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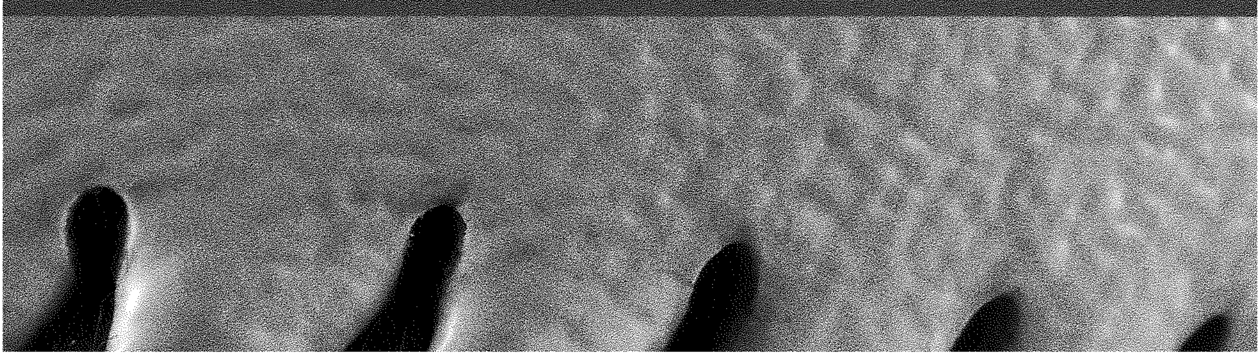
Sport and Fitness in Children and Adolescents

A Multidimensional View

Edited by Lucy-Joy Wachira



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Chapter 3

Increase in BMI and Negative Muscular Strength Trends in Adolescents in 1990 and 2020: Results from the Regional Observatory of Motor Development in Southern Italy

Domenico Monacis and Dario Colella

Abstract

In the last decades, low levels of physical activity and sedentary lifestyles were associated with the progressive decline in physical fitness in children and adolescents. The present cross-sectional study aims to assess the evolution of muscular strength in adolescents in an Apulia province (Italy), comparing motor performance in 1990 and 2020. The sample consists of 107 adolescents attending secondary school in Lecce in 1990, and 118 attending the same school in 2020 (11–12 years old). After dividing the sample according to gender and BMI, muscular strength was assessed with Standing Long Jump (SLJ) and Medicine Ball Throw 2 kg (MBT). Statistical analysis included ANOVA to highlight significant differences in motor performances in 1990 and 2020 according to gender and BMI, and linear regression to investigate the variance explained by BMI on SLJ and MBT. The results showed (a) lower motor performance in 2020 compared to 1990, (b) the increase in the percentage of overweight-obese from 1990 to 2020, and (c) a negative association between BMI and the SLJ in 2020. Findings suggest the need to assess and monitor physical fitness—as a health status indicator—in adolescents, and promote further opportunities to encourage and expand the time spent in physical activity in Apulia.

Keywords: healthy lifestyles, cross-sectional study, obesity, muscular strength, regional observatory

1. Introduction

Overweight and obesity are both specific causes of premature death in adulthood [1]. The progressive reduction of physical activity levels (PAL) in children and adolescents, together with the increase of sedentary habits, promote the development of non-communicable and chronic—cardiovascular, respiratory and metabolic—degenerative

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diseases [2, 3], bone demineralization and osteoporosis [4], but also sarcopenia, loss of strength and muscle tone [5].

The international guidelines and recommendations of the World Health Organization (WHO) provide for children and adolescents—aged between 5 and 17 years old—the daily practice of at least 60 minutes of moderate to vigorous physical activity (MVPA), together with muscular strength activities [5].

However, several studies showed that a large percentage of children and adolescents do not respect these guidelines and recommendations, preferring sedentary activities. According to a recent report—including 298 schools from 146 countries around the world—about 81% of students aged 11–17 years old did not regularly engage in physical activity in 2016 [6]. Furthermore, the socio-economic status was not a determining variable in predicting PAL: in low-income countries and high-income countries, the percentage of inactive children and adolescents was about 85 and 79%, respectively [6].

Sedentary habits during childhood and adolescence can generate a non-virtuous circular process, in which reduced levels of physical activity contribute to further reducing opportunities for motor practice (i.e., sports activities, recreational activities, group games, unstructured physical activity, free play, etc.), with consequent negative effects on physical literacy and motor development [7].

The latest data of the HBSC study—Health Behavior in School-aged Children—Health-related behaviors in school-age children [8]—aimed at monitoring the health and related factors of children in about 50 countries in Europe and North America, highlighted that (data referred to 2018):

- since 2014 there has been a global progressive decline in levels of moderate to vigorous physical activity (MVPA) in children and adolescents;
- only 20% of children and adolescents practiced daily physical activity;
- the percentage of children/adolescents who regularly practice physical activity decrease progressively as age increase;
- a high proportion of young people regularly consume alcoholic beverages;
- one in five teenagers is overweight/obese.

