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Effects of Extracurricular Sports in Prepubertal and Pubertal Girls

María Luisa Martín-Sánchez ¹, Samuel Manzano-Carrasco ¹, Jorge López-Fernández ^{2,*},
Jorge García-Unanue ¹, Antonio Hernández-Martin ¹, María Jesús Marín-Farrona ¹, Enrique Colino ³,
Manuel León-Jiménez ¹, Carlos Majano ¹, Marcos Celada-Gómez ¹, Leonor Gallardo ¹,
Javier Sánchez-Sánchez ² and José Luis Felipe ²

- ¹ Faculty of Sport Sciences, University of Castilla-La Mancha, 45004 Toledo, Spain; marisanpablo Rojas@gmail.com (M.L.M.-S.); Samuel.Manzano@uclm.es (S.M.-C.); Jorge.GarciaUnanue@uclm.es (J.G.-U.); Antonio.HMartinSan@uclm.es (A.H.-M.); MariaJesus.Marin@uclm.es (M.J.M.-F.); manuel.leonjimenez@yahoo.es (M.L.-J.); carlos.majanoldm@gmail.com (C.M.); Marcos.Celada@alu.uclm.es (M.C.-G.); Leonor.Gallardo@uclm.es (L.G.)
- ² School of Sport Sciences, European University of Madrid, 28670 Madrid, Spain; javier.sanchez2@universidadeuropea.es (J.S.-S.); joseluis.felipe@universidadeuropea.es (J.L.F.)
- ³ Exercise and Sport Science, Faculty of Health Sciences, University of Francisco de Vitoria, Pozuelo de Alarcon, 28223 Madrid, Spain; enrique.colino@uclm.es
- * Correspondence: jorgelopezfdez@gmail.com; Tel.: +34-697-688-866



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Abstract: The aim of this study was to analyse the effects of the type of extracurricular sport on the body composition, respiratory parameters, and physical condition in prepubertal and pubertal girls. Four hundred and eighty-five female athletes (aged 8–14) from different sports participated in this study. They were gathered into four groups according to the sport typology and maturity level: ‘prepubertal girls who practise collective sports’ (PRE-CS), ‘prepubertal girls who practise individual sports’ (PRE-IS), ‘pubertal girls who practise collective sports’ (PUB-CS), and ‘pubertal girls who practise individual sports’ (PUB-IS). The cardiorespiratory fitness (the 20 m shuttle run test, 20 mSRT), anthropometry, respiratory capacity (forced spirometry), handgrip, CMJ test, and stabilometry were collected. Prepubertal girls showed a lower muscle mass (kg) and fat mass (kg) than pubertal girls regardless of the extracurricular sports typology. PRE-CS and PRE-IS also showed a lower respiratory fitness and physical fitness than pubertal girls ($p < 0.05$). Pubertal girls did not show significant differences ($p > 0.05$) in any of the body composition, respiratory fitness, and physical fitness variables when comparing between collective sports and individual sports. The results show that extracurricular participation in these types sports by prepubertal girls can influence their body composition, respiratory fitness, and physical condition.

Keywords: physical activity; body composition; physical condition; health

1. Introduction

Insufficient physical activity has a negative influence on the body composition, physical fitness, and health in children and adolescents [1,2]. This fact is worsened for those children by high levels of sedentary behaviour [3] or their suffering some health disease [4] because these have a detrimental effect on the development of sports skills [5]. These factors, together with the increasing sedentary time engaged in by children after school [6,7] might explain why paediatricians are reporting that today’s youth is less strong, fast, and light than the previous generations [8].

This fact is substantiated by the increase in individuals with one, two, and even three syndromes of the ‘paediatric inactivity triad’ (PIT): ‘paediatric dynapenia’, ‘exercise deficit disorder’, and ‘physical literacy’ [8,9]. Thus, further effort in promoting physical activity is required [10,11]. Adolescence is probably the period in which higher morphological, physical, and physiological changes occur [12]. Many of these changes are influenced

by lifestyle factors such as diet, unstructured physical activity, and organised sports participation [13,14]. Thus, it seems appropriate to control or monitor these parameters in prepubertal and pubertal adolescents. This is even more important for girls, because the changes in their body composition, physical, and physiological fitness occurring in adolescence play a significant role in the impact of the menopause later in the adulthood [15]. Furthermore, childhood and adolescence are key stages in the acquisition and establishment of healthy lifestyle habits [16].

One of the existing formulas to promote the physical activity and health of girls is extracurricular sport (organised sport practised by children and adolescents after school) [17]. In fact, around half of European children and adolescents take part in these activities [18]. However, girls still show less participation than boys [19].

Previous studies suggested that the typology of the practised sport can lead to a different body composition, along with physical and physiological adaptations in prepubertal and pubertal girls [20]. In addition, these two growth stages are key periods in the acquisition of morphological, physical, and physiological adaptations [21]. Nonetheless, there is limited information in this regard, as most studies are focused on the bone mineral mass and maturation [22,23] or do not compare different sports typologies [24]. Consequently, further research is required to understand the role of the typology of the extracurricular sport in the morphological, physical, and physiological adaptations of pubertal and prepubertal girls.

To provide an initial approach to this gap in the literature, this study aimed to analyse the influence of the extracurricular sport typology (individual and collective) on the body composition, respiratory parameters, and physical fitness of prepubertal and pubertal female girls. Furthermore, this work tested the hypothesis that extracurricular sports participation influences physiological adaptations in both prepubertal and pubertal girls. In addition, we expected that pubertal girls would show greater fat mass, respiratory parameters, and physical fitness than pre pubertal girls.

