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A Pilot Comparison of Physical and Functional Conditions in 8–9-Year-Old Children Practicing Basketball, Football, Gymnastics, or Dance

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Abstract

Background. Different sports affect children's physical development in various ways. As the growth spurt begins around age 10, early assessment of 8–9-year-olds is important for injury prevention and safe development. However, there is limited research examining this age group's physical and functional condition in relation to participation in specific sports.

Aim – to evaluate the physical and functional condition of 8–9-year-old children participating in different sports clubs.

Methods. The study involved 33 children aged 8–9 (both boys and girls), each attending only one sport (basketball, football, gymnastics, or dance) for at least one year. All participants were injury-free in the past six months and had signed parental consent forms. Physical condition was assessed using the Sit and Reach and Ely's tests, and functional condition with the Flamingo, Timed Up and Go, and 10 × 5 m shuttle run tests.

Results. Children in the gymnastics group showed significantly better flexibility compared to other groups ($p < 0.05$). No significant flexibility differences were found among football, basketball, and dance groups ($p > 0.05$). Normative Sit and Reach test performance was achieved by 100% of the gymnastics group, 66.7% basketball, 62.5% football, and 37.5% dance. No statistically significant differences between groups were found in static and dynamic balance ($p > 0.05$). Most participants demonstrated poor static balance. Moreover, no significant differences between groups were found in agility ($p > 0.05$); however, only two children, from the football and gymnastics clubs, met the standard for agility.

Conclusions. Gymnastics is linked to greater flexibility in 8–9-year-old children, while basketball and football may contribute to rectus femoris muscle shortening. Balance showed no sport-specific differences and was generally poor, and agility seldom reached health-favourable levels.

Keywords: functional condition; physical fitness; children; sports clubs

1. INTRODUCTION

Childhood is a crucial period for developing various physical qualities, including flexibility, balance, coordination, and agility (Branković et al., 2023). Physical development in children is closely linked to regular participation in sports activities, which help shape motor skills and improve overall physical fitness (Song & Shi, 2023). Around the ages of 8–9, children typically begin participating in specific sports clubs that emphasise distinct physical characteristics (Pereira et al., 2021). For example,

gymnastics is known to enhance flexibility (Russo et al., 2021), while football and basketball are associated with improvements in speed, strength, and agility (Ari & Çolakoğlu, 2017; Cengizel et al., 2020). Despite these benefits, studies also suggest that some physical qualities may remain underdeveloped depending on the sport. For instance, reduced flexibility or shortened muscle length has been observed among young football and basketball players due to limited stretching practices (Aedo-Muñoz et al., 2019; Barkus & Šilinė, 2023). Moreover, balance ability – both static and dynamic – is often insufficient even in physically active children (Yu et al., 2025), highlighting the need for early functional assessment to prevent injury and ensure safe motor development.

Agility, another important component of physical fitness, can be developed through structured training programmes in various sports, such as football, gymnastics, or dance (Alhenawy, 2020; Ljubojevic et al., 2020). However, evidence indicates that performance improvements may vary depending on sport-specific content and training frequency (Chang & Lu, 2020; Jiang et al., 2021).

In Lithuania, the importance of monitoring physical fitness in school-age children is emphasised by national regulations that define evaluation criteria based on age and gender (Lietuvos Respublikos sveikatos apsaugos ministerija, 2019). Standardised tests such as the Sit and Reach test for flexibility or the 10 × 5 m shuttle run for agility are commonly used in national practice (Muliarčikas et al., 2007).

Different sports affect children's physical development in various ways (Ari & Çolakoğlu, 2017; Chang & Lu, 2020; Russo et al., 2021). As the growth spurt begins around age 10, early assessment of 8–9-year-olds is important for injury prevention and safe development (Hermassi et al., 2024; Pereira et al., 2021). However, there is limited research examining this age group's physical and functional condition in relation to participation in specific sports (Barkus & Šilinė, 2023; Jiang et al., 2021).

Although multiple studies explore isolated physical aspects across different sports, there remains a lack of comprehensive research comparing functional and physical performance indicators – such as flexibility, muscle length, balance, and agility – among 8–9-year-old children practicing different sports. Therefore, this study aims to evaluate and compare the physical and functional condition of children attending basketball, football, gymnastics, or dance clubs, thereby contributing to a better understanding of how different sports influence child development.