In Italy, the results of the HBSC report showed low levels of daily consumption of fruit and vegetables (about 27% of young people), low levels of daily moderate to vigorous physical activity (similar results were found in Portugal and France) and high levels of digital communication (smartphones, tablets, notebooks, etc.), especially in girls aged 15 years old (about 63%).

These results are supported by the latest ISTAT (Istituto Nazionale di Statistica) report referred to 2017–2018, according to which more than 2 million children and adolescents in Italy are overweight (25.5% of children aged 3–17), with a significant prevalence in boys (27.8%) than in girls (22.4%) [9]. Despite the slight decrease in the percentage of overweight/obese children and adolescents—28.5% in 2010–2011 and 25.2% in 2017–2018—the percentage of inactive and sedentary young people still remains very high: 1 million 925 thousand children and adolescents, equal to about 23% of the Italian population aged 3–17 years [9]. Italy together with Cyprus, Spain, Greece and Malta is the country with the highest proportion of overweight/obese children in the 7–8 years range [9].

Furthermore, the latest Okkio alla SALUTE report—the Italian national surveillance system on overweight, obesity and related risk factors in primary school children (6–10 years)—coordinated by the National Center for Disease Prevention and Health Promotion showed that the percentage of overweight and obese children was 20.4 and 9.4%, respectively (data referred to 2019) [10].

What effects on physical fitness and health status?

Healthy lifestyles promote better body composition preventing overweight and obesity [11], improving muscle strength development and a better functionality of the cardiovascular and lymphatic system [12, 13]. Regarding the psychological and cognitive domain, physical activity in childhood and adolescence involves personal well-being [14], and a better cognitive and emotional development [15, 16].

Recent findings revealed changes in body size, body circumferences and the percentage of body fat in adolescents aged 16–17 years [17].

A recent systematic review analyzed the evolution of motor skills in children aged 6–18 years from 1972 to 2015, highlighted a progressive decline in aerobic fitness and muscle power between 1986 and 2010–2012, and a moderate development of muscle strength and speed in the same period [18]. Other studies associated the increasing BMI (Body Mass Index) to decline in physical fitness related to 20 m shuttle run test [19], standing long jump test, sit-and-reach test, 50 m sprint and aerobic fitness [20]. Low physical activity and higher levels of BMI were also associated with reduced motor performance more significant in boys than girls [21–23] and especially in the 13–14 years group [24].

Previous studies, based on the monitoring of physical fitness in Apulia Region (Southern Italy), showed lower motor performance (strength, speed and aerobic fitness) in overweight/obese children aged 9–10 years, associated with lower levels of self-perception and enjoyment compared to normal weight peers [25, 26].

The assessment of physical fitness in adolescents allows the acquisition of transversal and longitudinal information on the development and evolution of motor skills as health indicators. Furthermore, it is possible to infer the evolution of the educational process during adolescence by combining anthropometric and physical fitness data (BMI, strength, speed, aerobic fitness) with psychological factors related to physical activity (e.g., intrinsic motivation, physical self-efficacy, enjoyment).

These data can be used to carry out surveillance studies necessary and unavoidable to program and to put into practice multi-component and interdisciplinary interventions, allowing dialog and synergies between the professionals dealing with health promotion.

In Southern Italy, a large percentage of children and adolescents are overweight-obese (about 32.7%) children and adolescents are very high [9]. In Apulia only 10% of children and adolescents carry out daily physical activity for 1 hour, with 1 out of 5 teenagers overweight or obese; at the same time, there are high levels of consumption of soda and sugars and low consumption of fruits and vegetables (lower than the recommendation of at least 5 servings per day) [8]. Moreover, in addition to the analysis of nutritional status highlighting alarming levels of overweight-obesity, there is a growing feeling of malaise that teenagers live in the relationship with their body image [8].

Health status of children and adolescents were behind the development of the Regional Observatory of Motor Development and Health Prevention in Apulia (Italy), a regional project—included in the Triennial Apulia Guidelines 2019/2021 on Sport [27]—for secondary schools of first and second grade and coordinated by the University of Foggia, afferent to the Laboratory of Didactics Motor Activities, aiming at: (a) assess health status and physical fitness in children and adolescents;

(b) create a regional database on motor development and levels of physical activity accessible and shared by different health professionals; (c) create and achieve regional reference values about physical fitness and PAL; (d) compare PAL and motor development of pupils in different ages; (e) disseminate results in different contexts (school, university, healthcare system, sport, local administrators) by orienting institutional resources and educational interventions; (f) develop and collect good practices, didactic guidelines and methodological implications in physical education (PE) for the promotion of healthy lifestyles. In addition, it allows to acquire and periodically compare quanti-qualitative data on the evolution of physical fitness and motor abilities in different geographical areas, evaluating the effectiveness of school, institutional and sports interventions for health promotion.

In the light of this evidence, this study aims to assess the evolution (development or decline) of strength levels in young adolescents aged 11–12 years, comparing motor performance in 1990 and in 2020 in the same Apulia province (Lecce).