2. Materials and Methods

2.1. Design and Participants

This was a cross-sectional study. A total of 485 girls aged between 8 and 14 years enrolled in different extracurricular sports in Castilla-La Mancha (a region located in the centre of Spain) participated in the study. Participants took part in non-performance focused extracurricular sports for at least two days a week for at least one hour each day [25]. The study was conducted during the academic season. The final groups were 'prepubertal girls who practised collective sports' (PRE-CS; $n = 111$; 10.17 ± 1.58 years; 141.31 ± 0.12 cm; 39.66 ± 11.05 kg); 'prepubertal girls who practised individual sports' (PRE-IS; $n = 230$; 8.68 ± 2.05 years; 133.19 ± 0.14 cm; 32.84 ± 10.79 kg); 'pubertal girls who practised collective sports' (PUB-CS; $n = 50$; 13.90 ± 1.14 years; 157.08 ± 0.07 cm; 53.84 ± 10.72 kg); and 'pubertal girls who practised individual sports' (PUB-IS; $n = 94$; 13.87 ± 1.29 years; 159.85 ± 0.07 cm; 55.35 ± 10.72 kg).

Participants and their parents or legal guardians were informed of the study's objectives and the tests' characteristics. They signed the informed consent before starting the tests. The tests lasted between 60 and 90 min and were conducted in groups of 12 to 14 girls. The project was approved by the ethics committee of the university in which the study was conducted (Ref: 508; 17/04/2020).

2.2. Procedure

2.2.1. Pubertal Status

Participants were individually evaluated to determine their pubertal status using the Marshall and Tanner test [26]. Stage I was categorised as prepubertal, while Stages II and III were classified as pubertal [27]. This test evaluates the development degree of girls' breasts and pubic villi in five different stages. It is a reliable and valid method used in many studies [27,28].

2.2.2. Anthropometric Measures

Height

Height (cm) was measured using a SECA height metre (model 214; Hamburg, Germany), standing with the heels, glutes, back, and occipital region in contact with the height bar [27]. Girls were assessed with clothes and without shoes.

Body Composition

Weight (kg); body fat (%); body mass (kg) and skeletal muscle mass (%); fat mass in the upper body and lower body (%); and muscle mass in (kg) were measured by a portable segmental multifrequency body composition analyser (Tanita MC-780; Tanita Corporation, Tokyo, Japan). The body mass index (BMI) was calculated with the weight (kg) divided by the squared height of the girls [29]. Participants completed this test after an overnight fast without any intensive exercise on the day before [30]. For the tests, participants had to hold two handles with both hands during the impedance measurement (hand to foot BIA), performing a complete segmental analysis in less than 20 s [30].

2.2.3. Spirometry

Respiratory fitness was measured by forced spirometry (Portable Spirometer Spirobank II Advanced, France) [31]. Each girl performed a maximum inspiration after no more than two seconds of apnoea. Immediately afterwards they performed a maximum expiration until there was no air left in the lungs [31]. The forced vital capacity (FVC)—which is the volume delivered during an expiration made as forcefully and completely as possible, starting from a full inspiration—and the forced expiratory volume in one second (FEV)—which is the volume delivered in the first second of an FVC manoeuvre—were recorded [32]. The best result of two attempts was used for the analysis [29].

2.3. Physical Condition

2.3.1. Manual Dynamometry

The upper-body muscular strength was assessed by handgrip strength with a hand dynamometer with an adjustable grip (TKK 5001 Grip A; Takei Scientific Instruments Co., Tokyo, Japan). The test was repeated twice with the dominant hand. The dominant hand was identified by asking the girls for the more comfortable hand to hold a racket [33]. To complete the test, girls had to close their dominant hand with their maximum force continuously for 2 s over the grip with their elbow position at its full extension [34,35]. The best score was taken for the analysis.

The results of the handgrip strength were expressed in kilograms (kg) and percentiles (pc) according to age [36,37].

2.3.2. Vertical Jump

The lower-body muscular strength was analysed using a countermovement jump test (CMJ) [34,38]. The jump height was calculated to the nearest 0.1 cm by two parallel photoelectric cells bars (Optojump, Microgate, Bolzano, Italy). These bars measured the time taken between the take-off and landing. The girls were instructed to jump as high as possible with a rapid, preparatory downward eccentric action, while their arms were able to be moved freely [38]. The best of three attempts (with 1 min. of recovery between trial) was selected for the analysis. The results of the CMJ were also standardised using the values of percentiles (pc) according to age [36,37].

2.3.3. Stabilometry

The distribution of pressure of the participants when standing on two legs was recorded by a portable baropodometry platform (Footwork[®] platform AM3-IST[®]; Paris, France). The test consisted of the participants standing upright and barefoot on the centre of the platform for 30 s while looking at a fixed point with their hands on their hips [39].

The results were expressed in percentage units (percentage of the difference between right and left leg).

2.3.4. Physical Condition: Course Navette Test

The Course Navette test (20 m shuttle run test (20 mSRT)) was used for assessing the cardiorespiratory fitness [40]. The test finished when the girls failed to run the full length of the 20 m line according to the audio signal beep two times in a row or if stopped because of fatigue. The results of the test were standardised using the values of percentiles (pc) and percentiles according to age [36,37]. The 20 mSRT was the final test conducted in the protocol, so that fatigue did not interfere with the previous tests [34].

2.4. Statistical Analysis

Data are presented as means \pm standard deviations. The normality of the variables was confirmed by the Kolmogorov–Smirnov test. A two-way analysis of variance (two-way ANOVA) was used to analyse the differences in body composition, physical condition, and cardiorespiratory variables according to the type of sport (collective or individual) and the pubertal status (prepubertal or pubertal). Pairwise comparisons were carried out by the Bonferroni post hoc test. Furthermore, in addition, the confidence interval (CI of 95%) was calculated to identify the magnitude of the changes and effect sizes (Cohen's *d*, ES) were calculated and defined as follows: trivial, <0.19 ; small, $0.2\text{--}0.49$; medium, $0.5\text{--}0.79$; large, >0.8 [41]. The level of significance was set at $p < 0.05$.

