RECREATIONAL GYMNASTICS IMPROVES HEALTH-RELATED PHYSICAL FITNESS IN PRIMARY SCHOOL CHILDREN

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ABSTRACT
Given the widespread participation of primary school children in recreational gymnastics globally, it's vital to gain a deep understanding of how this recreational activity benefits their health-related physical fitness. The aim of this study was to assess the health-related physical fitness of 6–11-year-old children and estimate the positive outcomes of recreational gymnastics practice in primary school age. The study included 43 primary school children engaged in recreational gymnastics who were practising for at least 1 year, with an average of 1 to 2 hours per week. Height and weight were measured, and BMI was calculated. Body fat percentage (%Body fat) was calculated and assessed by using Tanita BF-689 Children's Body Fat Monitor. Standing long jump and handgrip strength tests were applied to assess upper and lower body strength. International normative values for children at the same age were used to calculate percentile scores for all tests. The average height, body mass, BMI, and %BF of the gymnasts were within the healthy norms, with only 3 children assessed as 'overweight' and none as 'obese'. The results showed that primary school children engaged in recreational gymnastics, even for only 1.5 hrs a week, had considerably better health-related fitness than their peers. These findings highlighted that practising recreational gymnastics as an activity, one to two times a week, had a positive impact on children's health-related physical fitness. In conclusion, recreational gymnastics classes contributed to improving and sustaining a normal health status.

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Cite this article as:
Kolimechkov, S., Monacis, D. (2025). Recreational gymnastics improves health-related physical fitness in primary school children. *Proceeding book of the 4th International Scientific Congress "Applied Sports Sciences", 2025, Sofia.* pp. 212 - 219.
https://doi.org/10.37393/ICASS2025/33

Keywords: *general gymnastics, health, sport, physical activity*

INTRODUCTION

In an era characterized by increasing concerns over childhood inactivity and rising rates of non-communicable diseases, promoting regular physical activity in young populations is paramount for fostering lifelong health. Recreational sports offer a valuable avenue for children to engage in physical activity, develop fundamental movement skills, and cultivate positive attitudes towards exercise. Among these, gymnastics stands out as a globally popular activity, attracting millions of primary school-aged children. While competitive artistic gymnastics often emphasizes high-level performance and specialized training, recreational gymnastics typically focuses on participation, fundamental skill development, and general physical literacy within a less intensive environment.

Recreational gymnastics, distinct from competitive artistic gymnastics, offers a non-competitive pathway for children and adolescents to engage with the sport's fundamental elements. Unlike the rigorous training and specialized skill acquisition demanded by competitive programmes, recreational gymnastics focuses on promoting general physical fitness, motor skill development, coordination, flexibility, and strength in a fun and inclusive environment. Participants typically engage in a variety of activities encompassing elements from artistic gymnastics, such as basic tumbling, conditioning exercises, and introductory apparatus work on floor, beam, vault, and bars (Readhead et al., 2006), without the pressure of performance-based assessment. This approach emphasizes participation, enjoyment, and the development of a broad range of physical attributes, making it an accessible and beneficial activity for a diverse group of young individuals.

Understanding the health-related benefits derived from such widespread recreational participation is therefore crucial. Health-related physical fitness has a multidimensional structure, and it is recognized as a cornerstone of children's overall health and well-being. It encompasses key components such as body composition, musculoskeletal fitness (including strength and flexibility), motor fitness (e.g., speed, agility, coordination), and cardiorespiratory fitness (Artero et al., 2011; Kiuchukov et al., 2019; Kolimechkov, 2017; Kolimechkov et al., 2021; Ruiz et al., 2009; Ruiz et al., 2010). Evidence from both cross-sectional and longitudinal studies consistently demonstrates the significant role of health-related physical fitness as a major determinant of positive health outcomes in childhood (Ruiz et al., 2006; Ruiz et al., 2010). To accurately assess and monitor these vital biomarkers of health and fitness in young populations, various standardized, field-based test batteries have been developed and widely applied, such as the Alpha-fit test battery, recognized for its validity, reliability, and safety (Castro-Pinero et al., 2009; Cvejic et al., 2013; Espana-Romero et al., 2010; Kolimechkov, 2017; Ruiz et al., 2010; Santos & Mota, 2011).

Gymnastics, rooted in ancient practices and formalized into a modern sport, is distinctive in its comprehensive approach to physical development. Unlike many single-sport activities that might specialize in one or two fitness components, gymnastics inherently demands the integration of strength, flexibility, balance, coordination, power, and agility to execute its diverse range of movements (Pajek et al., 2010). Even at a recreational level, participants engage in foundational elements like controlled landings, dynamic jumps, held balances, and complex sequences that simultaneously challenge multiple physiological systems (Busquets et al., 2021). This multifaceted training stimulus is particularly beneficial during childhood, a critical period for motor skill acquisition and physical development, laying a robust foundation for general physical competence and reducing the risk of injuries in other physical activities later in life.