2. Materials and methods

2.1 Sample and study design

The present study used cross-sectional data from the "Regional Observatory of Motor Development and Health Prevention" project in Apulia Region, coordinated by the University of Foggia—Laboratory of Didactics of Motor Activities—aimed at assessing levels of physical fitness and health in young children and adolescents. The sample consisted of 107 and 118 children aged 11–12 years (first grade of the secondary school) attending the same school in Lecce, respectively in 1990 and in 2020.

The data from the 1990 sample were retrieved from physical education teacher's assessment during the monitoring carried out by the University of Foggia in the '90s, while data from 2020 sample were collected as part of the Motor Development and Health Prevention project. Written informed consent was obtained from all children's parents/guardians, both in 1990 and 2020 and stored at school institute.

2.2 Assessment tools

The assessment in 2020 involved anthropometric characteristics and a physical fitness test. Standing height and body weight were measured using a calibrated stadiometer and a balance scale (nearest 0.1 cm), respectively. BMI was obtained by dividing the body weight (kg) by the body height squared (m^2) [28].

After collecting and analyzing the sample's anthropometric characteristics (weight, height and BMI), participants were classified as normal weight (Nw) or overweight-obese (Ow-Ob) according to Cole's standard definition for child overweight and obesity [29].

Starting from BMI, Cole's Scale used cutoff points—based on centiles BMI curves adjusted by age and sex—to define child's normal weight, overweight or obese status [29].

The motor assessment involved the standing long jump—as a part of the Eurofit Fitness Testing Battery [30]—and the medicine ball throw test [31] to evaluate the strength and explosive power of the lower and upper limbs, respectively.

The assessment protocol was the same in 1990 and in 2020, as follows:

- Standing long jump (SLJ) [30]:

- student behind the starting line, previously traced in the gym;
- from here—with the lower limbs slightly apart on the front plane—perform a long jump with a semi-bend on the lower limbs, slandering the arms forward, falling back on the mattress on equal feet;
- measure jump distance in meters, from the starting line to the nearest sign left by the feet or from the other part of the body on the mattress;
- Medicine ball throw 2 kg (MBT) [31]:
- student positioned with his feet slightly apart on the front plane behind a line drawn on the floor—frontal to the throw direction—with his arms high and grabbing a 2 kg medical ball;
- from this position, after performing a semi-bending on the lower limbs, the throws the medical ball forward-up as far as possible;
- measure throw distance in meters.

For both physical fitness test, three trials were carried out. Only the best result was considered.

2.3 Data collection procedure

After recovering data from the PE teachers monitoring in 1990, a group of Graduates in Preventive and Adapted Motor Sciences conducted the assessment in the same school in Lecce (Apulia) in 2020. For better reliability of the results, five secondary school classes were randomly recruited and involved in the study, together with their respective physical education teachers (n = 2).

Sample characteristics—in terms of age and educational attainment—were the same in 1990 and 2020, while PE teacher's characteristics were not considered relevant variables in this study.

The monitoring activities were carried out by agreement with the school manager and the physical education teachers involved.

Three Graduates in Preventive and Adapted Motor Sciences were recruited by the Laboratory of Didactics of Motor Activities and trained to standardize the assessment protocol.

The assessment was conducted during curricular physical education lessons in January 2020 by Graduates in Preventive and Adapted Motor Sciences and PE teachers.

2.4 Statistical analysis

After verifying the normal distribution of data with the Saphiro-Wilk test (abnormal and minimum/maximum values were excluded), the results of the descriptive analyses were reported in terms of mean and standard deviation (M ± SD). After verifying the homoscedasticity condition (Levene test), variance analysis (ANOVA) was performed to compare motor performance in 1990 and 2020 (a) based on gender and BMI, and (b) based on total sample according to BMI. The effect size (ES; ηp^2) was reported to estimate the size of the detected differences, interpreting the values as follows: $\eta p^2 \sim 0.020$ = low ES, $\eta p^2 \sim 0.50$ = medium ES and $\eta p^2 \sim 0.80$ = high ES [32]. The chi-square test was used to highlight any differences in the distribution of normal weight and overweight-obese adolescents in 1990 and 2020. Linear regression analysis was performed to investigate variance in physical fitness test explained by BMI in 1990 and 2020. Data analysis was conducted using SPSS ver.25 software. All levels of significance were set at $p < 0.05$.

3. Results

Table 1 summarizes the anthropometric characteristics (age, weight, height and BMI) according to gender and BMI (normal weight and overweight-obese).

The analysis related to the prevalence of overweight-obesity (**Table 2**) showed that:

a. **the proportion of overweight adolescents increased significantly from 5.3 (1990) to 20.6% (2020) in boys ($X^2 = 6.250, p = 0.012$), and from 4.0 (1990) to 34.5% (2020) in girls ($X^2 = 13.762, p = 0.000$);**

b. **the percentage of the normal weight on total sample decreased significantly from 92.5 to 60.2% ($X^2 = 4.612, p = 0.032$), while the percentage of overweight and obese children increased from 4.7 to 27.1% ($X^2 = 19.703$, $p = 0.000$) and from 2.8 to 12.7% ($X^2 = 8.000, p = 0.005$), respectively.**