3. Results

The outcomes regarding the body composition are displayed in Table 1. Prepubertal girls showed a lower BMI ($p < 0.05$; ES = $0.66\text{--}1.02$), fat mass (in both percentage ($p < 0.05$; ES = $0.28\%\text{--}0.62\%$) and kilograms ($p < 0.05$; ES = $0.91\text{--}1.37$ kg)) and muscle mass (in kilograms; $p < 0.05$; ES = $1.75\text{--}2.16$ kg) values than pubertal girls regardless of the sports typology. Prepubertal girls also revealed a lower muscle mass in kilograms ($p < 0.05$) in their body trunk, both of their arms, and both of their legs than pubertal girls regardless of the sport typology. Finally, PRE-ISs showed a higher muscle mass (in percentage) than PUB-ISs and lower fat mass (in percentage) than PUB-ISs in their body trunks, both of their arms, and both of their legs ($p < 0.05$). PRE-CSs also displayed a lower fat mass (in percentage) in these three body segments than PUB-CSs, but significant differences were found only for the right leg ($p < 0.05$). The comparisons between collective and individual sports revealed PRE-CSs to have a significantly higher BMI ($+1.21\%$; $p < 0.05$; ES = 0.36 ; 95% CI: $0.41\%\text{--}2.01\%$), fat mass (in percentage ($p < 0.05$; ES = 0.26 ; CI: $0.16\%\text{--}2.74\%$) and kilograms ($p < 0.05$; ES = 0.49 ; CI: $1.16\text{--}3.56$ kg)), muscle mass (in kilograms; $p < 0.05$; ES = 0.65 ; CI: $2.83\text{--}5.62$ kg), and muscle mass in the three body sections (trunk, arms, and legs; $p < 0.05$) than PRE-ISs. On the contrary, PUB-CSs did not show significant differences in their body composition in comparison to PUB-ISs, except in the percentage of fat mass in their right legs (-1.86% ; $p < 0.05$; ES = 0.30 ; CI: between -0.05% and -3.76%).

The results of the respiratory variables are presented in Table 2. Prepubertal girls displayed significant lower values than pubertal girls in all respiratory variables ($p < 0.05$; ES = $1.23\text{--}2.31$) except FEV₁_FVC ($p > 0.05$) regardless the sport typology. The comparisons between sport typologies revealed that PRE-CSs had higher outcomes than PRE-ISs for FVC, FEV₁, PEF, and FEF₂₅₇₅ ($p < 0.05$; ES = $0.61\text{--}0.71$) but not for FEV₁_FVC (-0.12% ; $p > 0.05$; ES = 0.02 ; CI: between -1.60 and 1.34). On the contrary, PUB-CSs and PUB-ISs did not show significant differences in any of the studied variables.

Table 1. Body composition variables according to the typology of sport in prepubertal and pubertal girls.

	Individual Sports						Collective Sports					
	Prepubertal Girls			Pubertal Girls			Prepubertal Girls			Pubertal Girls		
BMI (kg/m ²)	18.19	±	3.33 ^{*,†}	21.81	±	3.73	19.41	±	3.45 [*]	21.81	±	3.79
Fat mass (%)	25.59	±	5.45 ^{*,†}	29.36	±	6.71	27.05	±	5.67 [*]	28.65	±	5.63
Fat mass (kg)	8.74	±	4.51 ^{*,†}	16.33	±	6.54	11.1	±	5.06 [*]	16.33	±	6.37
Muscle mass (%)	70.5	±	5.15 ^{*,†}	67.01	±	6.35	69.13	±	5.33	67.75	±	5.34
Muscle mass (kg)	22.85	±	6.55 ^{*,†}	35.58	±	5.21	27.07	±	6.47 [*]	37.03	±	4.93
Trunk fat mass (%)	19.46	±	5.72 ^{*,†}	23.06	±	6.77	21.59	±	6.66	22.89	±	5.66
Trunk muscle mass (kg)	14.01	±	3.63 ^{*,†}	21.24	±	2.95	16.2	±	3.79 [*]	21.87	±	2.67
Fat mass in left arm (%)	37.46	±	6.33 [*]	39.46	±	7.17	38.68	±	6.47	39.77	±	6.10
Muscle mass in left arm (kg)	0.93	±	0.33 ^{*,†}	1.53	±	0.29	1.12	±	0.32 [*]	1.56	±	0.29
Fat mass in right arm (%)	35.82	±	5.15	36.2	±	5.80	36.35	±	5.24	36.3	±	5.31
Muscle mass in right arm (kg)	0.89	±	0.32 ^{*,†}	1.45	±	0.26	1.07	±	0.32 [*]	1.5	±	0.27
Fat mass in left leg (%)	33.3	±	5.19 [*]	36.8	±	6.83	34.18	±	5.4	35	±	5.86
Muscle mass in left leg (kg)	3.48	±	1.22 ^{*,†}	5.6	±	0.88	4.18	±	1.16 [*]	5.95	±	0.9
Fat mass in right leg (%)	33.06	±	4.83 [*]	36.62	±	6.67	33.25	±	6.00 [*]	34.77	±	5.76
Muscle mass in right leg (kg)	3.54	±	1.24 ^{*,†}	5.75	±	0.95	4.49	±	1.63 [*]	6.15	±	0.95

* Difference in body composition between prepubertal and pubertal girls for each sports typology. $p < 0.05$. † Difference in body composition between individual and collective sports for each pubertal stage in girls. $p < 0.05$.

Table 2. Respiratory Variables According to the Typology of Sport in Prepubertal and Pubertal Girls.

