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The Correlation between Different Sports Club Training and Children's Basic Movement Patterns

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Abstract: This study aimed to determine the correlation between different school sports club trainings and the basic movement patterns of primary school students. Using the Functional Movement Screening (FMS), the study assessed students engaged in five distinct sports—track and field, basketball, aerobics, rope skipping, and cheerleading—against a control group with no sports club affiliation. The results demonstrated that students in any sports club had significantly superior total FMS scores, lower rates of scores below the injury threshold, and reduced movement asymmetry compared to non-participants. Significant variations existed among the sports, with cheerleading students exhibiting the highest scores, followed by track-and-field, aerobics, rope-skipping, and basketball. The study concludes that participation in sports clubs is beneficial for developing functional movement, though the degree of improvement is distinctly influenced by the type of sport practiced.

Keywords: sports club, movement skill, functional movement screening, basic movement patterns, sports injury

1. Introduction

Basic (functional/fundamental) movement patterns form the foundation of movement skill development. The limitation and asymmetry of basic movement patterns are thought to reduce the effects and benefits of functional training and physical conditioning (Brown, 2012). According to the "optimum performance pyramid" proposed by Gray Cook, movement training should be based on the mobility and stability of the human body to form an effective movement pattern, with subsequent attention to physical capacity and performance, and finally the improvement of skills. Functional movement screening (FMS) is mainly used to evaluate the basis of the human movement pattern, which can effectively detect insufficient motor function and predict physical injury, providing a basis for the implementation of preventive strategies (Cook et al., 2014). At present, FMS has been widely used in sports groups of different ages as an objective measurement tool for discovering the defects of movement patterns. Previous studies have confirmed that defective basic movement patterns (measured by FMS) can predict the probability of injury in sports including basketball (Bond et al., 2019), football (Kiesel et al., 2007), volleyball (Aka et al., 2019), jiu-jitsu (Del Vecchio et al., 2016), and wushu (Ghafouri et al., 2020). In addition, studies have demonstrated the effectiveness of basic movement pattern improvement plans through intervention studies (Bodden et al., 2015; Skotnicka et al., 2017; Maia Pacheco et al., 2013). However, few studies have focused on the impact of exercise activities themselves on basic movement patterns (Cowen, 2010; Gustafson et al., 2021; Zhang et al., 2025). Previous research has predominantly concentrated on athletes and students in general physical education (PE) classes (Qiu et al., 2025), mainly investigating their health-related fitness (Liu et al., 2023),

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self-efficacy (Qiu et al., 2025), and overall well-being (Nie et al., 2025; Ma et al., 2025; Gao et al., 2025; Nie et al., 2025). In contrast, studies concerning the fundamental movement patterns of children participating in school sports clubs are notably insufficient.

Compared to the number of athletes in schools, the group of students participating in school sports club activities is larger. In most primary schools in China, students usually have sports club activities after school. The school's sports club activities are an important source of physical activity for students. Among these sports clubs, basketball, aerobics, athletics, cheerleading, and jump rope clubs are very common. Exploring the correlation between the training of these sports clubs and the development of student movement patterns will help improve the practical implementation of school sports clubs, and has important value for the improvement of school physical education teaching theory.

This study conducted FMS on primary school students in five different sports clubs and some non-sports clubs to determine the differences in movement patterns among the students and the correction of different sports-associated training and the development of movement patterns, ultimately summarizing the promotion effects of different sports items on basic action modes of the sports-associated students and providing a reference for future teaching and training.

2. Methods

2.1 Participants

Students from sports clubs (n=101, 45 boys, 56 girls, mean age 11.2) and nonsports clubs (n=95,42 boys, 43 girls, mean age 11.4) within a primary school in Binhai New Area, Tianjin, were studied. The sports clubs included 5 programs: basketball, track and field, aerobics, rope skipping and cheerleading. Each sports club adopts a mixed curriculum for students from grade 4 to grade 5 and carries out 90-minute course training sessions once a week. Among the students of all associations, 83.4% studied for more than one semester. Non-sports club students were randomly selected from 4 ordinary classes in grade 4 and grade 5 that had not participated in sports club training. Institutional Review Board (IRB) approval was obtained from Beijing Normal University Ethical Advisory Committee. All participants in the study verbally agreed to the learning content and testing.