Furthermore, the structured yet adaptable environment of recreational gymnastics classes fosters not only physical attributes but also important psycho-social skills such as discipline, perseverance, body awareness, and spatial orientation. These non-physical benefits, while not the primary focus of health-related physical fitness assessments, indirectly contribute to a child's overall well-being and engagement in physical activity (Baumgarten & Pagnano-Richardson, 2010; Busquets et al., 2021; Sands, 1999). Given its capacity to promote a wide array of physical fitness components through varied and engaging activities, recreational gymnastics presents a compelling case as an effective intervention for enhancing children's health-related physical fitness, even with relatively modest time commitments. However, despite its widespread practice, specific empirical evidence quantifying the magnitude of these benefits in primary school-aged children within a recreational context remains an area warranting further scientific investigation.

Therefore, the aim of this study was to assess the health-related physical fitness levels of primary school children engaged in recreational gymnastics and to evaluate the positive outcomes associated with participation in this activity during this critical developmental period.

METHODOLOGY

Participants

This study included 43 recreational gymnasts (17 males and 26 females) between the ages of six and eleven. They were primary school children participating in gymnastics classes between 1 and 2 times a week, with 1 to 3 years of sports experience in this activity. Participants represented different schools within the Royal Borough of Kensington and Chelsea in London, and they were engaged in gymnastics classes as their main sport at the Kensington & Chelsea Gymnastics Academy. An informed consent form was obtained from the parents/guardians of all participants prior to this study.

Health-related fitness assessment

The health-related physical fitness was assessed using the main tests (height, weight, BMI, % Body fat, handgrip strength, and standing long jump) from the ALPHA Fit Test Battery for Children (ALPHA, 2009). Height was measured to the nearest 0.1 cm using the Leicester Height Measure. Body mass and body fat were measured using the Tanita BF-689 Children's Body Fat Monitor. Anthropometric procedures for such measurements were strictly followed (NHNES, 2007; Piwoz & Viteri, 1985). Body mass index (BMI) was calculated as: body mass in kilograms/height in metres squared. Percentile scores for each gymnast's height, weight, and BMI were calculated and assessed by using the WHO AnthroPlus software (WHO, 2011). The following percentile scores (PRs) WHO cut-offs were applied to assess the BMI results: BMI > 85th PRs was classified as 'overweight'; BMI > 97th PRs was 'obese'; BMI < 15th PRs was 'thinness'; and BMI < 3rd PRs was 'severe thinness' (WHO, 2025a).

Body fat percentile scores were calculated by using international norms for children (McCarthy et al., 2006). The following cut-offs were applied: %Body fat > 85th PRs is classified as 'overweight'; %Body fat > 95th PRs is 'obese'; and %Body fat < 2nd PRs is ‘under fat’ (McCarthy et al., 2006).

Handgrip strength was measured to assess upper-body isometric strength by using the TKK digital hand dynamometer (TKK 5101 Grip-D, Takey, Tokyo, Japan). The elbow of the tested hand was fully extended as recommended for measuring children’s strength with this dynamometer (ALPHA, 2009; Kolimechkov et al., 2020). Equations for girls and boys between the ages of 6 and 12 were used to determine the optimal grip span for each child when using the TKK dynamometer (Espana-Romero et al., 2008).

The standing long jump test was used to assess lower-body explosive strength. The distance was measured from the line of take-off to the line of the back of the heel in landing (ALPHA, 2009). The test was performed on a non-slippery, hard surface, and the measurement was recorded to within 1 cm. Percentile scores based on interpolated international norms for children were calculated to assess the average handgrip strength and the standing long jump results (Kolimechkov et al., 2018).

Statistical Analyses

The statistical analyses were conducted using IBM SPSS Statistics 26 software, employing descriptive statistics. All data presented in the text are expressed as *mean* ± *SD*. Percentile scores were compared to the 50th percentile of international norms for children by using a one-sample *t*-test, and they were also compared to some fixed percentile values, such as 25th, 35th, 40th, 75th, 85th, and 90th, to support the results analysis. *Cohen’s d* effect size was calculated for the parameters with significant differences. To classify the effect size, the following cutoffs were used: d > 2.00 - huge, d > 1.20 - very large, d > 0.80 - large, d > 0.50 - medium, d > 0.20 - small, and d > 0.01 - very small (Cohen, 1988; Sawilowsky, 2009).

