Pak. j. life soc. Sci. (2025), 23(2): 288-296 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences

www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2025-23.2.00166

RESEARCH ARTICLE

Cross-Cultural Differences in Physical Fitness among Primary School Children: A Comparative Analysis of Chinese and Thai Students Aged 6–8 Years

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ARTICLE INFO

Received: May 24, 2025

Accepted: Jul 15, 2025

Keywords

Anthropometric Data
Cross-Cultural Differences
Gender
Grade Level
Physical Fitness
School-Age Children

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ABSTRACT

Physical fitness during childhood plays a crucial role in promoting healthy growth and development. Cross-cultural comparisons offer insights into how environmental, educational, and lifestyle factors affect children's physical fitness. This study aimed to compare physical fitness among primary school students in China and Thailand. Participants were 280 children aged 6–8 (142 Chinese, 138 Thai). Physical fitness assessments included height, weight, body mass index (BMI), 50-meter sprint, sit-and-reach, and one-minute jump rope. Independent t-tests evaluated the measured outcomes between gender and country. Pearson correlations explored BMI and physical fitness relationships. Chinese students demonstrated superior performance in speed, flexibility, and coordination, despite having higher body weight and BMI compared to their Thai counterparts. Boys outperformed girls in speed and endurance, while girls exhibited greater flexibility. Grade level significantly influenced all physical fitness indicators. BMI was negatively correlated with flexibility and jump rope performance (p-value<0.01), but showed no significant association with running performance (p-value>0.05). Thai children had more favorable anthropometric profiles, while Chinese children showed better physical fitness, particularly in sprinting and coordination. These findings underscore the need for culturally tailored, developmentally appropriate physical education strategies that address national, gender, and developmental differences to support healthy growth.

INTRODUCTION

Physical fitness is regarded as a strong predictor of current and future health in children and adolescents, since it reduces stress, exhaustion, sedentary behavior, and health risk behaviors. Unfortunately, it is frequently noted that children and adolescents have poor physical fitness, which is primarily related to decreasing physical activity (Hafsteinsson Östenberg et al., 2022). High physical fitness at a young age is associated with a lower likelihood of being overweight or obese in adolescence, whereas low physical fitness in children and adolescents is associated with obesity, poor cardiometabolic health, and poor bone health in adulthood (Ruedl et al., 2021). Interestingly, there is a lack of research on physical fitness among Thai children, particularly in comparison to other Asian countries.

The World Health Organization (WHO) recommends that children aged 5-17 years do at least 60 minutes of moderate-to-vigorous physical activity (MVPA) every day (Chaput et al., 2020). But, less than 30% of the world's children and youth met these guidelines (Neil-Sztramko et al., 2021). Whereas the prevalence of adequate MVPA among Thai children and adolescents remained low, ranging between 20% and 28% during the period 2012–2019, it dropped significantly to 19% during the COVID-19 pandemic (Katewongsa et al., 2021; Widyastari et al., 2022). Overall, only 26.2-27% of Thai adolescents met the standard of 60 minutes of MVPA per day (classified as Grade D). Findings also showed a higher proportion of boys than girls (31-34.9% and 16.3-23%, respectively) met these guidelines pandemic (Katewongsa et al., 2021; Widyastari et al., 2022). The proportion with adequate physical activity in children and adolescent was highest among boys aged 6-8 years and lowest among boys aged 12-14 years. About one-third of Thai children and adolescents (37%) participated in organized sports, resulting in a grade of D+. It was found that only 25% of Thai children and adolescents (Grade D) achieved the mean percentile standardized values in the sit-to-stand walk and sit-up tests as suggested by Tomkinson et al. (2018). Slightly over half (54%, Grade C+) of children and adolescents had "good" physical literacy (Cairney et al., 2019).