2.2 Functional movement screening

Functional movement screening of all study subjects was conducted at the end of the semester and included 7 tests: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability. Subjects were observed for restricted movement, asymmetry between joints, movement compensation and other problems – the goal being to judge the mobility and stability of the human joints and identify defects and deficiencies in the movement mode to be corrected through targeted training (Beardsley & Contreras, 2014).

In each movement test, the subject received 3 points when the movement was completed with high quality; 2 points when the action was completed but was not of high quality; 1 point when the subject could not complete the action or maintain the starting action; and 0 points when pain occurred during the test. The total test score possible was 21 points. Five of the movements (hurdle step, in-line lunge, shoulder mobility, active straight leg raise and rotary stability) required testing on both the left and right sides. When the left and right test scores were different, the lower value was taken as the final score result. Previous studies have determined that for the general sports population, a value of greater than 14 is associated with a lower sports injury risk (Kiesel et al., 2007), while for sports groups, 17 is usually classified as the injury risk threshold (Shojaedin et al., 2014). In addition, although a score may be higher than the injury risk threshold, left and right asymmetry will increase the possibility of injury (Kiesel et al., 2008).

2.3 Statistical analysis

Data were analyzed using SPSS 26.0 statistical software. The statistical significance level was set at

0.05. Descriptive statistics were conducted to describe FMS total and subitem scores, low score rates and asymmetry rates for students with and without sports club training. Independent sample t tests were used to test the total scores and subitem scores of students with and without sports club training; Brown–Forsythe ANOVA was used to determine differences in the FMS total scores and subitem scores of students from different associations.

3. Results

3.1 Comparison of functional movement screening between sports club students and nonassociation students

Comparing the total and subitem scores of the functional movement screening, we found that, with the exception of shoulder mobility, the average functional movement screening scores of student with sports club training were significantly higher than those of nonsports club students, as shown in Table 1.

Table 1 Independent sample t tests comparing functional movement screening scores of students with sports association training to those without

items	mean score of associations	mean score of nonassociations	p value (independent sample t test)
deep squat	2.64±0.48	1.98±0.71	0.000
hurdle step	2.65±0.50	1.84±0.55	0.000
in-line lunge	2.80±0.40	2.37±0.55	0.000
shoulder mobility	2.55±0.62	2.45±0.70	0.283
active straight leg raise	2.69±0.46	2.38±0.59	0.000
trunk stability push-up	2.12±0.52	1.92±0.65	0.016
rotary stability	2.17±0.47	1.86±0.63	0.000
total score	17.63±1.70	14.8±2.39	0.000

The percentages of students from each group who scored below the injury thresholds were also determined (Table 2): the low score rate of students of sports club training was lower than that of nonassociation students when using either 17 or 14 as the threshold. Using the ≤17 score cutoff, 86.3% of non-sports-associated students scored low, compared to 46.5% of those with sports club training, among which, cheerleading students had the least occurrence of low scores (28.6%) and basketball students had the most (87.5%). Only 4 students with sports club training scored ≤14: 3 with basketball associations and 1 in a rope-skipping association.

Table 2 Descriptive statistics of low FMS score rates of student groups

items	number of participants	Low score rate (≤17)	number of participants	Low score rate (≤14)	number of participants
track and field	23	34.8%	8	0%	0
basketball	16	87.5%	14	18.8%	3
aerobics	21	52.4%	11	0%	0
rope skipping	20	40%	8	5%	1
sports dance	21	28.6%	6	0%	0
Summary of associations	101	46.5%	47	4%	4
Summary of nonassociations	95	86.3%	82	46.3%	44

The rate of functional movement screening asymmetry among the students in sports clubs and nonsports clubs (Table 3) showed that the overall asymmetry rate of the students in nonsports clubs was higher than that of the students in sports clubs. Of the measured asymmetries, shoulder mobility asymmetry was the most common in both sports and nonsports club students. Within the single sports clubs, asymmetry rates were most prominent in shoulder mobility and rotation stability of track-and-field association students, shoulder mobility and active straight knee lift of basketball association students, hurdle step and rotation stability of aerobics association students, in-line lunge of jump rope association students, and shoulder mobility and rotation stability of cheerleading association students.