Table 3 and **Figures 1** and **2** summarize the results of the physical fitness tests according to gender and BMI (Male/Female and Nw/Ow-Ob). Results showed better motor performance in the SLJ test in 1990 compared to 2020, regardless of gender and/or BMI (male normal weight $p = 0.016$; male overweight-obese $p = 0.049$; female normal weight $p = 0.000$; female overweight/obese $p = 0.049$; total normal weight

Sample						
		N	**Age**	**Weight**	**Height**	**BMI**
1990						
Male	Nw	54	11.17 ± 0.50	40.38 ± 7.32	1.50 ± 0.07	17.69 ± 2.17
	Ow-Ob	3	11.67 ± 1.15	54.33 ± 1.52	1.52 ± 0.07	23.57 ± 1.49
Female	Nw	45	11.02 ± 0.33	40.60 ± 7.46	1.49 ± 0.05	17.96 ± 2.55
	Ow-Ob	5	11.20 ± 0.45	60.20 ± 9.98	1.51 ± 0.05	26.28 ± 3.04
2020						
Male	Nw	42	11.60 ± 0.49	40.32 ± 7.84	1.50 ± 0.08	17.73 ± 2.14
	Ow-Ob	21	11.62 ± 0.49	58.54 ± 10.47	1.52 ± 0.06	24.98 ± 3.29
Female	Nw	29	11.24 ± 0.43	40.64 ± 7.75	1.51 ± 0.08	17.45 ± 1.89
	Ow-Ob	26	11.62 ± 0.50	59.38 ± 8.19	1.53 ± 0.05	25.04 ± 2.90

Nw = normal weight, Ow-Ob = overweight-obese.

Table 1.
Anthropometric characteristics of the sample.

Percentage of normal weight and overweight-obese adolescents								
		1990		2020		X^2	*df*	*p*
		n	%	*n*	%			
Male	Nw	54	94.7	42	66.7	1.500	1	0.221
	Ow	3	5.3	13	20.6	6.250	1	0.012
	Ob			8	12.7	/	/	/
Female	Nw	45	90	29	52.7	3.459	1	0.063
	Ow	2	4.0	19	34.5	13.762	1	0.000
	Ob	3	6.0	7	12.7	1.600	1	0.206
Total	Nw	99	92.5	71	60.2	4.612	1	0.032
	Ow	5	4.7	32	27.1	19.703	1	0.000
	Ob	3	2.8	15	12.7	8.000	1	0.005

Table 2.
Sample distribution about BMI.

Physical fitness test								
			1990	2020				
			$M \pm$ SD	$M \pm$ SD	*F*	*df*	*p*	ηp^2
Male	SLJ	Nw	1.57 ± 0.23	1.46 ± 0.24	6.015	1	0.016	0.060
		Ow-Ob	1.23 ± 0.22	1.20 ± 0.20	4.253	0.1	0.049	0.162
	MBT	Nw	4.88 ± 0.87	4.24 ± 1.05	10.591	1	0.002	0.101
		Ow-Ob	4.70 ± 1.15	4.10 ± 0.76	1.408	1	0.248	0.060
Female	SLJ	Nw	1.43 ± 0.18	1.21 ± 0.18	24.828	1	0.000	0.256
		Ow-Ob	1.38 ± 0.24	1.10 ± 0.22	4.171	1	0.049	0.134
	MBT	Nw	4.31 ± 0.72	3.64 ± 0.48	18.737	1	0.000	0.206
		Ow-Ob	5.01 ± 0.75	3.83 ± 0.63	13.560	1	0.001	0.319
Total	SLJ	Nw	1.51 ± 0.21	1.36 ± 0.25	17.699	1	0.000	0.095
		Ow-Ob	1.42 ± 0.22	1.15 ± 0.21	8.599	1	0.005	0.144
	MBT	Nw	4.62 ± 0.85	4.00 ± 0.91	20.792	1	0.001	0.110
		Ow-Ob	4.89 ± 0.85	3.95 ± 0.70	11.439	1	0.001	0.178

Table 3.
Motor performance about gender and BMI.

$p = 0.000$; total overweight/obese $p = 0.005$). The effect size values were relatively low; higher levels were reported in the normal weight female group ($\eta p^2 = 0.256$).

The same results were obtained in the MBT test: all groups showed higher motor performances in 1990 compared to 2020 (male normal weight $p = 0.002$; female normal weight $p = 0.000$; female overweight/obese $p = 0.001$; total normal weight $p = 0.001$; total overweight/obese $p = 0.001$), except in male overweight/obese.

Data analysis revealed better results in the 1990 sample, suggesting a decline in lower and upper limb strength levels. The effect size values were relatively low, except in female overweight/obese group ($\eta p^2 = 0.319$).