	Individual Sports						Collective Sports					
	Prepubertal Girls			Pubertal Girls			Prepubertal Girls			Pubertal Girls		
FVC (L)	1.87	±	0.57 ^{*,†}	3.16	±	0.59	2.27	±	0.56 [*]	3.3	±	0.57
FEV ₁ (L)	1.69	±	0.51 ^{*,†}	2.82	±	0.47	2.04	±	0.49 [*]	2.95	±	0.46
PEF (L/s)	3.29	±	1.08 ^{*,†}	4.95	±	0.97	3.95	±	1.08 [*]	5.15	±	0.94
FEF ₂₅₋₇₅ (L/s)	2.16	±	0.72 ^{*,†}	3.53	±	0.73	2.67	±	0.76 [*]	3.56	±	0.69
FEV ₁ _FVC (%)	90.01	±	7.00	89.92	±	5.66	90.13	±	5.56	89.71	±	5.78

FVC, forced vital capacity; FEV₁, forced expiratory volume; PEF, peak expiratory flow; FEF₂₅₋₇₅, mean forced expiratory flow between 25% and 75% of FVC; L, litres; L/s, litres per second. * Difference in respiratory variables between prepubertal and pubertal girls for each sports typology, $p < 0.05$. † Difference in respiratory variables between individual or collective sport for each pubertal stage in girls, $p < 0.05$.

The outcomes of the physical tests are displayed in Table 3. Prepubertal girls showed a lower handgrip (kg), Course Navette test score (stages), and vertical jump (cm) performance than pubertal girls ($p < 0.05$; ES = 0.80–2.04) regardless of the sport typology. Furthermore, PRE-ISs also showed significantly higher values for the Course Navette (percentile) and vertical jump (percentile) ($p < 0.05$; ES = 0.55–0.78) tests than PUB-ISs. The comparison according to the sport typology revealed PRE-CSs to get significant higher values in the handgrip (+3.72 kg; $p < 0.05$; ES = 0.67; CI: 2.51–4.92), handgrip (percentile; $p < 0.05$; ES = 0.24; CI: 0.47–14.50) and Course Navette (stages; $p < 0.05$; ES = 0.49; CI: 0.40–1.13) tests but significant lower values for vertical jump (percentile; $p < 0.05$; ES = 0.33; CI: 1.54–15.52%) than PRE-ISs. No significant differences were found in the remaining variables ($p > 0.05$; ES = 0.04–0.13). Finally, PUB-CSs and PUB-ISs did not display significant differences in any of the studied physical variables ($p > 0.05$; ES = 0.07–0.39).

Table 3. Physical Parameters According to the Typology of Sport in Prepubertal and Pubertal Girls.

	Individual Sports						Collective Sports					
	Prepubertal Girls			Pubertal Girls			Prepubertal Girls			Pubertal Girls		
Handgrip (kg)	14.07	±	5.31 ^{*,†}	24.18	±	4.58	17.78	±	5.65 [*]	24.51	±	5.15
Handgrip (percentile)	48.76	±	33.12 [†]	46.65	±	26.68	56.25	±	28.67	50.16	±	29.19
Course Navette (stages)	3.46	±	1.47 ^{*,†}	4.76	±	1.78	4.23	±	1.68 [*]	5.07	±	1.59
Course Navette (percentile)	72.91	±	22.28 [*]	59.26	±	27.03	75.77	±	22.56 [*]	64.74	±	25.87
Vertical jump (cm)	18.78	±	4.73 [*]	24.04	±	3.95	18.1	±	6.26 [*]	22.04	±	10.00
Vertical jump (percentile)	51.75	±	26.29 ^{*,†}	33.42	±	20.17	43.22	±	25.24	42.16	±	24.36
Pressure asymmetry (%)	9.44	±	7.58	8.2	±	6.15	9.82	±	8.33	9.27	±	7.47

* Difference in muscle fitness variables between prepubertal and pubertal girls for each sports typology, $p < 0.05$. † Difference in muscle fitness variables between individual and collective sport for each pubertal stage in girls, $p < 0.05$.

4. Discussion

This is the first study that analyses the influence of the extracurricular sport typology on the body composition, respiratory fitness, and physical condition of prepubertal and pubertal girls. The main findings were that morphological, physical, and respiratory adaptations vary according to the growth stage (i.e., prepubertal and pubertal) and the practised extracurricular sport (i.e., individual or collective). However, significant differences according to the extracurricular practised sport were found only in prepubertal girls, partially confirming the initial hypothesis.

The existing evidence suggests that the transition from prepuberty to puberty increase girls' fat mass regardless of their daily physical activity [42]. This study is line with this evidence and our second hypothesis, as pubertal girls (either PUB-CSs or PUB-ISs) showed higher fat mass pubertal girls. However, this is a cross-sectional study, while diet and active life were not controlled, so cause–effect cannot be set from this study. The transition from prepuberty to puberty is also associated with a muscle mass increase in girls [43,44]. Nonetheless, this increment seems to be higher in girls participating in extracurricular sports [19,45]. This might explain why both pubertal groups showed a higher muscle mass even when the average age (PUB-CS = 13.90 ± 1.14 years; PUB-IS = 13.87 ± 1.29) was lower than the age period (around 15 years old) during which muscular strength and muscle mass gain are accelerated [43]. The fact that both fat mass and muscle mass increase during adolescence also explains why both groups (PUB-CS and PUB-IS) displayed higher BMI levels than the prepubertal girls, which is in line with a previous study in pubertal girls participating in extracurricular sports [46]. Thus, care must be taken when tracking changes in adolescence using the BMI.

It has been suggested that the extracurricular sport typology plays a significant role in the body composition [47]. However, this is partially evidenced in the current study as PUB-CSs and PUB-ISs did not show differences in their body composition. It is important to highlight that only two sport typologies were defined in this study, so future studies attempting to confirm or reject our findings should consider more sports typologies. The fact that PRE-CSs showed a higher muscle mass might be due to the demands of collective sports (i.e., jumps, changes of direction, acceleration, deceleration, sprinting, etc.) [48]. However, additional studies are needed to confirm these findings. Furthermore, PRE-CSs showed a higher fat mass and percentage fat mass than PRE-ISs, which might be due to the demands of the practised sports but also due to their food habits [49] or daily activity. Therefore, future studies should also attempt to control the diet of prepubertal and pubertal girls and measure the daily activity.

In line with previous studies [50], girls' pulmonary capacity improved with age regardless of the sport typology. This might be due to several reasons; however, maturity is likely to be the main reason for the higher respiratory capacity of pubertal girls, as it causes an increase in the lungs' dimensions and the muscles participating in breathing [51,52].