RESULTS

The health-related fitness parameters, their percentile scores, and effect size vs the 50th percentile (PRs) of the male recreational gymnasts are presented in Table 1. The males had an average sports experience of 2 years in recreational gymnastics (24.4 months ± 8.34) with 1 to 2 sessions per week. The average height, body mass, and BMI were within the healthy norms, with no significant difference from the 50th percentile of the WHO norms. The average %Body fat was also within the healthy norms, with no significant difference from the 50th percentile.

Table 1. *Health-related fitness parameters (mean ± SD) of the recreational male gymnasts, their percentile scores, and effect size vs the 50th percentile (PRs) from the international norms for boys at this age.*

		Male recreational gymnasts (n=17)	
Age (years)		**8.16** ± 1.33	
Sports experience (months)		**24.35** ± 8.34	
Sessions per week		**1.35** ± 0.49	
Height (cm)		**126.99** ± 7.60	
Height – percentile score		**43.26** ± 27.63	
	Effect size vs 50th PRs		NS
Weight (kg)		**26.44** ± 3.55	
Weight – percentile score		**55.06** ± 25.32i	
	Effect size vs 50th PRs		NS
BMI (kg/m^2)		**16.33** ± 0.88	
BMI – percentile score		**59.35** ± 21.62	
	Effect size vs 50th PR		NS
% Body fat		**17.11** ± 2.67	
% Body fat - percentile score		**51.89** ± 30.32	
	Effect size vs 50th PRs		NS
Handgrip strength test (kg)		**13.69** ± 3.42	
Handgrip strength test (percentile score)		**60.42** ± 23.40	
	Effect size vs 50th PRs		NS
Standing long jump (cm)		**150.84** ± 25.21	
Standing long jump (percentile score)		**86.96** ± 15.91	
	Effect size vs 50th PRs	**2.32*****	

Note: [i] n=15 because 2 out of 17 male gymnasts were older than age of 10 (WHO does not provide weight-for-age reference data for children older than 10 years of age).
**** – p < .001 vs 50th PRs; NS – not significant*

The individual results showed that 3 out of the 17 male gymnasts were classified as 'overweight' and none were 'obese' based on the BMI percentile score (>85th PRs). However, the individual %Body fat revealed that only 2 out of the 17 were 'overweight' based on their fat percentile score.

The average handgrip strength percentile scores did not differ significantly from the 50th percentile of the international norms for children at this age. The average standing long jump percentile scores were significantly greater than the 50th percentile of the norms, and the effect size was huge (d=2.32 for the male gymnasts). In fact, the male gymnasts scored significantly better than 75% of their peers (p < .01; d = 0.75) when the average score for the male group was compared to the 75th percentile of the norms. The individual results of the standing long jump showed that only 1 gymnast scored below the 50th PRs, and 14 out of the 17 scored above the 80th percentile.

The health-related fitness parameters, their percentile scores, and effect size vs the 50th percentile (PRs) of the female recreational gymnasts are presented in Table 2. The females had an average sports experience of nearly 2 years in recreational gymnastics (23.6 months ± 9.26) with 1 to 2 sessions per week. The average height, body mass and BMI were within the healthy norms, and the percentile scores for those parameters were significantly lower (with small to medium effect size) from the 50th percentile of the WHO norms (Table 2). The average %Body fat was also within the healthy norms, and significantly lower than the 50th percentile for children with a large *Cohen's d* effect size (p < .001; d = 1.05).

Table 2. *Health-related fitness parameters (mean ± SD) of the recreational female gymnasts, their percentile scores, and effect size vs the 50th percentile (PRs) from the international norms for girls at this age.*

		Female recreational gymnasts (n=26)
Age (years)		**8.78** ± 1.66
Sports experience (months)		**23.58** ± 9.26
Sessions per week		**1.27** ± 0.45
Height (cm)		**128.92** ± 11.71
Height – percentile score		**36.34** ± 30.39
	Effect size vs 50th PRs	**0.45***
Weight (kg)		**26.62** ± 7.33
Weight – percentile score		**35.78** ± 26.09[i]
	Effect size vs 50th PRs	**0.55***
BMI (kg/m2)		**15.73** ± 2.01
BMI – percentile score		**38.97** ± 26.84
	Effect size vs 50th PRs	**0.41***
% Body fat		**17.43** ± 4.30
% Body fat - percentile score		**21.91** ± 26.86
	Effect size vs 50th PRs	**1.05*****
Handgrip strength test (kg)		**11.75** ± 2.98
Handgrip strength test (percentile score)		**37.92** ± 23.49
	Effect size vs 50th PRs	**0.51***
Standing long jump (cm)		**136.27** ± 27.47
Standing long jump (percentile score)		**77.67** ± 23.42
	Effect size vs 50th PRs	**1.18*****

Notes: [i] n=16 because 10 out of 26 female gymnasts were older than age of 10 (WHO does not provide weight-for-age reference data for children older than 10 years of age).
** – p < .05 vs 50th PRs; *** – p < .001 vs 50th PRs*

The individual results showed that only 1 out of the 26 female gymnasts were classified as 'overweight' and none were 'obese' based on the BMI percentile score (>85th PRs). This was confirmed by the individual results from the %Body fat.