2. METHODS

This study included 33 children aged 8–9 years (19 boys and 14 girls) who had been participating in a single sport – basketball, football, gymnastics, or dance – for at least 12 months. All participants were injury-free for the past six months and had signed informed parental consent. The participants' mean age was 8.9 ± 0.2 years, with a mean height of 140.6 ± 6.9 cm and weight of 33.7 ± 6.5 kg. Among them, 18.2% wore corrective glasses. Based on their chosen sport, participants were divided into four groups: basketball, football, gymnastics, and dance. Demographic data are presented in Table 1.

Ethical approval for the study was obtained from the Local Bioethics Committee (Nr-1/24/25). Participation in the study was voluntary and conducted in accordance with the principles of the Declaration of Helsinki.

Table 1. **Participant characteristics by sport group**

Variable	Basketball (n = 9)	Football (n = 8)	Gymnastics (n = 8)	Dance (n = 8)	p-value
Gender (boys/girls)	9/0	8/0	0/8	2/6	–
Age (years)	9.0 ± 0.0	9.0 ± 0.0	8.8 ± 0.5	9.0 ± 0.0	$p > 0.05$

Variable	Basketball (n = 9)	Football (n = 8)	Gymnastics (n = 8)	Dance (n = 8)	p-value
Height (cm)	143.2 ± 6.4	143.5 ± 3.3	137.4 ± 4.2	138.1 ± 10.3	$p > 0.05$
Weight (kg)	37.6 ± 9.5*	34.8 ± 3.1	30.5 ± 5.3*	31.3 ± 3.5	$p < 0.05$
Wears glasses (yes/no)	1/8	1/7	2/6	2/6	–

Note: *$p < 0.05$, comparison between basketball and gymnastics groups.

The study was conducted in two phases. In the first phase, physical condition was assessed using the Sit and Reach and Ely's tests. On the following day, functional condition was evaluated using the Flamingo (balance), Timed Up and Go (dynamic balance), and 10 × 5 m shuttle run (agility) tests.

Questionnaire: A custom-made survey consisting of nine questions (three open-ended and six closed-ended) was completed by parents/guardians to gather demographic and health-related data.

Sit and Reach test: Assesses flexibility. The child sits on the floor, legs extended, and reaches forward on a measurement box. The better of two barefoot attempts is recorded in centimetres. Evaluation: Boys <11.6 cm – poor, 11.6–25.7 cm – satisfactory, >25.7 cm – good; Girls <12.7 cm – poor, 12.7–27.3 cm – satisfactory, >27.3 cm – good (Muliarčikas et al., 2007).

Ely's test: Assesses rectus femoris flexibility. The child lies prone while the tester passively bends the knee. A positive result is noted if the heel cannot touch the buttocks or if the pelvis lifts (Kodesho et al., 2021).

Flamingo test: Evaluates static balance. The child stands on one foot with hands on hips and balances on the toes. Time is recorded until balance is lost. Three trials per leg; average is used. Rating: <10 s – very poor, 10–24 s – poor, 25–39 s – moderate, 40–50 s – excellent (Rahman et al., 2017).

Timed Up and Go test: Measures dynamic balance. The child stands up from a chair, walks 3 m, turns, and returns to sit. Time is recorded over three trials; the average is used. Norm: ≤10 s (Tajane et al., 2025).