Exercise has been associated with a higher respiratory capacity in both prepubertal and pubertal girls [53]. However, most of the studies analysing lung capacity in these populations have focused on one sport, with swimming being the most common one [54]. Thus, the role of the extracurricular sport typology in the pulmonary adaptations before and after the menarche in girls remains unknown. Our findings suggest that the exercise typology might cause different respiratory fitness adaptations in prepubertal girls, but this was not evidenced in pubertal girls, partially confirming the first hypothesis. Although cause and effect cannot be established, one of the reasons for PRE-CSs having greater respiratory adaptation might be the intensity of the exercise performed [55], which might somehow be reduced in PRE-ISs in order to get an accurate sports technique. Subdividing individual and collective sports into further categories, as well as monitoring the training load (e.g., through heart rate), might provide additional information about the role of extracurricular sports on the pulmonary capacity of both prepubertal and pubertal girls.

Regarding the physical fitness parameters, PRE-IS and PRE-CS girls showed a lower handgrip, and Course Navette and vertical jump performance than PUB-IS and PUB-CS girls. This was expected, as maturity improves the physical fitness and strength [43,55]. When comparing the two selected extracurricular sports typologies, PRE-ISs showed a lower handgrip, handgrip percentile, and Course Navette score (stages) than PRE-CSs. This was probably due to the demands of the practised sports, as the intensive training stimulus of collective sports improves the maximum aerobic power and strength of prepubescent children [56]. The fact that PRE-ISs showed a higher vertical jump percentile than PRE-CSs might somehow contradict our previous statement; however, it has been reported that strength and coordination play a key role in prepubertal children's jumping ability [57,58], so that might be the reason why PRE-ISs achieved a higher percentile in the CMJ test [59]. On the other hand, no significant differences between PUB-CSs and PUB-ISs were found for physical fitness. Once again, it is likely that the absence of significant differences was due to only two sport typologies being identified. Therefore, further studies are required to understand the role of sport typology in the physical parameters of pubertal girls.

This is an initial attempt to address a gap identified in the literature, and therefore the reason why only two sport typologies were defined. Another significant limitation is that this is a cross-sectional study, in which factors such as diet or life activity were not controlled, so cause and effect cannot be established. Future studies should attempt to overcome these limitations by comparing more categories of both individual sports and collective sports and controlling girls' dietary habits and life activity. The measurement of the body composition was measured by a Tanita, which is less accurate than the gold standard (Hologic Series Discovery QDR, Software Physician Viewer, APEX System Software v 3.1.2; Bedford, MA, USA) [27]. However, the Tanita has proven to be effective in comparing a large number of population groups [60,61]. The physical condition was also measured indirectly, but again, this formula is suitable for measuring and comparing large population groups [62].

5. Conclusions

Extracurricular sports (of individual and collective modality) are not a determining factor on the physiological parameters of pubertal girls, but they cause different physiological adaptations in prepubertal girls. Pubertal girls participating in extracurricular sports have a greater fat mass percentage, respiratory capacity, and physical fitness than prepubertal girls.

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Abbreviations

PIT	Paediatric Inactivity Triad
PRE-CS	Prepubertal girls who practised Collective Sports
PRE-IS	Prepubertal girls who practised Individual Sports
PUB-CS	Pubertal girls who practised Collective Sports
PUB-IS	Pubertal girls who practised Individual Sports
cm	centimetres
Kg	kilogrammes
BMI	Body Mass Index
Pc	Percentile
FVC	Forced Vital Capacity
FEV	Forced Expiratory Volume in one second
20 mSRT	20 m Shuttle-Run Test
Handgrip	Handgrip strength
CMJ	Countermovement Jump

References

1. Drenowatz, C.; Kobel, S.; Kettner, S.; Keszytüs, D.; Steinacker, J.M. Interaction of sedentary behaviour, sports participation and fitness with weight status in elementary school children. *Eur. J. Sport Sci.* **2014**, *14*, 100–105. [[CrossRef](#)]
2. Micheli, L.; Mountjoy, M.; Engebretsen, L.; Hardman, K.; Kahlmeier, S.; Lambert, E.; Ljungqvist, A.; Matsudo, V.; McKay, H.; Sundberg, C.J. Fitness and health of children through sport: The context for action. *Br. J. Sports Med.* **2011**, *45*, 931–936. [[CrossRef](#)]
3. Carson, V.; Hunter, S.; Kuzik, N.; Gray, C.E.; Poitras, V.J.; Chaput, J.-P.; Saunders, T.J.; Katzmarzyk, P.T.; Okely, A.D.; Connor Gorber, S.; et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth: An update. *Appl. Physiol. Nutr. Metab.* **2016**, *41*, S240–S265. [[CrossRef](#)]
4. Wu, X.Y.; Han, L.H.; Zhang, J.H.; Luo, S.; Hu, J.W.; Sun, K. The influence of physical activity, sedentary behavior on health-related quality of life among the general population of children and adolescents: A systematic review. *PLoS ONE* **2017**, *12*, e0187668. [[CrossRef](#)]