The average handgrip strength percentile scores were significantly lower than the 50th percentile of the international norms for females at this age (p < .05; d = 0.51). The average standing long jump percentile scores were significantly greater than the 50th percentile of the norms, with a large *Cohen's d* effect size (d =1.18) for the female gymnasts. Similarly to the male gymnasts, the female gymnasts scored significantly better than 65% of their peers (p < .01; d = 0.54) when the average score for the female group was compared to the 65th percentile of the norms. The individual results of the standing long jump showed that only 5 gymnasts scored below the 50th PRs, and 17 out of the 26 scored above the 80th percentile.

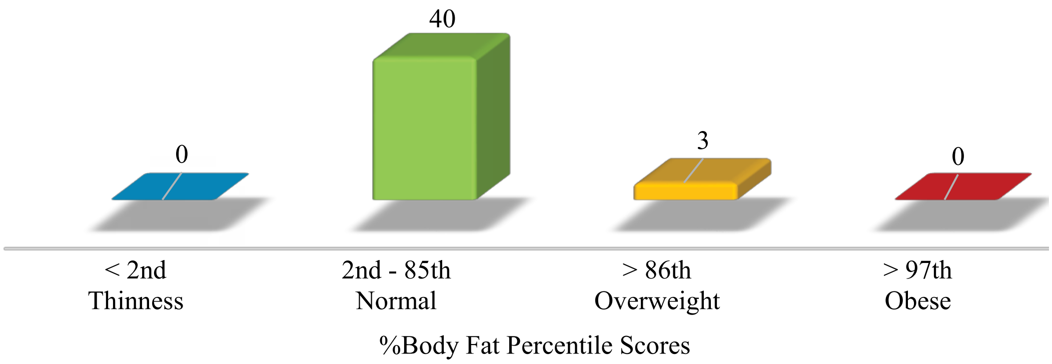

Figure 1. *Distribution of the %Body fat percentile scores in the recreational gymnasts (males and females together, n=43).*

The distribution of the %Body fat percentile scores of all gymnasts (males and females, *n*=43) is presented in Figure 1. The results showed that 40 out of the 43 recreational gymnasts had their body fat within the norms, three gymnasts were assessed as 'overweight', and none as 'obese' or 'thinness'.

DISCUSSION

The main findings showed that recreational gymnastics contributes to maintaining a normal body composition in childhood and thereby sustaining a normal health status. The average percentile scores for height, body mass, BMI, and %Body fat of the female gymnasts were significantly lower than the 50th percentile of the WHO norms for children at the same age and from the same gender (Table 2). Such lower mean values as the ones recorded in our female recreational gymnasts are expected to be seen in children engaged in artistic gymnastics (Benardot, 2014; Kiuchukov et al., 2019; Kolimechkov et al., 2021; Kolimechkov et al., 2016). While the observed lower body mass, BMI, and body fat percentages in gymnasts are considered highly beneficial when within healthy ranges, a potential reduction in height may raise concerns for parents and educators. Indeed, some studies, such as that by Benardot & Czerwinski (Benardot & Czerwinski, 1991), have reported a decrease in height-for-age percentiles among young female artistic gymnasts as they aged. However, it is important to clarify that this does not imply intensive gymnastics training inherently stunts growth. A comprehensive review by Malina et al. (Malina et al., 2013) concluded that intensive gymnastics training at a young age or during puberty does not compromise the adult height of either male or female artistic gymnasts. While gymnasts may be shorter and lighter on average, their training does not attenuate the growth of their upper or lower body segments (Malina et al., 2013). This unique characteristic of gymnastics allows it to provide competitive opportunities for smaller and lighter athletes, contrasting with many sports that favour larger physiques (Sands, 1999).