Significant changes in Chinese society and lifestyle have affected the physical status of children and adolescents (Luo et al., 2023). In the China, the percentage of children and adolescents (9-17 years old) in China who meet the recommended 60-minute MVPA per day is only 13.1%. Boys were more active than girls (14.5% vs. 11.7%, respectively). The rates of meeting the PA guidelines declined gradually as students progressed from primary school (18.9%) to secondary school (8.0-11.9%) (Liu et al, 2019). While only 3 out of 10 students achieving an "excellent" or "good" grade in the national physical fitness standards (Zhu et al., 2017). Overweight/obese children and youth tended to perform poorly on certain physical fitness tests. While 22.5% of children and adolescents are obese or overweight (Ke et al., 2019).

The differences between Thailand and China may influence to their physical fitness, as cultural variations would significantly affect health behaviors and physical outcomes. Therefore, the objectives of this study were to conduct a detailed cross-gender comparative analysis of physical fitness such as body mass index (BMI), 50-meter running, seated forward bending, and one-minute skipping of primary school students in grades 1 to 3 between Thailand and China. This multidimensional comparison may help to reveal the influence of gender and cultural background on children's physical development and athletic ability, filling the gap of cultural-based gender and age differences.

MATERIALS AND METHODS

Participants

This cross-sectional study included 280 children aged 6 to 8 years from Thailand and China. Prior to the test, recruitment information was distributed to three purposively selected public primary schools in Khon Kaen province, Thailand. In China, three schools in Maoming City, Guangdong Province were also selected for participants' recruitment. Subsequently, a stratified random sampling method was employed, using age and gender as stratification factors. A total of 138 children (82 boys and 56 girls) from Thailand and 142 children (76 boys and 66 girls) from China participated in the study. Children with physical or mental disabilities are excluded from the study. Written informed consent was obtained from the children's parents or guardians and verbal assent was collected from the children prior to their participation in the study. The study follows the Declaration of Helsinki and was approved by the Ethics Committee of Khon Kaen University (HE#672147).

Procedures

(1) Height, weight and BMI measurement: participants stand upright, with their head in a horizontal plane and their back pressed against the measurement board, then their height was recorded in centimeters (cm.), with values rounded to the nearest 0.5 cm. Participants' weight was measured using a calibrated electronic scale. During the weight measurement, children were asked to remove their belts and any items from their pockets, such as coins, toys, or keys, to ensure that only their body weight was recorded. Weight was recorded to the nearest 0.1 kilogram. BMI was calculated with weight divided by height in meters squared (kg/m^2).

(2) Fifty-meter sprint test: researchers ensured that the start and finish lines were clearly marked and that the track was level before the test. Participants were required to complete a full warm-up and wear appropriate sports shoes. The test began with the participant standing behind the start line, and timing started with the signal and ended when the participant crossed the finish line. Completion time was recorded to the nearest 0.1 second to ensure accuracy. As part of the cool-down routine, participants were encouraged to engage in stretching and light jogging (Hu et al., 2022).

(3) Sit-and-bend forward test measurement: the subject sits on a soft pad connected to the testing apparatus, with a standard meter ruler placed on a sit-and-reach box. The 20 cm mark on the ruler is aligned with the reference point for negative and positive values, corresponding to the heel position, which is defined as the zero point. The legs are fully extended, with heels together and toes naturally spaced 10 to 15 centimeters (cm.) apart, pressed firmly against the vertical panel of the tester. The participant places their hands on their thighs, bends forward as far as they can, then uses their hands to contact their ruler or the farthest point on their toes. Participants were instructed to keep their knees straight and refrain from making any impulsive movements to gain additional distance. The measurement was performed twice, and the best performance was recorded. The recorded value may be negative, zero, or positive, depending on the individual's flexibility. The assessor documented the maximum reach to the nearest 0.1 cm (Hu et al., 2022). Children who achieve a reach of less than 2 cm are classified as having "very low" flexibility, while those who exceed 11 cm are classified as having "very good" flexibility.

(4) One-minute jump rope measurement: Make sure the jump rope's length is suitable for the tester; when standing in the middle of the rope, the ends should be level with the tester's armpits. Before the test, warm up properly to lower the chance of harm. The test involves the tester holding the jump rope's handles with both hands, keeping a steady standing stance, and jumping the rope as many times as they can in a minute. Participants have the option to jump using one foot, both feet alternately, or both feet simultaneously. A stopwatch is used to time the activity and count the number of successful jumps (Hu et al., 2022). If any students were unable to perform the jump rope test, a professional coach provided individual instruction to the correct technique. Once the researcher confirmed that the participants had acquired the necessary skills, they were given a ten-minute rest before undergoing the test again.