Table 3 Descriptive statistics of asymmetry rates from student FMS

	track and field (n)	basketball (n)	aerobics (n)	rope skipping (n)	sports dance (n)	asymmetry rate of associations (n)	asymmetry rate of nonassociations (n)
hurdle step	8.7%(2)	12.5%(2)	33.3%(7)	20%(4)	4.8%(1)	15.8%(16)	24.2%(23)
in-line lunge	13%(3)	12.5%(2)	9.5%(2)	30%(6)	9.5%(2)	14.9%(15)	28.4%(27)
shoulder mobility	17.4%(4)	37.5%(6)	14.3%(3)	20%(4)	23.8%(5)	21.8%(22)	33.7%(32)
active straight leg raise	8.7%(2)	43.8%(7)	14.3%(3)	15%(3)	0%(0)	14.9%(15)	15.8%(15)
rotary stability	17.4%(4)	12.5%(2)	19%(4)	15%(3)	19%(4)	16.8%(17)	34.7%(33)

**n represents number of participants.*

3.2 Functional movement screening and comparison among different sports clubs

Brown–Forsythe ANOVA of functional movement screening scores between the different sport associations showed significant differences in total score, active straight leg raise and rotary stability subscores. In terms of the mean scores, the highest to lowest scoring associations were cheerleading, track and field, aerobics, rope skipping and basketball. In the active straight leg raise score, cheerleading, aerobics, rope-skipping, track-and-field and basketball scores decreased in turn. In the rotary stability analysis, the scores from high to low were cheerleading, aerobics, track and field, rope skipping and basketball. Deep squat, hurdle step, in-line lunge, shoulder mobility, and trunk stability push-up did not differ significantly among the different sports clubs.

Table 4 Functional movement screening scores and group differences among sports associations

	track and field	basketball	aerobics	rope skipping	sports dance	Differences between groups (Brown–Forsythe)
deep squat	2.65±0.49	2.50±0.52	2.62±0.50	2.60±0.50	2.81±0.40	0.397
hurdle step	2.74±0.45	2.63±0.50	2.52±0.51	2.60±0.60	2.76±0.44	0.510
in-line lunge	2.78±0.42	2.75±0.45	2.90±0.30	2.65±0.49	2.90±0.30	0.212
shoulder mobility	2.61±0.58	2.5±0.52	2.43±0.75	2.75±0.44	2.48±0.75	0.482
active straight leg raise	2.70±0.47	2.13±0.34	2.86±0.36	2.75±0.44	2.90±0.30	0.000
trunk stability push-up	2.35±0.57	1.94±0.44	2.10±0.30	2.15±0.67	2.00±0.45	0.097
rotary stability	2.13±0.34	1.87±0.62	2.29±0.46	2.10±0.31	2.38±0.50	0.018
total score	17.96±1.43	16.31±1.66	17.71±1.49	17.60±2.11	18.24±1.34	0.010

4. Discussion

In this study, functional movement screening of sports club and nonsports club students found that the total FMS score of students involved with sports clubs was significantly better than that of students without. Previous studies have reported similar conclusions. Pollen et al. (2021) found that athletes scored better in FMS than did ordinary college students and high school students (Pollen et al., 2021). Moreover, when comparing the low FMS score rates of students in different sports clubs, it was found that the results differed depending on the segmentation point used. Using 17 as the segmentation point, the low scores of the aerobics and basketball students accounted for more than half, and the overall low score rate reached 46.5%. Using 14 as the segmentation point, cheerleading, aerobics and track and field associations had no low-scoring students, and basketball and rope skipping had 3 and 1 low scores, respectively. Shojaedin et al. (2014) found that if athletes scored lower than 17 points at screening, the chance of having a lower limb injury was approximately 4.7 times higher than those with 17 points (Shojaedin et al., 2014). Kiesel et al. (2007) showed that athletes with scores below or equal to 14 had 11.7 times higher odds of severe injury than those with scores greater than 14 (Kiesel et al., 2007). Gray Cook (2011) suggests that athletes with scores below 14 discontinue special sports skills training and instead emphasize the strengthening of physical function and rehabilitation training, which can not only relieve the pain but also reduce the incidence of sports injury (Brown, 2012). Although a higher functional movement screening score does not represent a higher level of exercise or better exercise potential, under the same training or competition conditions, a higher functional movement screening score is related to a lower probability of injury. From this point of view, it is of important value to take the results of students' functional movement screening as a reference for student selection in associations. Compared to ordinary physical education courses, the course content of sports clubs is highly targeted, with a large sports load and longer class time. Aggressive physical training cannot change fundamental mobility and stability problems at an effective rate without also introducing a degree of compensation and increased risk of injury. It is suggested that functional movements should be screened in the selection of students in sports clubs. Only the students who meet the selection needs of the sports club can participate in the training, which can provide support for the safety and efficiency of sports club training. In addition, the process of club