5. Ceschia, A.; Giacomini, S.; Santarossa, S.; Rugo, M.; Salvadego, D.; Da Ponte, A.; Driussi, C.; Mihaleje, M.; Poser, S.; Lazzer, S. Deleterious effects of obesity on physical fitness in pre-pubertal children. *Eur. J. Sport Sci.* **2016**, *16*, 271–278. [[CrossRef](#)] [[PubMed](#)]
6. Lee, J.E.; Pope, Z.; Gao, Z. The role of youth sports in promoting children's physical activity and preventing pediatric obesity: A systematic review. *Behav. Med.* **2018**, *44*, 62–76. [[CrossRef](#)]
7. Maitland, C.; Foster, S.; Stratton, G.; Braham, R.; Rosenberg, M. Capturing the geography of children's active and sedentary behaviours at home: The HomeSPACE measurement tool. *Child. Geogr.* **2019**, *17*, 291–308. [[CrossRef](#)]
8. Faigenbaum, A.D.; Rebullido, T.R.; MacDonald, J.P. Pediatric inactivity triad: A risky PIT. *Curr. Sports Med. Rep.* **2018**, *17*, 45–47. [[CrossRef](#)]
9. Poitras, V.J.; Gray, C.E.; Janssen, X.; Aubert, S.; Carson, V.; Faulkner, G.; Goldfield, G.S.; Reilly, J.J.; Sampson, M.; Tremblay, M.S. Systematic review of the relationships between sedentary behaviour and health indicators in the early years (0–4 years). *BMC Public Health* **2017**, *17*, 868. [[CrossRef](#)]
10. Benjamin-Neelon, S.E.; Neelon, B.; Pearce, J.; Grossman, E.R.; Gonzalez-Nahm, S.; Slining, M.; Duffey, K.; Frost, N. State regulations promoting infant physical activity in early care and education. *Child. Obes.* **2018**, *14*, 368–374. [[CrossRef](#)] [[PubMed](#)]
11. Pfeiffer, K.A.; Wierenga, M.J. Promoting physical activity through youth sport. *Kinesiol. Rev.* **2019**, *8*, 204–210. [[CrossRef](#)]
12. McKay, D.; Broderick, C.; Steinbeck, K. The adolescent athlete: A developmental approach to injury risk. *Pediatric Exerc. Sci.* **2016**, *28*, 488–500. [[CrossRef](#)] [[PubMed](#)]
13. Ferri-Morales, A.; Nascimento-Ferreira, M.V.; Vlachopoulos, D.; Ubago-Guisado, E.; Torres-Costoso, A.; De Moraes, A.C.F.; Barker, A.R.; Moreno, L.A.; Martínez-Vizcaíno, V.; Gracia-Marco, L. Agreement between standard body composition methods to estimate percentage of body fat in young male athletes. *Pediatric Exerc. Sci.* **2018**, *30*, 402–410. [[CrossRef](#)] [[PubMed](#)]
14. Ramires, V.V.; Dumith, S.C.; Wehrmeister, F.C.; Curi Hallal, P.; Baptista Menezes, A.M.; Gonçalves, H. Physical activity throughout adolescence and body composition at 18 years: 1993 Pelotas (Brazil) birth cohort study. *Int. J. Behav. Nutr. Phys. Act.* **2016**, *13*, 105. [[CrossRef](#)] [[PubMed](#)]
15. Sherar, L.B.; Cumming, S.P.; Eisenmann, J.C.; Baxter-Jones, A.D.G.; Malina, R.M. Adolescent biological maturity and physical activity: Biology meets behavior. *Pediatr. Exerc. Sci.* **2010**, *22*, 332–349. [[CrossRef](#)]
16. Sawyer, S.M.; Afifi, R.A.; Bearinger, L.H.; Blakemore, S.-J.; Dick, B.; Ezech, A.C.; Patton, G.C. Adolescence: A foundation for future health. *Lancet* **2012**, *379*, 1630–1640. [[CrossRef](#)]
17. De Meester, A.; Aelterman, N.; Cardon, G.; De Bourdeaudhuij, I.; Haerens, L. Extracurricular school-based sports as a motivating vehicle for sports participation in youth: A cross-sectional study. *Int. J. Behav. Nutr. Phys. Act.* **2014**, *11*, 48. [[CrossRef](#)] [[PubMed](#)]
18. Tremblay, M.S.; Barnes, J.D.; González, S.A.; Katzmarzyk, P.T.; Onywera, V.O.; Reilly, J.J.; Tomkinson, G.R. Global matrix 2.0: Report card grades on the physical activity of children and youth comparing 38 countries. *J. Phys. Act. Health* **2016**, *13*, S343–S366. [[CrossRef](#)]
19. Telford, R.M.; Telford, R.D.; Olive, L.S.; Cochrane, T.; Davey, R. Why are girls less physically active than boys? Findings from the LOOK longitudinal study. *PLoS ONE* **2016**, *11*, e0150041. [[CrossRef](#)]
20. Magnani Branco, B.H.; Carvalho, I.Z.; Garcia de Oliveira, H.; Fanhani, A.P.; Machado Dos Santos, M.C.; Pestillo de Oliveira, L.; Macente Boni, S.; Nardo, N.J. Effects of 2 types of resistance training models on obese adolescents' body composition, cardiometabolic risk, and physical fitness. *J. Strength Cond. Res.* **2020**, *34*, 2672–2682. [[CrossRef](#)]
21. Llorente-Cantarero, F.J.; Aguilar-Gómez, F.J.; Anguita-Ruiz, A.; Rupérez, A.I.; Vázquez-Cobela, R.; Flores-Rojas, K.; Aguilera, C.M.; Gonzalez-Gil, E.M.; Gil-Campos, M.; Bueno-Lozano, G. Changes in physical activity patterns from childhood to adolescence: Genobox longitudinal study. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7227. [[CrossRef](#)] [[PubMed](#)]
22. Almagia Flores, A.A.; Rodriguez Rodriguez, F.; Barranza Gomez, F.O.; Lizana Arce, P.J.; Jorquera Aguilera, C.A. Anthropometric profile of female football-soccer Chilean players. *Int. J. Morphol.* **2014**, *26*, 817–821.
23. Méndez-Pérez, B.; López-Blanco, M. Health, and Nutrition in Northwestern South America. *Biol. Anthropol. Lat. Am.* **2017**, 249–251.
24. Bayios, I.A.; Bergeles, N.K.; Apostolidis, N.G.; Noutsos, K.S.; Koskolou, M.D. Anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players. *J. Sports Med. Phys. Fit.* **2006**, *46*, 271.
25. Zaina, F.; Donzelli, S.; Lusini, M.; Minnella, S.; Negrini, S. Swimming and spinal deformities: A cross-sectional study. *J. Pediatr.* **2015**, *166*, 163–167. [[CrossRef](#)]
26. Marshall, W.A.; Tanner, J.M. Variations in pattern of pubertal changes in girls. *Arch. Dis. Child.* **1969**, *44*, 291. [[CrossRef](#)]
27. Ubago-Guisado, E.; Gómez-Cabello, A.; Sánchez-Sánchez, J.; García-Unanue, J.; Gallardo, L. Influence of different sports on bone mass in growing girls. *J. Sports Sci.* **2015**, *33*, 1710–1718. [[CrossRef](#)] [[PubMed](#)]
28. Vicente-Rodríguez, G.; Ara, I.; Perez-Gomez, J.; Serrano-Sanchez, J.A.; Dorado, C.; Calbet, J.A. High femoral bone mineral density accretion in prepubertal soccer players. *Med. Sci. Sports Exerc.* **2004**, *36*, 1789–1795. [[CrossRef](#)]
29. Manzano-Carrasco, S.; Felipe, J.L.; Sanchez-Sanchez, J.; Hernandez-Martin, A.; Gallardo, L.; Garcia-Unanue, J. Physical Fitness, Body Composition, and Adherence to the Mediterranean Diet in Young Football Players: Influence of the 20 mSRT Score and Maturational Stage. *Int. J. Environ. Res. Public Health* **2020**, *17*, 3257. [[CrossRef](#)]
30. Verney, J.; Metz, L.; Chaplais, E.; Cardenoux, C.; Pereira, B.; Thivel, D. Bioelectrical impedance is an accurate method to assess body composition in obese but not severely obese adolescents. *Nutr. Res.* **2016**, *36*, 663–670. [[CrossRef](#)] [[PubMed](#)]
31. Miller, M.R.; Hankinson, J.; Brusasco, V.; Burgos, F.; Casaburi, R.; Coates, A.; Crapo, P.; Enright, P.; Van der Grinten, P.; Jensen, R.; et al. Standardisation of spirometry. *Eur. Respir. J.* **2005**, *26*, 319–338. [[CrossRef](#)]