Statistical Analysis

Statistical analysis was performed using SPSS version 28.0. Descriptive statistics were used to calculate the mean, standard deviation, and percentiles for each physical fitness variable. Independent sample t-tests were conducted to compare differences in these variables between Chinese and Thai participants, as well as across genders and age groups (grade levels). Pearson correlation analyses were conducted to examine the relationship between BMI and various measures of physical fitness, aiming to identify potential associations between body composition and physical performance indicators. All statistical tests were considered significant at a p-value of less than 0.05 (p-value<0.05).

Table 1. Comparison of physical fitness between Thai and Chinese children, analyzed by genders

	Boy			**Girl**			**Total**		
	Thai (n=82)	**Chinese** (n=76)	p-value	**Thai** (n=56)	**Chinese** (n=66)	p-value	**Thai** (n=138)	**Chinese** (n=142)	p-value
Height (cm.)	125.43±0.77	124.81±0.77	0.737	123.91±0.96	124.78±0.99	0.524	124.81±6.94	124.79±7.31	0.983
Weight (kg.)	25.21±0.73	21.94±0.61	0.002	22.88±0.85	21.41±0.77	0.230	24.19±6.61	21.69±5.73	<0.01
BMI (kg/m^2)	15.83±0.31	13.94±0.28	<0.01	14.72±0.37	13.52±0.3	0.018	15.32±2.85	13.75±2.45	<0.01
50-meter sprint (s.)	11.86±0.15	11.17±0.12	<0.01	13.02±0.17	12.03±0.13	<0.01	12.33±1.47	11.57±1.15	<0.01
Sit-and-bend forward (cm.)	2.90±0.69	5.54±0.57	<0.01	3.71±0.89	7.75±0.52	<0.01	2.04±6.56	6.57±4.75	<0.01
1-minute jump rope (rep.)	16.45±1.06	34.89±1.92	<0.01	15.75±1.03	37.18±2.28	<0.01	16.21±8.84	35.96±17.55	<0.01

Note: Analyzed by the Independent samples t-test.

Table 2. Comparison of physical fitness between Thai and Chinese children, analyzed by grades

	Grade 1			**Grade 2**			**Grade 3**		
	Thai (n=48)	**Chinese** (n=47)	p-value	**Thai** (n=46)	**Chinese** (n=47)	p-value	**Thai** (n=44)	**Chinese** (n=48)	p-value
Height (cm.)	122.13±0.53	118.92±0.73	< 0.01	128.96±0.98	124.97±0.64	0.003	135.36±1.84	130.18±0.96	0.017
Weight (kg.)	22.24±0.53	17.28±0.50	< 0.01	26.93±0.95	23.61±0.56	0.002	33.14±2.32	23.91±0.87	< 0.01
BMI (kg/m^2)	14.81±0.28	12.13±0.25	< 0.01	16.10±0.41	15.04±0.24	0.030	17.9±0.92	13.99±0.37	< 0.01
50-meter sprint (s.)	12.60±0.14	12.06±0.15	0.019	11.36±0.23	11.36±0.13	0.508	12.31±0.42	11.37±0.17	0.026
Sit-and-bend forward (cm.)	3.03±0.57	5.19±0.62	0.053	-0.04±1.52	6.73±0.56	0.007	-0.79±2.28	8.15±0.74	0.008
1-minute jump rope (rep.)	15.13±0.71	27.81±2.12	< 0.01	19.33±2.27	34.17±2.00	<0.01	17.21±3.32	44.04±2.78	< 0.01

Note: Analyzed by the Independent samples t-test.