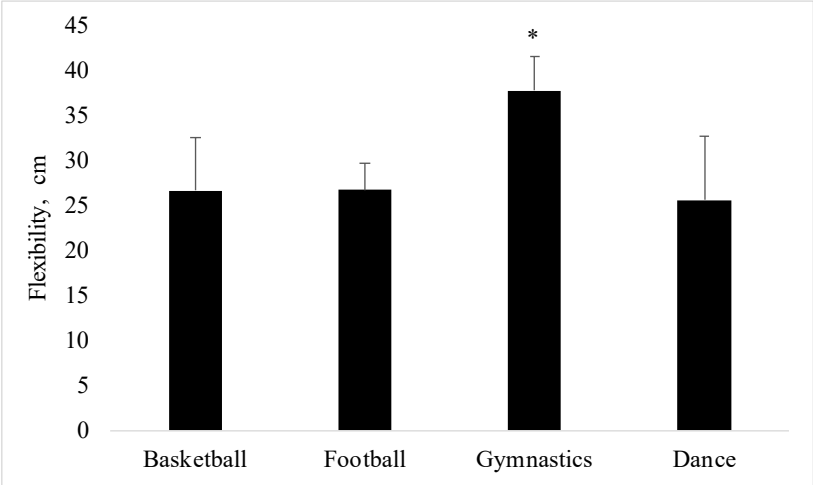
10 × 5 m shuttle run test: Assesses agility. The child runs back and forth between two 5-meter lines five times (total 50 m). Performance is recorded in seconds. The results were interpreted based on national physical fitness norms, which differ by age and gender. For 8-year-old boys, a result of ≥24.12 s indicated the health risk zone, 24.11–20.51 s represented the improvement zone, and ≤20.50 s was considered the health-promoting physical fitness zone. For 8-year-old girls, the corresponding values were ≥25.00 s (risk), 24.99–21.63 s (improvement), and ≤21.62 s (health-promoting). For 9-year-old boys, the thresholds were ≥22.00 s (risk), 21.99–19.63 s (improvement), and ≤19.62 s (health-promoting). For 9-year-old girls, the limits were ≥23.13 s, 23.12–20.08 s, and ≤20.07 s, respectively.

Data were analysed using IBM SPSS Statistics version 17.0. Tables and graphs were created using Microsoft Excel 2016. Results are presented as mean ± standard deviation or percentages. Normality was tested using the Kolmogorov–Smirnov test. One-way ANOVA was applied for between-group comparisons, and Tukey HSD post hoc analysis was used when appropriate. Statistical significance was set at $p < 0.05$.

3. RESULTS

Flexibility in 8–9-year-old children participating in different sports clubs was assessed using the Sit and Reach test. The mean flexibility scores were as follows: basketball – 26.7 ± 5.9 cm, football – 26.8 ± 2.9 cm, gymnastics – 37.9 ± 3.7 cm, and dance – 25.7 ± 7.1 cm. Statistical analysis revealed that children in the gymnastics group had significantly greater flexibility compared to those in the football,

basketball, and dance groups ($p < 0.05$). No significant differences were observed among the football, basketball, and dance groups ($p > 0.05$) (Fig. 1).



Note: *$p < 0.05$ compared to the gymnastics group.

Figure 1. **Flexibility assessment results**

To assess rectus femoris muscle length, Ely's test was used. Shortened rectus femoris was identified in three participants (two from the basketball group and one from the football group) while the rest showed normal results.

Static balance was assessed using the Flamingo test, measuring standing time in seconds. Most participants had poor or very poor balance. In the basketball group, 89% showed very poor static balance on the right leg and 78% on the left. In the football group, very poor balance was found in 75% (right) and 100% (left); gymnastics – 87.5% (right); dance – 75% on both sides. Basketball participants balanced on the right leg for 6.3 ± 4.4 s and on the left for 5.6 ± 3.5 s; football participants – 8.0 ± 2.3 s (right) and 6.4 ± 2.0 s (left); gymnastics group – 7.0 ± 1.4 s (right) and 6.6 ± 3.1 s (left); dance group – 8.2 ± 5.5 s (right) and 8.4 ± 5.6 s (left). No significant differences in static balance were found between groups ($p > 0.05$) (Fig. 2).