training should also be improved based on the score of the student's functional movement screen. In this study, most students in sports club training scored more than 14 points, but nearly half of them did not reach 17 points. Therefore, to reduce the occurrence of sports injury, sports clubs students should increase functional movement mode practice along with sport-specific skills.

FMS also detected differences in the bilateral asymmetry rate between students of different sports clubs. Students in cheerleading associations have a high asymmetry rate in shoulder mobility and in-line lunge, those in aerobics associations have highest asymmetry in hurdle step, and those in basketball associations have highest asymmetry in shoulder mobility and active straight leg raise. Kiesel et al. (2008) suggested that certain physiological asymmetries can be considered normal or even desirable (Kiesel et al., 2008). However, if the muscle strength difference between the left and right sides of the body is greater than 10 to 15%, this imbalance will have a greater impact on the occurrence of injury (Gibson et al., 2018). Most sports have the phenomenon of a dominant unilateral limb. Without resetting our movement system, we can compound the negative effects of hard training and competition without being aware of a decline in movement-pattern quality (Brown, 2012). The imbalance of muscle and the change of movement pattern will increase the occurrence of compensation with the increase of exercise years, thus forming chronic tension injury. This development of physical asymmetry explains the disadvantages of premature movement specialization. Therefore, in the development process of adolescent sports skills, it is particularly important to pay attention to the development of basic movement patterns and to improve physical stability and mobility.

Students with different sports clubs also significantly differ in total FMS scores, with cheerleading, track and field, aerobics, rope skipping and basketball decreasing in turn. Different sports also have certain advantages and disadvantages; for example, cheerleading and aerobics students are better than other sports club students in in-line lunge, active straight leg raise and rotation stability, while their shoulder mobility and push-up scores are relatively poor. The advantage may be due to the large content of leg mobility and body rotation exercises associated with cheerleading and aerobics. The disadvantage may be that cheerleading and aerobics association participants are both girls, and girls have weak upper limb strength in primary school; as they are still developing functional stability, mobility will be limited (Brown, 2012). Track-and-field and rope-skipping associations are relatively balanced as a whole, but students of rope-skipping associations are better than other associations in shoulder mobility, and students of track-and-field associations have great advantages in hurdle steps and push-ups. This should be the result of the requirements and influence of mobility in the rope-skipping movement as well as the strengthening of knee-lifting ability and core stability in track and field. Students in basketball associations scored lower than other associations. In previous studies, similar conclusions were drawn. Xia et al. (2007) found that the total FMS score of basketball team athletes was poor in different events, which was reflected in poor reaction support stability, core strength and stability, and increased compensatory actions (Xiao-fei & Feng, 2016). The functional movement differences presented by different sports projects should be improved and promoted in practical teaching.

5. Conclusion

In primary school students, the development of basic movement patterns is better in those participating in sports clubs than in those of nonsports clubs, and the students of nonsports clubs have increased frequency of low FMS scores and asymmetry rates. In addition, there are significant differences in the basic movement patterns of students in different sports clubs and different degrees of low scores and asymmetry rates. To avoid damage caused by improper basic movement patterns, follow-up research is warranted to explore scientific

and reasonable teaching and training programs and further study the intervention effects of different teaching content.

Conflict of interest

The authors declare that they have no conflicts of interest in this work.

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