RESULTS

Table 1 presents the comparative analysis of physical fitness indicators between Thai and Chinese children, disaggregated by gender and totals. There were no significant differences in height between Thai and Chinese children across boys, girls, or the total sample (p-value>0.05), suggesting similar growth trends in stature across both nationalities and genders. However, Thai boys had significantly higher weight than Chinese boys (25.21 kg vs. 21.94 kg, p-value<0.01), while the difference among girls was not statistically significant (p-value=0.230). When considering the total sample, Thai children weighed significantly more than Chinese children (p-value<0.01). In terms of BMI, both Thai boys (15.83 kg/m^2) and girls (14.72 kg/m^2) had significantly higher BMI compared to their Chinese counterparts (boys: 13.94 kg/m^2; girls: 13.52 kg/m^2), with p-value<0.05. Among speed (50-meter sprint), Chinese children demonstrated superior sprinting performance across both genders. Chinese boys completed this test significantly faster than Thai boys (11.17 s vs. 11.86 s, respectively, p-value<0.01), and Chinese girls also outperformed Thai girls (12.03 s vs. 13.02 s, p-value<0.01).

Chinese students also showed significantly better flexibility. Chinese boys (5.54 cm) and girls (7.75 cm) scored significantly higher than Thai boys (2.90 cm) and girls (3.71 cm), respectively (p-value<0.01 for both). The 1-minute jump rope test showed a marked performance gap, with Chinese children far outperforming their Thai peers. Chinese boys completed an average of 34.89 repetitions, more than double that of Thai boys (16.45), p-value<0.01. Similar results were found among girls (Chinese: 37.18; Thai: 15.75; p-value<0.01) and the total group (p-value<0.01). These results highlight a significant advantage in muscular endurance and coordination among Chinese children.

Table 2 show a significant difference in multiple variables across both nationality and grade level. Thai children were consistently taller and heavier than their Chinese peers at all grade levels. For example, in Grade 1, Thai children had a significantly greater height (122.13 cm vs. 118.92 cm, p-value<0.01) and weight (22.24 kg vs. 17.28 kg, p-value<0.01). This trend persisted in Grade 2 and Grade 3 with statistical significance in all comparisons (p-value<0.05). BMI values followed a similar pattern, with Thai children exhibiting significantly higher BMI across all grades, suggesting a greater prevalence of higher body mass among Thai participants. Chinese children generally demonstrated better sprint performance, with significantly faster times than their Thai counterparts in Grade 1 and Grade 3 (p-value<0.05). Chinese children also generally demonstrated better sprint performance, with significantly faster times than their Thai counterparts in Grade 1 (p-value=0.019) and Grade 3 (p-value=0.026). However, no significant difference was observed in Grade 2, indicating a potential convergence in sprint ability at this developmental stage. Also, Chinese children showed superior flexibility across all grades, with the difference reaching statistical significance in Grade 2 and Grade 3 (p-value<0.05). Although Grade 1 results borderline significance (p-value=0.053), the trend suggests that Chinese children consistently performed better in flexibility-related tasks. Chinese

children significantly outperformed Thai children in the 1-minute jump rope test, indicating better coordination and lower limb muscular endurance. The differences were substantial and statistically significant across Grades 1 to 3 (p-value<0.01), with performance gaps widening in higher grades (e.g., 44.04 ± 2.78 reps. for Chinese vs. 17.21 ± 3.32 reps. for Thai in Grade 3).

Table 3. Correlation between those physical fitness variables

	50-m sprint	Sit-and-bend forward	1-minute jump rope
BMI (kg/m²)	-0.023	-0.173**	-0.162**
50-m sprint (s.)		-0.120*	-0.395**
Sit and bend forward (cm.)			0.316**

Note: ** Correlation was significant at the 0.01 level (p-value <0.01)
*** Correlation was significant at the 0.05 level (p-value <0.05)**
- indicates a negative correlation
+ indicates a positive correlation

Table 3 shows that BMI has a significant negative association with flexibility (r=-0.173, p-value<0.01) and jump rope performance (r=-0.162, p-value<0.01), indicating that a higher BMI is associated with reduced flexibility and fewer jump rope repetitions. However, the correlation between BMI and 50-meter sprint time was weak and not statistically significant. Furthermore, significant correlations were observed among the physical fitness measures. The 50-meter sprint showed a moderate negative correlation with jump rope performance (r=-0.395, p-value<0.01) and a weak negative correlation with flexibility (r=-0.120, p-value<0.05), indicating that better sprint performance (i.e., faster times) is associated with higher jump rope counts and greater flexibility. Additionally, flexibility demonstrated a moderate positive correlation with endurance, as measured by the 1-minute jump rope test (r=0.316, p-value<0.01), suggesting that greater flexibility is linked to better endurance performance.