Overall, the WHO AnthroPlus software (WHO, 2011) was easy to use, and the calculated percentile scores provided an accurate assessment of the recreational gymnasts. It is important to note, however, that the World Health Organization (WHO) does not provide weight-for-age reference data for children beyond 10 years of age. This is because, during and after the pubertal growth spurt, this indicator cannot reliably differentiate between increases in height and body mass (WHO, 2025b) . Also, the percentile score for BMI failed to appropriately evaluate the body composition of one individual male gymnast with normal %Body fat. While BMI is a commonly used measure for assessing body composition (Flegal et al., 2006; Keys et al., 2014), its utility is limited for children who possess a higher muscle mass (Kolimechkov & Petrov, 2020; Kolimechkov et al., 2021; Kolimechkov et al., 2016). Consequently, for anthropometric analyses of gymnasts, it is more appropriate to primarily rely on body fat percentage (%Body fat) and strength-based parameters, such as relative upper arm muscle area and relative handgrip strength.

Our results indicated that participation in recreational gymnastics contributes to healthy body composition management (Figure 1). Furthermore, it helps maintain a normal health status for both genders involved in the sport. Specifically, the %Body fat of the recreational gymnasts from our study (17.1 ± 2.67% in males, Table 1, and 17.4 ± 4.30% in females, Table 2), was comparable to the 9% to 22% range found in Benardot's 2014 review of children and adolescents practicing gymnastics (Benardot, 2014).

Regarding upper-body strength, our recreational gymnasts demonstrated notable symmetry between their left and right handgrip strength, a finding particularly evident in female participants (11.6 ± 3.11 kg for the left hand vs. 11.9 ± 2.99 kg for the right hand, $p > .05$). This bilateral symmetry is consistent with observations from previous studies on children involved in artistic gymnastics (Kolimechkov et al., 2021; Kolimechkov et al., 2013). While the absolute handgrip strength in female recreational gymnasts was significantly lower than the 50th percentile from the norms (Table 2), this can be attributed to their generally lower body weight. Therefore, for a more accurate assessment of strength in this population, it is crucial to consider relative handgrip strength (strength per kilogram of body weight) rather than absolute values. Gymnasts, including the recreational participants in this study, typically exhibit smaller body sizes compared to international norms for their age and gender. Given that the primary workload in gymnastics involves overcoming the person's own body weight, relative strength parameters are arguably more appropriate for evaluating muscle mass and strength in children engaged in gymnastics. However, to date, standardized percentile norms for relative handgrip strength in children are not widely available in the literature, highlighting a critical area for future research.

Our results for lower-body explosive power, as measured by the standing long jump, showed significantly elevated scores in both male and female recreational gymnasts compared to international norms. Male gymnasts, for instance, exhibited a huge effect size ($d = 2.32$), performing significantly better than 75% of their peers. Similarly, female gymnasts demonstrated a large effect size ($d = 1.18$), with their average performance surpassing that of 65% of their age-matched peers. This pronounced advantage in jumping ability underscores the specific benefits of recreational gymnastics for developing lower-body power. The foundational elements of gymnastics, which include dynamic jumps and controlled landings on mainly floor and vault, inherently train the musculature and neuromuscular coordination required for explosive lower limb movements. These findings reinforce the idea that even regular, relatively low-volume engagement in recreational gymnastics can lead to substantial improvements in key health-related fitness components, particularly explosive leg power, crucial for overall physical competence and performance in various daily activities and sports.

CONCLUSION

This study provides compelling evidence that regular participation in recreational gymnastics significantly contributes to the maintenance of a healthy weight and overall normal health status in both boys and girls. Our anthropometric analysis revealed that recreational gymnasts, irrespective of sex, typically exhibit lower BMI and very low body fat percentages when compared to international norms for their age. Furthermore, our findings highlight distinct advantages in specific fitness components. While absolute handgrip strength might appear low in female recreational gymnasts due to their small body size, the emphasis on relative handgrip strength is crucial for accurate assessment, especially given that gymnastic training primarily involves managing one's own body weight. The observed bilateral symmetry in handgrip strength also underscores the balanced muscular development fostered by recreational gymnastics. Most notably, both male and female recreational gymnasts demonstrated superior lower-body explosive power, as indicated by significantly elevated standing long jump scores compared to age-matched international references.

In summary, recreational gymnastics emerges as a valuable activity promoting positive body composition and enhancing key physical fitness attributes, particularly explosive leg power and symmetrical upper body strength, in primary school children. These results underscore the potential of recreational gymnastics not only for fostering healthy growth and development but also for cultivating specific physical capacities that contribute to overall health and well-being. Future research should prioritize establishing percentile norms for relative strength parameters in children to facilitate more precise comparative analyses and individualized assessments.

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Design: Slavka Asenova, Svetla Kostova
Publisher: Scientific Publishing House NSA Press
ISBN (Online): 978-954-718-803-7