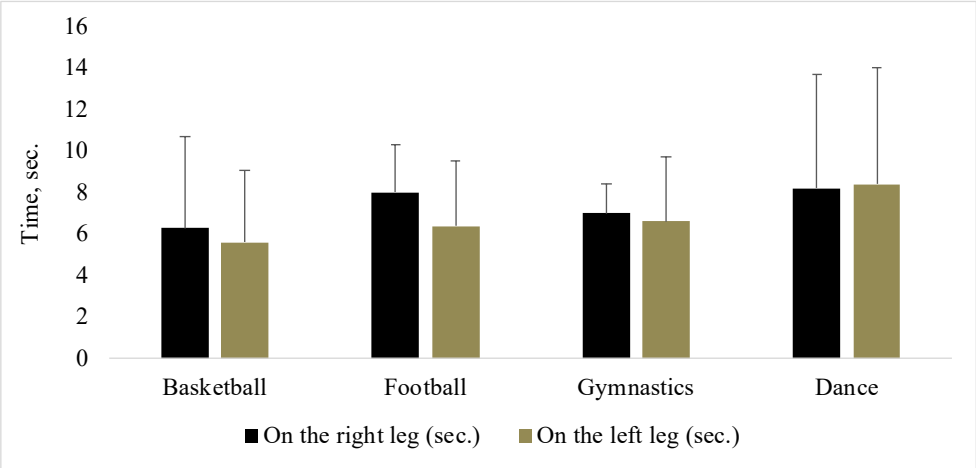


Figure 2. **Static balance assessment results**

Dynamic balance was assessed using the Timed Up and Go test. The mean time for basketball participants was 7.07 ± 1.08 s, football – 6.93 ± 1.09 s, gymnastics – 6.87 ± 0.6 s, and dance – 6.7 ± 0.58 s. No statistically significant differences were found between groups ($p > 0.05$) (Fig. 3).

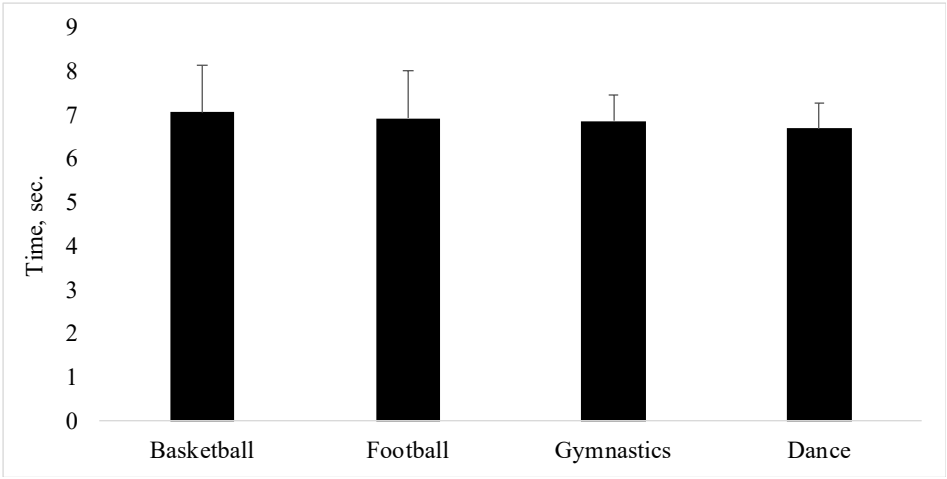


Figure 3. **Dynamic balance assessment results**

Agility was assessed using the 10 × 5 m shuttle run test. Only 6% of participants reached the health-favourable physical performance zone: one from the football group and one from gymnastics. In the improvement zone were 78% of basketball players, 62.5% of football and gymnastics participants, and 75% of dancers. The health risk zone included 22% from basketball and 25% each from football, gymnastics, and dance groups. Mean times were: basketball – 21.1 ± 0.9 s, football – 21.1 ± 1.1 s, gymnastics – 22.0 ± 1.6 s, and dance – 22.5 ± 2.9 s. Differences were not statistically significant ($p > 0.05$) (Fig. 4).