32. Serra-Majem, L.; Ribas, L.; Ngo, J.; Ortega, R.M.; García, A.; Pérez-Rodrigo, C.; Aranceta, J. Food, youth and the Mediterranean diet in Spain. Development of KIDMED, Mediterranean Diet Quality Index in children and adolescents. *Public Health Nutr.* **2004**, *7*, 931–935. [[CrossRef](#)]
33. Hadler, R.; Chiviawosky, S.; Wulf, G.; Gomes Schild, J.F. Children's learning of tennis skills is facilitated by external focus instructions. *Mot. Rev. De Educ. Física* **2014**, *20*, 418–422. [[CrossRef](#)]
34. Manzano-Carrasco, S.; Felipe, J.L.; Sanchez-Sanchez, J.; Hernandez-Martin, A.; Gallardo, L.; Garcia-Unanue, J. Weight Status, Adherence to the Mediterranean Diet, and Physical Fitness in Spanish Children and Adolescents: The Active Health Study. *Nutrients* **2020**, *12*, 1680. [[CrossRef](#)] [[PubMed](#)]
35. Ruiz, J.R.; Castro-Piñero, J.; España-Romero, V.; Artero, E.G.; Ortega, F.B.; Cuenca, M.M.; Jimenez-Pavón, D.; Chillón, P.; Girela-Rejón, M.J.; Mora, J.; et al. Field-based fitness assessment in young people: The ALPHA health-related fitness test battery for children and adolescents. *Br. J. Sports Med.* **2011**, *45*, 518–524. [[CrossRef](#)] [[PubMed](#)]
36. Castro-Piñero, J.; Ortega, F.B.; Keating, X.D.; González-Montesinos, J.L.; Sjöström, M.; Ruíz, J.R. Percentile values for aerobic performance running/walking field tests in children aged 6 to 17 years; influence of weight status. *Nutr. Hosp.* **2011**, *26*, 572–578.
37. Gulías-González, R.; Sánchez-López, M.; Olivás-Bravo, Á.; Solera-Martínez, M.; Martínez-Vizcaíno, V. Physical fitness in Spanish schoolchildren aged 6–12 years: Reference values of the battery EUROFIT and associated cardiovascular risk. *J. Sch. Health* **2014**, *84*, 625–635. [[CrossRef](#)] [[PubMed](#)]
38. Glatthorn, J.F.; Gouge, S.; Nussbaumer, S.; Stauffacher, S.; Impellizzeri, F.M.; Maffiuletti, N.A. Validity and reliability of Optojump photoelectric cells for estimating vertical jump height. *J. Strength Cond. Res.* **2011**, *25*, 556–560. [[CrossRef](#)] [[PubMed](#)]
39. Bortone, I.; Trotta, G.F.; Donato Cascarano, G.; Regina, P.; Brunetti, A.; De Feudis, I.; Buongiorno, D.; Loconsole, C.; Bevilacqua, V. *A supervised approach to classify the status of bone mineral density in post-menopausal women through static and dynamic baropodometry. Presented at the 2018 International Joint Conference on Neural Networks (IJCNN), Rio de Janeiro, Brazil, 8–13 July 2018; IEEE: Piscataway, NJ, USA, 2018; pp. 1–8.* [[CrossRef](#)]
40. Guillamón, A.R.; Garcia Canto, E.; Carrillo López, P.J. Relación entre capacidad aeróbica y el nivel de atención en escolares de primaria (Relationship between aerobic capacity and level of attention in primary school children). *Retos* **2019**, *35*, 36–41. [[CrossRef](#)]
41. Cohen, J.; Cohen, P.; West, S.G.; Aiken, L.S. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*; Psychology Press: New York, NY, USA, 2013.
42. Gavela-Pérez, T.; Garcés, C.; Navarro-Sánchez, P.; López Villanueva, L.; Soriano-Guillén, L. Earlier menarcheal age in Spanish girls is related with an increase in body mass index between pre-pubertal school age and adolescence. *Pediatr. Obes.* **2015**, *10*, 410–415. [[CrossRef](#)]
43. Brown, K.A.; Patel, D.R.; Darmawan, D. Participation in sports in relation to adolescent growth and development. *Transl. Pediatr.* **2017**, *6*, 150. [[CrossRef](#)]
44. Kaplowitz, P.B. Link between body fat and the timing of puberty. *Pediatrics* **2008**, *121*, S208–S217. [[CrossRef](#)] [[PubMed](#)]
45. Pavlovic, R. The Engagement of Schoolchildren Females in Extracurricular Sports Activities. *Int. J. Sci. Cult. Sport* **2016**, *4*, 218–229. [[CrossRef](#)]
46. Krahnstoever Davison, K.; Werder, J.L.; Trost, S.G.; Baker, B.L.; Birch, L.L. Why are early maturing girls less active? Links between pubertal development, psychological well-being, and physical activity among girls at ages 11 and 13. *Soc. Sci. Med.* **2007**, *64*, 2391–2404. [[CrossRef](#)]
47. Rodrigues da Costa, D. *Association of Social, Cultural and Environmental Factors with Participation in Extracurricular Sport and Obesity Indicators in 6–10-Year-Old Children Living in Urban and Non-Urban Settings*; ProQuest Dissertations Publishing: Coimbra, Portugal, 2018.
48. Bertelloni, S.; Ruggeri, S.; Baroncelli, G.I. Effects of sports training in adolescence on growth, puberty and bone health. *Gynecol. Endocrinol.* **2006**, *22*, 605–612. [[CrossRef](#)]
49. Manzano-Carrasco, S.; Felipe, J.L.; Sanchez-Sanchez, J.; Hernandez-Martin, A.; Clavel, I.; Gallardo, L.; Garcia-Unanue, J. Relationship between Adherence to the Mediterranean Diet and Body Composition with Physical Fitness Parameters in a Young Active Population. *Int. J. Environ. Res. Public Health* **2020**, *17*, 3337. [[CrossRef](#)]
50. Sadiq, S.; Ahmed, S.T.; Rizvi, N.A.; Ahmed, F. Establishing age specific spirometry reference ranges for children/adolescents of Karachi, Pakistan: Randomized trials. *JPMA J. Pak. Med Assoc.* **2019**, *69*, 24. [[PubMed](#)]
51. Daniels, S.R.; Kimball, T.R.; Morrison, J.A.; Khoury, P.; Witt, S.; Meyer, R.A. Effect of lean body mass, fat mass, blood pressure, and sexual maturation on left ventricular mass in children and adolescents: Statistical, biological, and clinical significance. *Circulation* **1995**, *92*, 3249–3254. [[CrossRef](#)]
52. Manna, I.; Pan, S.R.; Chowdhury, M. Anthropometric, physical, cardiorespiratory fitness and lipids and lipoproteins profile of young Indian children of 10–16 years age group. *Am. J. Sports Sci. Med.* **2014**, *2*, 154–160. [[CrossRef](#)]
53. Özveren, Y.; Özçaldıran, B.; Onur, O. Examining effects of volleyball trainings on some respiration and circulation parameters of 11–14 years old female test subjects. *Int. J. Sport Cult. Sci.* **2015**, *2*, 234–241. [[CrossRef](#)]
54. Atabek, H.Ç. The effects of swimming training on selected strength and respiratory function variables in pre-pubertal children. *J. Athl. Perform. Nutr.* **2017**, *4*, 17–33.
55. Marcovecchio, M.L.; Chiarelli, F. Obesity and growth during childhood and puberty. *Nutr. Growth* **2013**, *106*, 135–141.
56. Marta, C.; Marinho, D.A.; Marques, M.C. Physical fitness in prepubescent children: An update. *J. Phys. Educ. Sport* **2012**, *12*, 445. [[CrossRef](#)]