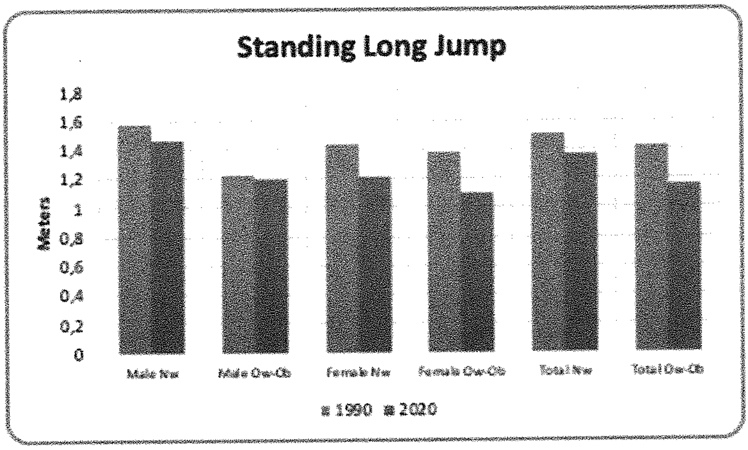

Figure 1.
Performance in SLJ:1990 vs 2020.

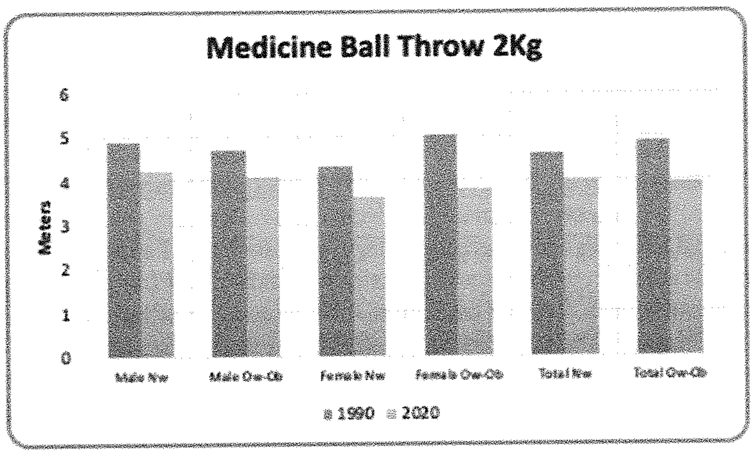

Figure 2.
Performance in MBT: 1990 vs 2020.

Linear regression between BMI and physical fitness test										
	BMI in 1990					**BMI in 2020**				
	b	***R*²**	***F***	***df***	***p***	***b***	***R*²**	***F***	***df***	***p***
SLJ	−0.190	0.036	3.971	1	0.052	**−0.329**	0.108	14.092	1	**0.000**
MBT	**0.213**	0.046	5.006	1	**0.027**	0.118	0.014	1.141	1	0.202

Table 4.
Relationship between BMI and motor performance.

Regression analysis (**Table 4**) highlighted the relation between BMI and motor performance: in 1990 BMI was significantly related to MBT (b = 0.213. p = 0.027) explaining only 4.6% of total variance, and in 2020 BMI was inversely related to SLJ (b = −0.329, p = 0.000, with the 10.8% of the total variance explained).

4. Discussion

This study aimed to assess and compare the evolution of physical fitness in adolescents attending the first year of secondary school in 1990 and in 2020.

The first statistically significant (and alarming) data was related to the sample's distribution: the percentage of overweight and obese male adolescents increased from 5.3% in 1990 to 33.3% in 2020, and from 10.0 to 47.2% in females. This data, in addition to soliciting the interest of coaches, PE teachers, parents and institutional policies (*something has changed?*), reflected the decline and involution of physical fitness over the last 30 years.

Results showed a reduction and decline in motor performance from 1990 to 2020, both in boys and girls regardless of the BMI. In addition, this study showed more significant differences in girls than boys. The interpretation of the physical fitness test underlined a key concept: adolescents in 1990 were stronger than those in 2020, and this result cannot be considered separately from the increase in the percentage of overweight-obesity.

BMI was related to MBT in 1990 and no relation was found SLJ in the same year. In 2020 BMI was negatively associated with the SLJ, without significant effects on MBT. These results lead to the following (possible) considerations:

- in 1990 the low percentage of overweight-obese children did not allow to define the BMI a variable significantly associated with the strength of the lower limbs (SLJ). At the same time, overweight-obese children in 1990 had higher upper limb strength (MBT). The BMI helped to explain only 4.6% of variance of MBT in 1990: a small percentage, although statistically significant, that put the BMI in second plane in explaining these differences, considering that the sample was almost exclusively normal weight (92.5%);

- in 2020 the BMI was inversely related to SLJ, so as the BMI increases, the motor performance in the SLJ progressively reduced. Only BMI explains about 11% of the total variance in the SLJ.

Contrary to findings evidenced by other studies [24, 33], according to which the BMI increase it corresponds an increase of the upper limbs strength in the MBT, this study did not provide a significant relation between BMI and MBT. This could imply a flattening of motor performance and upper limb strength levels, regardless of BMI levels. BMI did not determine, in this case, a greater strength expression in tasks that require moving and/or moving an object (e.g., throwing), but it influences significantly the SLJ, that is, a task requiring the horizontal movement of the entire body, stressing the need to define physical fitness sex-specific and age-specific normative values for children and adolescents [34].