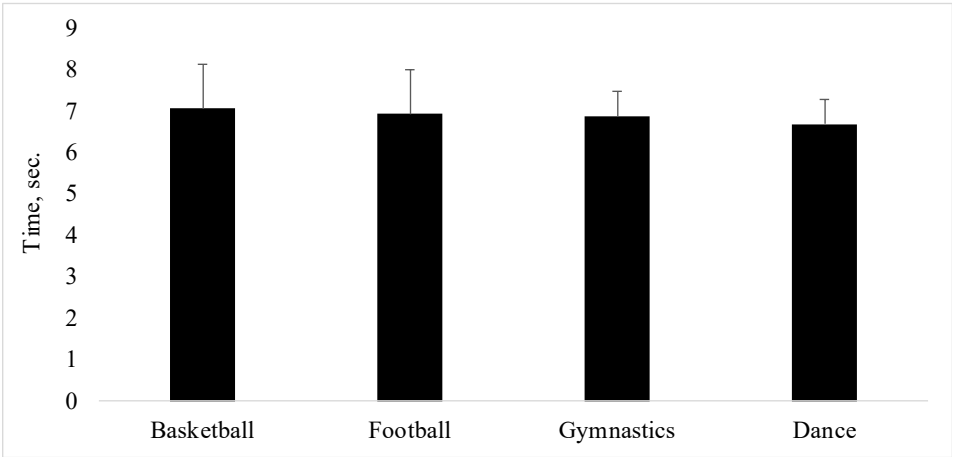


Figure 4. **Agility assessment results**

4. DISCUSSION

The present study aimed to evaluate the functional and physical condition of 8–9-year-old children involved in different sports activities, focusing on flexibility, muscle length, balance, and agility. The main findings of the study were that gymnastics participation was specifically associated with superior flexibility, while children across all sports demonstrated generally poor balance and insufficient agility levels.

The results showed that children attending gymnastics had significantly greater flexibility compared to those in basketball, football, and dance groups. This finding is consistent with previous studies indicating that gymnastics training enhances flexibility due to its strong emphasis on stretching exercises (Russo et al., 2021). For instance, Ömer et al. (2024) found that children (6.2 ± 1.1 years) in gymnastics achieved a mean Sit and Reach score of 26.04 ± 10.51 cm, with 100% meeting the test norm. Similarly, Soomro et al. (2024) also reported greater flexibility in gymnasts compared to children in football or basketball. These studies highlight that stretching and flexibility-focused exercises are central in gymnastics but are less emphasised in other sports.

In our study, no significant flexibility differences were found between football, basketball, and dance groups. This suggests that these sports prioritise muscle strength, speed, and coordination more than flexibility. Usgu et al. (2020) and Ari and Çolakoğlu (2017) confirm that basketball and football typically lack flexibility training components. However, Warneke et al. (2023) emphasised that dancers, like gymnasts, often exhibit high flexibility – though this was not observed in our study, possibly due to the relatively short minimum training duration among participants.

Analysis of rectus femoris muscle length showed that three children had shortened muscles – two from basketball and one from football group. All others showed normal length. This aligns with studies by Barkus and Šilinė (2023) and Theodorou et al. (2023), which indicated that sports requiring explosive movements, such as basketball and football, often contribute to muscle shortening due to inadequate stretching. For example, Barkus and Šilinė (2023) found shortened rectus femoris in 60% of boys and 40% of girls in basketball training. These findings support the idea that sports focused on strength and speed – unlike gymnastics – may increase the risk of muscle tightness (Aedo-Muñoz et al., 2019). Furthermore, the rectus femoris, crossing both the hip and knee joints, is biomechanically predisposed to injury because high eccentric loading during sprinting, jumping, or kicking increases strain when the muscle is shortened. In adolescents, this tension may result in apophyseal avulsion injuries of the anterior inferior iliac spine, a well-recognised complication during growth (Cerezal et al., 2025). In addition, rectus femoris tightness increases patellofemoral joint stress by altering quadriceps force distribution, which may contribute to anterior knee pain and overuse syndromes such as patellofemoral pain syndrome or Osgood–Schlatter disease (Babler et al., 2025). Together, these mechanisms suggest that inadequate flexibility in sports emphasising explosive power not only predisposes to hip injuries but may also play a role in the development of knee pain in young athletes.

Results of the static balance test (Flamingo test) revealed no significant differences among groups, but most children demonstrated poor or very poor balance. Similar trends were reported by Yu et al. (2025) and Kabasakal et al. (2024), who found that many physically active children lack adequate balance if it is not explicitly trained. Even in the gymnastics group, which showed relatively better results, static balance remained suboptimal, suggesting that at this age, balance skills are still developing. Azevedo et al. (2022) similarly reported that girls demonstrated better balance than boys and that balance performance improved modestly with age. These results support the notion that static balance is driven more by neuromotor maturation and sensory integration. Conner et al. (2019) further showed that static balance performance does not significantly improve between ages 5 and 12, whereas dynamic balance does, highlighting that static balance lags due to the differential maturation of sensorimotor systems. Taken together, these data suggest that the predominance of poor static balance in this age group reflect ongoing sensorimotor development and point to the importance of early and targeted balance training that addresses neuromuscular integration.