DISCUSSION

This study aimed to compare anthropometric characteristics and physical fitness indicators between Thai and Chinese primary school children. To the best of our knowledge, the present study is the first to systematically examine and compare the influence of gender, grade level, and BMI on physical fitness of primary school students in China and Thailand. The findings offer cross-cultural insights into youth fitness development and inform the design of culturally appropriate physical education policies and health promotion strategies. This research contributes theoretically and practically by addressing gaps related to demographic and contextual factors influencing physical fitness, while also highlighting potential differences in activity patterns and educational practices across national contexts.

Anthropometric data revealed no significant differences in height between Thai and Chinese children across gender or grade levels, suggesting similar growth patterns in stature during early childhood. This is consistent with recent observations by Khadilkar et al. (2024), who reported negligible differences in height among Southeast Asian children under age 10. But, Thai children consistently showed higher weight and BMI values compared to their Chinese counterparts, with significant differences noted across boys, girls, and all 3 grade levels. While the relative age effect plays a significant role in elementary school, where children who are relatively older within an age group tend to be taller and heavier than their peers, impacting physical performances (Drenowatz et al., 2022).

A significant negative correlation was found between BMI and both flexibility and jump rope performance. These findings indicate that BMI has a greater negative impact on flexibility and endurance activities than on sprint performance. The strong negative association between BMI and flexibility observed in this study further supports the idea that lower body mass contributes to enhanced range of motion. This supports the findings of Barros et al. (2022), who reported that excess weight impairs physical functioning in young children—particularly in tasks involving flexibility and

muscular endurance—and is also associated with an increased risk to physical health. As BMI did not significantly correlate with sprint performance, it may be due to the short duration of the sprint test, which may not fully capture the impact of excess body weight on sustained movement. Prior study similarly suggested that as BMI increases, physical fitness scores decrease, highlighting a significant relationship between body weight and physical performance (Puchalska-Sarna et al., 2022). This trend was observed in multiple countries, including China, Sweden, and New Zealand, where increased body weight and BMI negatively impacted physical fitness (Masanovic et al., 2020). Higher BMI levels are linked to decreased flexibility and fewer repetitions in endurance-related activities like jump rope, although sprint performance remains unaffected (Manzano-Carrasco et al., 2023). In terms of speed, Chinese children demonstrated superior performance in the 50-meter sprint, particularly in Grades 1 and 3. These findings are consistent with those of Zhu et al. (2017), who observed that Chinese children often outperform their peers in short-distance speed tasks, likely due to variations in the intensity and frequency of physical education curricula. The non-significant result observed in Grade 2 may reflect developmental fluctuations or differences in the maturation of motor coordination at this age. Longitudinal research conducted among primary school students in Qinghai Province, China, showed improvements in 50-meter sprint performance from 2019 to 2023. During this period, the average time for boys decreased from 9.77 seconds to 9.64 seconds (a difference of 0.13 seconds), while the average time for girls improved from 10.59 seconds to 10.20 seconds (a difference of 0.39 seconds) (Zhang et al., 2025). In the present study, Chinese children demonstrated superior speed across both genders. Chinese boys completed the test significantly faster than Thai boys by an average of 0.69 seconds, while Chinese girls outperformed Thai girls by 0.99 seconds. These differences may be associated with enhanced physical abilities that contribute to injury prevention in daily activities, such as avoiding traffic accidents or other hazardous situations that require quick reflexes and speed, which are also related to overall athletic ability.