The results of this study were partly confirmed by previous studies. A recent systematic review, analyzed the evolution of motor abilities (strength, speed, flexibility and coordination) from 2006 to 2019 in children and adolescents aged 4–18 years, showing the decline in physical fitness over the past decade, especially in terms of aerobic fitness, strength and flexibility [35].

A further review analyzed the evolution of motor performance in children and adolescents (6–18 years) from 1972 to 2015, considering aerobic fitness, strength, muscle power and speed as health indicators [18]. The results of the 22 studies included in the systematic review can be summarized as follows:

- development of aerobic fitness from 1972 to 1986, and a subsequent decline until 2010–2012, then stabilized until 2015;
- slight increase in muscle strength (stable since 2006);
- progressive reduction and loss of muscle power (expression of strength in the shortest time possible) with a slight increase in speed (especially in the 3 years 2012–2015).

Contrary to the trends highlighted so far, positive trends of improvement of motor abilities (from 1989 to 2019) were reported in Slovenian children aged 7–10 years, especially in girls [36].

A further Slovenian study showed, however, a negative trend between the increase in anthropometric factors (especially BMI) and the decline in motor abilities, emphasizing a significant reduction in lower and upper limb strength levels, with peaks (in terms of involution) observed in the years 1993/1994–2003/2004 [37].

What has been highlighted so far is even more worrying and is an important wake-up call considering that the development of physical fitness—especially the standing long jump—is an important health indicator in children and adolescents [38].

These results suggest that the progressive reduction of health-related components and physical fitness was more oriented towards overweight-obese children showing worse motor performances in aerobic fitness, muscular endurance and explosive muscular power [39].

The strength development also has important effects and implications for the prevention of numerous non-communicable diseases and premature death. A recent study analyzed the evolution of the muscular strength of the American population—assessed through Hand Grip (grip strength)—in the years 2011–2012 and 2013–2014 on 12295 participants aged 6–85 years. Although, the results did not reveal significant differences over the years (based on age, gender, and ethnicity), they stressed and reiterated the importance of assessing and monitoring the strength development of the entire population, as an important indicator of the general health status [40].

Other studies, in addition to highlighting significant lower physical fitness measures (grip strength, standing long jump, 20-meter shuttle run) and motor competence (throwing and catching skills) in schoolchildren aged 13–14 years from 2014 to 2019, reported the reduction of the 16% of the hours spent in physical education between 2010 and 2019 [40]. Data revealed that the normal-weight group has highlighted the most important decline in fitness levels and motor competence compared to the overweight-obese peers [41].

Furthermore, a recent systematic review and meta-analysis examined the effects of physical education interventions carried out on curricular time, based on quanti-qualitative intervention protocols, in terms of motor development and motor skills learning [42]. Results suggest that quanti-qualitative interventions are associated with an increase in aerobic fitness, strength and, at the same time, allows to enhance end improve motor learning [42].

The learning of motor skills is guaranteed by the interaction of the child with the environments, spaces, tools, objects, classmates, and is mediated by the circular relation between the executive variants (spatial-temporal-qualitative-quantitative) applied to one or more fundamental motor skills (e.g., jump + long-forward), and sense-perceptual, coordinative and conditional abilities functional to a specific motor task (e.g., jump long-forward = rapid strength of lower limbs).

This study captured BMI and physical fitness in two-time points highlighting moderate changes in physical strength in children in Apulia.

Despite the randomization of the sample in the same school in 1990 and the involvement of the same protocols in performing SLJ and MBT, some limitations of the study that would have increased the magnitude and the generalization of the results emerged.

Socio-economic status, levels of motor competence, behaviors, diet, eating habits and maturation, as well as factors related to the practice of physical activity (e.g., enjoyment, self-perception, intrinsic motivation, etc.), were not available at both time points (1990 and 2020), so the conclusions are based only on objective measures (BMI and muscular strength).

5. Conclusions

The present study provides several considerations regarding the decline in muscular strength in adolescents according to (a) the increase in BMI and sedentary lifestyles, (b) general lower health status and (c) motor learning processes. The progressive decline in motor performance and the corresponding increase in BMI, therefore, affects not only physical education teachers, graduates in motor science, coaches, etc. but the entire public health system, requiring a convergence of intentions and interventions by educational, political, cultural, social and health Apulia institutions. The analysis and interpretation of the data show the need to monitor and, consequently, intervene through the implementation of good practices in the younger populations.

Despite the undoubted positive effects linked to a physical education based on quanti-qualitative interventions, further opportunities are also needed to encourage and expand the time spent in physical activity (e.g., through active breaks, active lessons and active transport).

Future research should be oriented at monitoring health status, anthropometric characteristics and physical fitness (in terms of strength, speed, aerobic fitness and flexibility) in children and adolescents involving more factors, such as socio-economic status, ethnic group, urban or rural environment, etc. to obtain results that are as representative as possible of a specific target sample.

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Conflict of interest

The authors declare no conflict of interest.