In the Timed Up and Go test for dynamic balance, no significant differences between groups were observed, and all children met the test norm. This could be due to all participants being involved in sports activities, which typically include rapid and coordinated movements beneficial to dynamic

balance. Tajane et al. (2025) support this, reporting that children in sports performed significantly better than their non-active peers in dynamic balance assessments. However, Sheth et al. (2021) found that even children not participating in sports could perform well in this test. This raises concerns about the sensitivity of the Timed Up and Go test in healthy children.

Agility measures did not significantly differ between groups, indicating that all evaluated sports contributed similarly to agility development. This is consistent with findings by Alhenawy (2020), Cengizel et al. (2020), and Ljubojevic et al. (2020), who noted that sports such as basketball, football, dance, and gymnastics all effectively develop agility through rapid movements and coordination. However, most children in our study only reached the 'improvement' zone, and very few achieved health-favourable fitness levels. This suggests that agility development may still be insufficient, regardless of the sport practiced. While sport participation positively affects children's physical fitness, areas such as flexibility, balance, and agility may still be underdeveloped and potentially increase the risk of injury.

5. CONCLUSIONS AND PERSPECTIVES

Gymnastics is linked to greater flexibility in 8–9-year-old children, while basketball and football may contribute to rectus femoris muscle shortening. Balance showed no sport-specific differences and was generally poor, and agility seldom reached health-favourable levels.

Future studies should include larger samples of children with standardised training frequency and duration. More sensitive tests should be used, especially for dynamic balance, and additional muscle groups should be included in muscle length assessments.

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Conflicts of Interest: The authors declare no conflict of interest.

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8–9 metų vaikų, lankančių krepšinio, futbolo, gimnastikos ar šokių būrelius, fizinės ir funkcinės būklės palyginimas: pilotinis tyrimas

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Santrauka

Tyrimo pagrindimas. Įvairios sporto šakos skirtingai veikia vaikų vystymąsi. Kadangi augimo šuolis prasideda apie dešimtuosius metus, 8–9 metų vaikų fizinės ir funkcinės būklės vertinimas ypač svarbus siekiant sumažinti traumų riziką. Vis dėlto trūksta tyrimų, nagrinėjančių ryšį tarp praktikuojamų sporto šakų ir šios amžiaus grupės vaikų fizinės ir funkcinės būklės.

Tikslas. Įvertinti 8–9 metų vaikų, lankančių skirtingus sporto būrelius, fizinę ir funkcinę būklę.

Metodai. Tyrime dalyvavo 33 vaikai (mergaitės ir berniukai, amžius 8–9 metai), lankantys tik vieną sporto būrelį (krepšinį, futbolą, gimnastiką arba šokius) ne trumpiau kaip vienus metus. Visi dalyviai per pastaruosius šešis mėnesius nebuvo patyrę traumų, buvo gauti tėvų sutikimai dalyvauti tyrime. Fizinė būklė vertinta „Sėstis ir siekti“ bei „Ely“ testais, funkcinė – „Flamingo“, „Stotis ir eiti“ bei 10 × 5 m bėgimo šaudykle testais.

Rezultatai. Geriausias lankstumas buvo vaikų, lankančių gimnastikos būrelį ($p < 0,05$). Krepšinio, futbolo ir šokių būrelių vaikų lankstumas tarp grupių nesiskyrė ($p > 0,05$). Testo „Sėstis ir siekti“ normatyvą pasiekė visi gimnastikos grupės vaikai (100 proc.), o krepšinio grupėje – 66,7 proc., futbolo – 62,5 proc., šokių – 37,5 proc. vaikų. Statinės ir dinaminės pusiausvyros rezultatai tarp vertintų sporto būrelių nesiskyrė ($p > 0,05$). Visų vertintų vaikų statinė pusiausvyra buvo labai prasta arba prasta. Vikrumo rezultatai tarp vertintų sporto būrelių vaikų nesiskyrė ($p > 0,05$), tačiau tik dviejų vaikų, iš futbolo ir gimnastikos būrelių, vikrumas atitiko normą.

Išvados. Gimnastika siejama su didesniu 8–9 metų vaikų lankstumu, o krepšinis ir futbolas galimai lemia tiesiojo šlaunies raumens sutrumpėjimą. Pusiausvyros ir vikrumo rodikliai nepriklausė nuo sporto šakos ir dažniausiai neatitiko normatyvų.

Reikšminiai žodžiai: funkcinė būklė; fizinis pajėgumas; vaikai; sporto būreliai

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