Our results also indicate that physical fitness improves across various components with increasing age, which is consistent with the findings of previous studies. They found that older children generally perform better than younger ones in tests of strength, endurance, and speed (Drenowatz et al., 2022; Yip et al., 2022). While flexibility outcomes showed a consistent advantage for Chinese children across both genders and most grade levels, with statistically significant differences emerging in Grades 2 and 3. This pattern reflects the findings of prior study in China by Fan and Cao (2021) who documented that Chinese school children, especially in urban settings, often engage more frequently in flexibility and mobility-focused exercises such as gymnastics and martial arts. Another study on Austrian primary school students aged 6-11 found that every aspect of physical fitness increased significantly across age groups, except for flexibility, which decreased substantially (Drenowatz et al., 2022). However, flexibility tends to decrease with age, particularly in Thai children. This trend highlights the importance of age-specific training programs that provide to the developmental needs of children at different stages. Chinese children's performance in the 1-minute jump rope test—a proxy for muscular endurance and coordination—was markedly better across all grades and genders. These differences were statistically significant and became more pronounced with increasing grade level. This trend is consistent with research by Xiao and Tang (2025), which showed that East Asian schoolchildren generally score higher in endurance-based tasks, attributed to more rigorous school physical education standards and broader participation in extracurricular physical training. Moreover, the moderate positive correlation between flexibility and jump rope performance ($r = 0.32$) observed in this study is consistent with the findings of a meta-analysis (Zhao et al., 2023), which highlighted the interrelationship between flexibility and endurance as key indicators of general motor proficiency in children. Additionally, stronger sprint performance leads to improved jump rope ability and flexibility.

Our findings indicate considerable disparities in physical fitness between males and girls. Boys excel in speed and coordination, and they perform better in exercises such as the 50-meter run and the jump rope test. In contrast, girls have greater flexibility, as shown by higher scores on the seated body forward flexion test. Furthermore, boys have a higher body weight and BMI than girls, suggesting differences in body composition and muscle mass. A meta-analysis revealed that boys are stronger than girls on average, with the strength difference increasing significantly during male puberty and being more pronounced in upper-limb muscles. Boys also tend to be more active than girls, engaging in more MVPA (Nuzzo and Pinto, 2025). Another study in Poland also revealed that older boys and

girls outperformed younger ones. Boys outperformed girls in every physical fitness component except flexibility. Boys performed quicker in the 20-meter run and did more sit-ups, covered more distance in the 6-minute run. Girls did better than boys in the sit-and-reach (Lisowski et al., 2022). These findings highlight gender inequalities in physical fitness, with boys showing an advantage in explosive power and endurance while girls show an advantage in flexibility.

This study is not without its limitations. Although stratified random sampling based on age and gender was employed, the initial selection of schools was purposive. As a result, the sample may be subject to selection bias and may not be fully representative of the broader population of children in each country. The cross-sectional design, which involves data collection at a single time point, limits the ability to establish causality or observe developmental trends over time, particularly in relation to comparisons across grade levels. Additionally, other potential confounding factors such as socioeconomic status, dietary intake, school facilities, and physical activity levels outside of school were not assessed. In addition, it concentrates on certain regions in China and Thailand, which may not accurately reflect the people of both nations. Future research should further investigate the socio-environmental, curricular, and behavioral factors contributing to these disparities. Longitudinal studies that track changes in BMI and physical fitness over time will provide more in-depth insight into developmental trajectories and help inform the design of targeted, sustainable interventions to promote healthy growth and physical competence in children.

In summary, these findings underscore the multifactorial nature of physical fitness, shaped by biological, socio-cultural, and environmental influences. The superior physical performance of Chinese children in several domains could be partially attributed to more structured and consistent physical education programs in Chinese schools. Conversely, the higher BMI in Thai children may reflect broader public health concerns related to sedentary behavior and nutritional trends in Thailand, which should be addressed through targeted health and fitness interventions.

CONCLUSION

This study highlights notable differences between Thai and Chinese children in terms of physical characteristics and fitness. Thai children tend to have higher body weight and BMI, suggesting a greater prevalence of overweight tendencies. In contrast, Chinese children show superior physical fitness, excelling in areas such as speed, flexibility, and muscular endurance. These findings underscore the importance of addressing both nutritional and physical activity factors in promoting healthier lifestyles for children in both populations, with particular emphasis on Thailand. Moreover, this study provides an important reference for the formulation of health promotion policies and individualized exercise intervention programs in line with children's growth and development characteristics, especially in the cross-cultural context, and helps to design health management strategies that adapt to the needs of children in different countries and regions.