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References

[1] Bhaskaran K, Santos-Silva I, Leon DA, Douglas IJ, Smeeth L. Association of BMI with overall and cause-specific mortality: A population-based cohort study of 3·6 million adults in the UK. The Lancet Diabetes and Endocrinology. 2018;**6**(12):944-953

[2] Zhang T, Xu J, Li S, Bazzano LA, He J, Whelton PK, et al. Trajectories of childhood BMI and adult diabetes: The Bogalusa Heart Study. Diabetologia. 2019;**62**(1):70-77

[3] Umer A, Kelley GA, Cottrell LE, Giacobbi PJ, Innes KE, Lilly CL. Childhood obesity and adult cardiovascular disease risk factors: a systematic review with meta-analysis. BMC Public Health. 2017;**17**(1):683

[4] Pinheiro MB, Oliveira J, Bauman A, Fairhall N, Kwok W, Sherrington C. Evidence on physical activity and osteoporosis prevention for people aged 65+ years: a systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. International Journal of Behaviour Nutrition and Physical Act. 2020;**17**(1):150

[5] Rosique-Esteban N, Babio N, Díaz-López A, Romaguera D, Alfredo Martínez J, Sanchez VM, et al. Leisure-time physical activity at moderate and high intensity is associated with parameters of body composition, muscle strength and sarcopenia in aged adults with obesity and metabolic syndrome from the PREDIMED-Plus study. Clinical Nutrition. 2019;**38**(3):1324-1331

[6] Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 16 million participants. The Lancet Child & Adolescent Health. 2020;**4**(1):23-35

[7] Faigenbaum AD, Rebullido TR, MacDonald JP. Pediatric Inactivity Triad: A Risky PIT. Current Sports Medicine Reports. 2018;**17**(2):45-47

[8] Cavallo F, Dalmasso P, Vieno A, Lazzeri G, Galeone D. La Sorveglianza HBSC 2018.

[9] Stili di vita di bambini e ragazzi. Anni 2017-2018 [Internet]. 2019. Available from: https://www.istat.it/it/files/2019/10/Report_Stili_di_vita_minori.pdf [Accessed: January 11, 2022]

[10] Indagine nazionale 2019: i dati nazionali. Available from: https://www.epicentro.iss.it/okkioallasalute/indagine-2019-dati [Accessed: January 11, 2022]

[11] Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. Cochrane Database of Systematic Reviews. 2017;**6**(6):CD012691

[12] Abrignani MG, Lucà F, Favilli S, Benvenuto M, Rao CM, Di Fusco SA, et al. Lifestyles and cardiovascular prevention in childhood and adolescence. Pediatric Cardiology. 2019;**40**(6):1113-1125

[13] Alves JGB, Alves GV. Effects of physical activity on children's growth. Journal of Pediatrics. 2019;**95**(Suppl. 1):72-78

[14] Hosker DK, Elkins RM, Potter MP. Promoting mental health and wellness in youth through physical activity, nutrition, and sleep. Child and Adolescent Psychiatric Clinics of North America. 2019;**28**(2):171-193

[15] Singh AS, Saliasi E, van den Berg V, Uijtdewilligen L, de Groot RHM, Jolles J, et al. Effects of physical activity interventions on cognitive and academic performance in children and adolescents: a novel combination of a systematic review and recommendations from an expert panel. British Journal of Sports Medicine. 2019;**53**(10):640-647

[16] Rodriguez-Ayllon M, Cadenas-Sánchez C, Estévez-López F, Muñoz NE, Mora-Gonzalez J, Migueles JH, et al. Role of physical activity and sedentary behavior in the mental health of preschoolers, children and adolescents: A systematic review and meta-analysis. Sports Medicine. 2019;**49**(9):1383-1410

[17] Godina EZ, Lhagvasuren G, Shagdar B-E, Zadorozhnaya LV, Permiakova EY, Khomiakova IA. Secular changes in Mongolia: Shift in Tempos of growth. Collegium Antropologicum. 2019;**43**:11-20

[18] Führer T, Kliegl R, Arntz F, Kriemler S, Granacher U. An update on secular trends in physical fitness of children and adolescents from 1972 to 2015: A systematic review. Sports Mediicne. 2021;**51**:303-320

[19] Tomkinson GR, Léger LA, Olds TS, Cazorla G. Secular trends in the performance of children and adolescents (1980-2000): An analysis of 55 studies of the 20m shuttle run test in 11 countries. Sports Medicine. 2003;**33**(4):285-300

[20] Bi C, Zhang F, Gu Y, Song Y, Cai X. Secular trend in the physical fitness of Xinjiang children and adolescents between 1985 and 2014. International Journal of Environmental Research and Public Health. 2020;**17**:2195

[21] Colley RC, Clarke J, Doyon CY, Janssen I, Lang JJ, Timmons BW, et al. Trends in physical fitness among Canadian children and youth. Health Reports. 2019;**30**(10):3-13

[22] Dong Y, Lau PWC, Dong B, Zou Z, Yang Y, Wen B, et al. Trends in physical fitness, growth, and nutritional status of Chinese children and adolescents: a retrospective analysis of 1·5 million students from six successive national surveys between 1985 and 2014. The Lancet Child & Adolescent Health. 2019;**3**(12):871-880