57. Fransen, J.; Pion, J.; Vandendriessche, J.; Vandorpe, B.; Vaeyens, R.; Lenoir, M.; Philippaerts, R.M. Differences in physical fitness and gross motor coordination in boys aged 6–12 years specializing in one versus sampling more than one sport. *J. Sports Sci.* **2012**, *30*, 379–386. [[CrossRef](#)]
58. Iadreev, V.; Cherkashin, I.; Vujkov, S.; Drid, P. Differences in anthropometric, motoric and cognitive abilities between athletically trained and untrained girls. *Biomed. Hum. Kinet.* **2015**, *7*, 73–77. [[CrossRef](#)]
59. Ford, P.; Collins, D.; Bailey, R.; MacNamara, Á.; Pearce, G.; Toms, M. Participant development in sport and physical activity: The impact of biological maturation. *Eur. J. Sport Sci.* **2012**, *12*, 515–526. [[CrossRef](#)]
60. Beeson, W.L.; Batech, M.; Schultz, E.; Salto, L.; Firek, A.; Deleon, M.; Balcazar, H.; Cordero-Macintyre, Z. Comparison of body composition by bioelectrical impedance analysis and dual-energy X-ray absorptiometry in Hispanic diabetics. *Int. J. Body Compos. Res.* **2010**, *8*, 45. [[PubMed](#)]
61. Orsso, C.E.; Silva, B.M.I.; Gonzalez, M.C.; Rubin, D.A.; Heymsfield, S.B.; Prado, C.M.; Haqq, A.M. Assessment of body composition in pediatric overweight and obesity: A systematic review of the reliability and validity of common techniques. *Obes. Rev.* **2020**, *21*, e13041. [[CrossRef](#)] [[PubMed](#)]
62. Ayán, C.; Cancela, J.M.; Romero, S.; Alonso, S. Reliability of two field-based tests for measuring cardiorespiratory fitness in preschool children. *J. Strength Cond. Res.* **2015**, *29*, 2874–2880. [[CrossRef](#)] [[PubMed](#)]