Study implications

Thai children have comparable height growth to their peers but fall behind in physical fitness, especially in muscular endurance and flexibility. This may be due to higher BMI, lower physical activity, and less structured physical education compared to countries like China. Poor performance in activities like jump rope highlights the need for improved physical education focusing on cardiovascular endurance, strength, and motor coordination. High BMI negatively impacts flexibility and endurance, supporting the idea that excess weight reduces movement efficiency. In contrast, Chinese children benefit from disciplined physical activity programs, providing a model for Thailand. Incorporating daily exercise, flexibility training, and extracurricular sports could enhance Thai children's fitness. A balanced, holistic approach—addressing sprint speed, flexibility, and endurance together—is essential for healthy physical development.

Conflict of interest

The authors have no conflicts of interest to report.

Funding

This study was supported by grants from the Research Center in Back, Neck, Other Joint Pain and Human Performance (BNOJPH), Khon Kaen University, Thailand. The funder had no role in the design

of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Acknowledgment

We fully appreciate all of the students and schools who participated in our study.

Authors' contributions

XZ conceived and designed the idea, data collection, and performed the data analysis, and first drafted the manuscript. KK conceived and designed the idea, contributed to the review of the final manuscript and prepared it for submission. WE and CZ conceived and designed the idea. JK and MR administered the data collection. PS performed the statistical analysis and interpretation, all authors approved the final format of the submitted manuscript.

REFERENCES

Barros WMA, da Silva KG, Silva RKP, Souza APDS, da Silva ABJ, Silva MRM, et al. (2022). Effects of overweight/obesity on motor performance in children: a systematic review. Frontiers in Endocrinology, 12: 759165.

Cairney J, Dudley D, Kwan M, Bulten R, & Kriellaars D. (2019). Physical literacy, physical activity and health: toward an evidence-informed conceptual model. Sports Medicine, 49(3), 371-83.

Chaput JP, Willumsen J, Bull F, Chou R, Ekelund U, Firth J, et al. (2020). 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5-17 years: summary of the evidence. International Journal of Behavioral Nutrition and Physical Activity, 17(1), 141.

Drenowatz C, Chen ST, Cocca A, Ferrari G, Ruedl G, & Greier K. (2022). Association of body weight and physical fitness during the elementary school years. International Journal of Environmental Research and Public Health, 19(6), 3441.

Fan X, & Cao ZB. (2017). Physical activity among Chinese school-aged children: national prevalence estimates from the 2016 physical activity and fitness in China-the youth study. Journal of Sport and Health Science, 6(4), 388-394.

Hafsteinsson Östenberg A, Enberg A, Pojskic H, Gilic B, Sekulic D, & Alricsson M. (2022). Association between physical fitness, physical activity level and sense of coherence in swedish adolescents; an analysis of age and sex differences. International Journal of Environmental Research and Public Health, 19(19), 12841.

Hu WN, Li DY, Lam WK, Wang Y, Wong DW, & Cheung JC. (2022). Physical fitness of Chinese primary school students across the Coronavirus (COVID-19) outbreak: a retrospective repeated cross-sectional study. International Journal of Environmental Research and Public Health, 19(13), 7870.

Katewongsa P, Pongpradit K, & Widyastari DA. (2021). Physical activity level of Thai children and youth: Evidence from Thailand's 2018 report card on physical activity for children and youth. Journal of Exercise Science and Fitness, 19(2), 71-4.

Ke Y, Zhang S, Hao Y, & Liu Y. (2023). Associations between socioeconomic status and risk of obesity and overweight among Chinese children and adolescents. BMC Public Health, 23(1), 401.

Khadilkar AV, Oza C, Kajale N, Pulungan AB, Wacharasindhu S, Moelyo AG, et al. (2024). Local anthropometric parameters for assessing double burden of malnutrition in South Asian and Southeast Asian countries: a review and retrospective analysis. Lancet Regional Health - Southeast Asia, 28, 100473.