[23] Milanovic I, Radisavljevic-Janic S, Zivkovic MZ, Mirkov DM. Health-related physical fitness levels and prevalence of obesity in Serbian elementary schoolchildren. Nutrición Hospitalaria. 2019;**36**:253-260

[24] Pate RR, Schenkelberg MA, Dowda M, McIver KL. Group-based physical activity trajectories in children transitioning from elementary to high school. BMC Public Health. 2019;**19**(1):323

[25] Colella D, Monacis D, d'Arando C. Motor performances in relation to perceived physical self-efficacy, enojoyment and BMI in primary school children. European Journal of Physical Education and Sports Science. 2020;**6**(3):27-46

[26] Colella D, Bellantonio S, D'Arando C, Monacis D. Interventions for the promotion of motor activities in primary school. Assessment of motor performance in relation to perceived self-efficacy and enjoyment. Italian Journal of Educational Research. 2020;**25**:49-62

[27] Bozza Linee Guida Triennali 2019/2021 in materia di Sport [Internet]. Available from: http://www.pugliasportiva.it/visualizzazione?p_p_id=visualizzazionedettagliocontenuti_WAR_visualizzazionefrontendportlet01&_visualizzazionedettagliocontenuti_WAR_visualizzazionefrontendportlet01_myaction=visualizzaDettaglioElemento&idElemento=43782&tipoElemento=Contenuto web [Accessed: February 16, 2022]

[28] Khosla T, Lowe CR. Indices of obesity derived from body weight and height. British Journal of Preventive & Social Medicine. 1967;**21**(3):122-128

[29] Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. BMJ. 2000;**320**(7244):1240

[30] Sport C of EC for the D of. Eurofit: Handbook for the Eurofit Tests of Physical Fitness [Internet]. Council of Europe; 1993.

[31] Morrow JJR, Mood D, Disch J, Kang M. Measurement and Evaluation in Human Performance, 5E [Internet]. Human Kinetics; 2015. Available from: https://books.google.it/books?id=xN5rCgAAQBAJ

[32] Cohen P, West SG, Aiken LS. Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences. Psychology Press; 2014

[33] Colella D, Monacis D, Massari FE. Assessment of motor performances in Italian Primary School Children: Results of SBAM Project. Advances in Physical Education. 2019;**9**(2):117-128

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

[35] Eberhardt T, Niessner C, Oriwol D, Buchal L, Worth A, Bös K. Secular trends in physical fitness of children and adolescents: A review of large-scale epidemiological studies published after 2006. International Journal of Environmental Research and Public Health. 2020;**17**

[36] Potočnik ŽL, Jurak G, Starc G. Secular trends of physical fitness in twenty-five birth Cohorts of Slovenian Children: A Population-Based Study. Frontiers in Public Health. 2020;**8**:616

[37] Đurić S, Sember V, Starc G, Sorić M, Kovač M, Jurak G. Secular trends in muscular fitness from 1983 to 2014 among Slovenian children and adolescents. Scandinavian Journal of Medicine & Science in Sports. 2021

[38] Pinoniemi BK, Tomkinson GR, Walch TJ, Roemmich JN, Fitzgerald JS. Temporal trends in the standing broad jump performance of United States Children and Adolescents. Research Quarterly for Exercise and Sport. 2021;**92**(1):71-81

[39] Albon HM, Hamlin MJ, Ross JJ. Secular trends and distributional changes in health and fitness performance variables of 10-14-year-old children in New Zealand between 1991 and 2003. British Journal of Sports Medicine. 2010;**44**(4):263-269

[40] Loprinzi PD. An initial assessment of secular trends in muscular strength among children, adolescents, and adults across the lifespan: National Sample of Americans. American Journal of Health Promotion. 2016;**32**(3):705-707

[41] Weedon BD, Liu F, Mahmoud W, Burden SJ, Whaymand L, Esser P, et al. Declining fitness and physical education lessons in UK adolescents. BMJ Open Sport & Exercise Medicine. 2022;**8**(1):e001165

[42] García-Hermoso A, Alonso-Martínez AM, Ramírez-Vélez R, Pérez-Sousa MÁ, Ramírez-Campillo R, Izquierdo M. Association of physical education with improvement of health-related physical fitness outcomes and fundamental motor skills among youths: A systematic review and meta-analysis. JAMA Pediatrics. 2020;**174**(6):e200223

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Participation in fitness and sports activities bestows far-reaching benefits on children's growth, physical and mental development, health, skill acquisition, and physical performance. Besides the typical description of common concepts, subjects, and general literature, this book presents a variety of topics associated with physical activity and fitness among children and youth. Work presented in this book ranges from complex descriptions of the role of vitamin D deficiency on children's physical activity and lifelong health to the analyses of the role of motor proficiency among children with an autism spectrum disorder. Some authors report on the association between physical activity and fitness and cognitive function among children while others describe noted differences in selected physical fitness components among children over a span of 30 years. The book also provides empirical insights into the role and status of school sports. While the feasibility and benefits of designed programmes and organized school activities have been demonstrated, the need for targeted specialized interventions and additional knowledge underpins the need for multidisciplinary and inter-sectoral approaches when working with children.

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