., 2008), and a positive self-perception was a mediator of this association (Barnett et al., 2008). One recent study conducted with Canadian pre-schoolers (Crane et al., 2015) also found that object control skills were more closely related to MVPA than locomotor skills, but perceived competence did not mediate the association. The inconsistent results observed in these previous studies (Barnett et al., 2008; Crane et al., 2015) may be that they did not align measures of actual and perceived competence to examine their associations with PA (Robinson et al., 2015a). It is likely that children may have different perceptions of their ability in movement skill and sport-related or outdoor games.

In the current study, we measured both perceived physical competence and perceived movement skill competence (based on the TGMD-2), but only the latter was significantly associated with MVPA. This finding provides preliminary evidence that perceptions of movement skill competence may also influence children's activity levels. Increasing research has aligned the measures of actual and perceived movement skill competence to investigate their association with objectively measured PA (Barnett, Ridgers, & Salmon, 2015; Slykerman et al., 2016). In contrast, no association between perceived movement skill competence and MVPA was found for young children (4-8 years old) in these studies. Our results extend previous knowledge in that, perceived rather than actual skill competence is more important to MVPA in older primary school children. More importantly, it provides support for the inclusion of perceived skill competence to match with the assessment of actual movement skills in future studies. Further investigations of the development of perceived movement skill competence in children and its mediating role between FMS and PA may help better understand the association (Barnett et al., 2015).

It should be noted, however, that inconsistent findings were found between different PA measures in the current study. Perceived FMS was associated with MVPA, but not for self-reported PA. This discrepancy highlights the importance of providing comparative objective measures of PA (Kavanaugh, Moore, Hibbett, & Kaczynski, 2015), and calls for valid and reliable PA measures to increase precision and accuracy in detecting associations of PA with actual and perceived competence among children. Yet, the mediation of physical competence and enjoyment was observed only for self-reported and not objectively measured PA. The strength of associations may have been systematically overestimated for self-report PA measures because of social desirability bias in children (Adamo, Prince, Tricco, Connor-Gorber, & Tremblay, 2009). The difference is also likely due to inflated method variance when both PA and psychosocial correlates are assessed using self-report measures (Podsakoff, MacKenzie, & Podsakoff, 2012). However, it is argued that statistical techniques such as SEM can be used to control method biases (Podsakoff et al., 2012).

Due to logistics challenges, accelerometer data was only obtained in a subsample which may have prohibited detecting a significant association between FMS and MVPA. Further, children in densely populated city of Hong Kong with limited space for PA, may be more often to engage in sedentary behaviours and habitual PA (i.e., light- to moderate-intensity PA) than MVPA. It is thus possible to further investigate and determine the association between FMS and PA using objective measures that may offer a more accurate indication of actual PA involvement at different intensity levels (i.e. light, MVPA, and vigorous PA). Although much of the research has been focused on MVPA, there is some support for the associations among FMS, sedentary behaviour and light- to moderate- intensity PA (Foweather et al., 2015; Gu, 2016; Johnstone, Hughes, Janssen, & Reilly, 2017).

Utilising Harter’s competence motivation theory, this study recruited a large sample of children across the primary school years (P1–P6) to investigate the associations between FMS, perceived physical and movement skill competence, enjoyment, self-reported and objectively measured PA (Harter, 1978). This research goes beyond existing knowledge by examining the potential mediating effects of enjoyment and perceived movement skill competence on the association between FMS and PA, which may help translate the theoretical links to applications for effective skill learning and PA behaviour change in different settings. The strengths of this study lie in the use of a comprehensive, process-oriented battery to assess children’s FMS competence, and matched measures of actual and perceived movement skill proficiency. Children’s PA levels were obtained using both objective (accelerometers) and subjective (questionnaires) measurement techniques. Confounding variables were controlled in all analyses.

Some methodological limitations need to be acknowledged. As with all cross-sectional studies, the data in the current study were collected at one specific period and therefore causation cannot be established. Although SEM controlled for age, BMI, and gender, the results of the potential mediating effects of enjoyment and skill perceptions on the association between FMS and PA remained insufficient for making a confident causal inference. Experimental and longitudinal studies can strengthen a directionality argument. Considering the fact that estimation of the model may be affected by the potential presence of multicollinearity (Vatcheva, Lee, McCormick, & Rahbar, 2016), caution should be warranted when interpreting the preliminary results found in this study. Another potential limitation is that social support as an important construct in Harter’s competence motivation theory was not measured in the current study.

The results of the study supported the conclusions drawn by a review, indicating that perceived competence plays an increasing influential role in the promotion of PA engagement across childhood (Babic et al., 2014). Further, findings from the current study highlight that both general perceptions of physical competence and specific skill perceptions appear to be important determinants of PA in children. Perceived physical competence might be viewed as a multidimensional construct and thus, future research could seek to combine multiple assessments of physical self-perceptions to investigate the association between FMS and PA. Simultaneously, there has been growing evidence regarding the use of process and product assessments to provide a holistic assessment of children's FMS competence (Logan, Barnett, Goodway, & Stodden, 2017; Rudd et al., 2016). Towards a better understanding of the examined relationships, it may be particularly important to consider using a wider range of test batteries to capture children's motor competence.

Given the rising levels of physical inactivity (Hallal et al., 2012), accompanied by a growing concern in many countries about declining FMS proficiency in children across all ages (Bardid et al., 2016; Foweather, 2010; Hardy, Barnett, Espinel, & Okely, 2013), mediation analyses are warranted to explore the underlying mechanism to further define the associations between FMS and PA at different intensities (i.e. light, MVPA, and vigorous PA) as well as time spent in sedentary behaviours. The current study contributes to the literature by utilising both objective and subjective measures of PA when investigating their relationships with psychosocial variables among children. In conclusion, the results of this study help improve the present understanding of the association between FMS and PA in primary children as well as inform the design of future effective FMS interventions.

Disclosure of interest

The authors report no conflicts of interest.

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