Lisowski P, Kantanista A, & Bronikowski M. (2022). Moderate effects of school-based time increasing physical education intervention on physical fitness and activity of 7-year pupils-a report from a follow-up of a HCSC study. Children (Basel), 9(6), 882.

Liu Y, Tang Y, Cao ZB, Zhuang J, Zhu Z, Wu XP, et al. (2019). Results from the China 2018 Report Card on physical activity for children and youth. Journal of Exercise Science and Fitness, 17(1), 3-7.

Luo D, Ma N, Liu Y, Yan X, Ma J, Song Y, et al. (2023). Long-term trends and urban-rural disparities in the physical growth of children and adolescents in China: an analysis of five national school surveys over three decades. Lancet Child & Adolescent Health, 7(11), 762-72.

Manzano-Carrasco S, Garcia-Unanue J, Haapala EA, Felipe JL, Gallardo L, & Lopez-Fernandez J. (2023). Relationships of BMI, muscle-to-fat ratio, and handgrip strength-to-BMI ratio to physical fitness in Spanish children and adolescents. European Journal of Pediatrics, 182(5), 2345-57.

Masanovic B, Gardasevic J, Marques A, Peralta M, Demetriou Y, Sturm DJ, et al. (2020). Trends in physical fitness among school-aged children and adolescents: a systematic review. Frontiers in Pediatrics, 8, 627529.

Neil-Sztramko SE, Caldwell H, & Dobbins M. (2021). School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. Cochrane Database Systematic Reviews, 9(9), CD007651.

Nuzzo JL, & Pinto MD. (2025). Sex differences in upper- and lower-limb muscle strength in children and adolescents: a meta-analysis. European Journal of Sport Science, 25(5), e12282.

Puchalska-Sarna A, Baran R, Kustra M, Pop T, Herbert J, & Baran J. (2022). The level andfactors differentiating the physical fitness of adolescents passively and actively resting in south-eastern Poland-a pilot study. Children (Basel), 9(9), 1341.

Ruedl G, Niedermeier M, Wimmer L, Ploner V, Pocecco E, Cocca A, et al. (2021). Impact of parental education and physical activity on the long-term development of the physical fitness of primary school children: an observational study. International Journal of Environmental Research and Public Health, 18(16), 8736.

Tomkinson GR, Carver KD, Atkinson F, Daniell ND, & Lewis LK, Fitzgerald JS, et al. (2018). European normative values for physical fitness in children and adolescents aged 9-17 years: results from 2 779 165 Eurofit performances representing 30 countries. British Journal of Sports Medicine, 52(22), 1445-14563.

Widyastari DA, Saonuam P, Pongpradit K, Wongsingha N, Choolers P, Kesaro S, et al. (2022). Results from the Thailand 2022 report card on physical activity for children and youth. Journal of Exercise Science and Fitness, 20(4), 276-82.

Xiao Q, & Tang F. (2025). Extracurricular physical exercise and self-education expectations among Chinese teenagers. Frontiers in Psychology, 16, 1518100.

Yip KM, Wong SWS, Chua GT, So HK, Ho FK, Wong RS, et al. (2022). Age- and sex-specific physical fitness reference and association with body mass index in Hong Kong Chinese schoolchildren. International Journal of Environmental Research and Public Health, 19(22), 15346.

Zhang L, Li Z, Kong Z, Sun Y, Lu Y, & Zhu W. (2025). Comparison of physical activity, sedentary time, and physical fitness among Chinese children and adolescents in Qinghai between 2019 and 2023. Scientific Reports, 15(1), 15995.

Zhao Q, Wang Y, Niu Y, & Liu S. (2023). Jumping rope improves the physical fitness of preadolescents aged 10-12 years: a meta-analysis. Journal of Sports Science and Medicine, 22(2), 367-80.

Zhu Z, Yang Y, Kong Z, Zhang Y, & Zhuang J. (2017). Prevalence of physical fitness in Chinese school-aged children: Findings from the 2016 physical activity and fitness in China-the youth study. Journal of Sport and Health Science, 6(4), 395-403.