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A *Mediation Analysis* on the Relationship of Physical *Fitness* Components, *Obesity*, and *Academic* Performance in Children

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CONCLUSIONS

This investigation contributes to the current knowledge by adding evidence about the crucial role of physical fitness in terms of academic performance rather than obesity status, suggesting that physical fitness may ameliorate the negative influence of obesity on academic performance.

METHODS

A cross-sectional study including data from 250 Spanish schoolchildren (Balearic Islands) between 10 and 12 years of age (mean age, 10.98 ± 0.76 years) was conducted. Obesity measures (body mass index, body fat, waist circumference, hip circumference, and waist-to-height ratio), physical fitness components (cardiorespiratory fitness, muscular fitness, and speed-agility), and academic performance (Spanish language, Catalan language, English language, natural sciences, social sciences, arts, physical education, religion, and grade point average [GPA]) were collected.

INTRODUCTION

To examine the relationship between a battery of obesity indicators and physical fitness components with academic performance in children and to explore the combined and mediation role of the physical fitness components in the relationship between obesity and academic performance in children.

RESULTS

All obesity measures were negatively related to at least 3 of the 10 academic indicators, including GPA (β range, -0.135 to -0.229; all P < .05). Cardiorespiratory fitness and speed-agility were positively related to all academic indicators (β range, 0.182 to 0.350; all P < .046) and muscular fitness with 3 academic indicators (β range, 0.143 to 0.253; all P < .039). Children considered as fit had better academic performance than their unfit peers (score +0.75; P = .001). The association between body mass index and GPA was mediated by cardiorespiratory fitness and speed-agility.

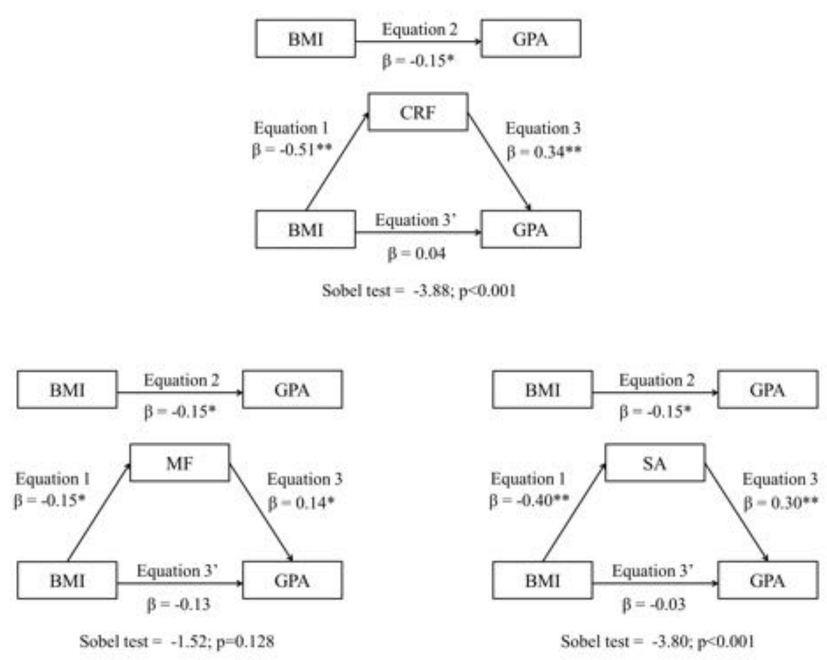

Figure 1. Physical fitness mediation models of the relationship between body mass index and grade point average in children, adjusted by sex, age (years), parental occupational level, and CRF, muscular fitness or speed-agility according to mediation variable included in the model. BMI: body mass index; CRF: cardiorespiratory fitness; MS: muscular strength; SA: speed-agility; GPA: grade point average. *P < .05; **P < .001.

Table 1. Associations of physical fitness components with academic performance in children (n=234).

	Maths		Spanish language		Catalan language		English language		Natural sciences		Social sciences		Arts		Physical education		Religion		Grade point average	
	B	p	β	p	β	p	β	p	β	P	β	p	β	p	β	p	β	p	β	p
Cardiorespiratory fitness (ml/kg/min)																				
Model 1	.329	<.001	.218	.011	.258	.005	.171	.046	.316	<.001	.299	<.001	.299	<.001	.350	<.001	.283	.001	.348	<.001
Model 2	.428	<.001	.189	.089	.220	.044	.245	.029	.291	.007	.294	.007	.378	<.001	.333	.002	.339	.002	.380	<.001
Model 3	.245	.056	.047	.722	.147	.265	.166	.217	.176	.172	.167	.197	.241	.056	.099	.441	.229	.077	.215	.092
Muscular fitness z-score‡																				
Model 1	.232	.001	.065	.355	.050	.470	.073	.299	.082	.237	.063	.362	.109	.107	.253	<.001	.115	.095	.143	.039
Model 2	.222	.001	.045	.524	.030	.668	.069	.330	.055	.428	.040	.569	.096	.158	.229	.001	.101	.147	.121	.079
Model 3	.080	.323	-.084	.313	-.077	.357	-.027	.748	-.088	.277	-.122	.136	-.069	.386	.092	.255	-.031	.702	-.048	.553
Speed-agility (sec^{1})*																				
Model 1	.295	<.001	.220	.001	.182	.008	.148	.033	.253	<.001	.256	<.001	.259	<.001	.340	<.001	.228	.001	.302	<.001
Model 2	.308	<.001	.198	.008	.152	.041	.161	.034	.214	.003	.230	.002	.265	<.001	.313	<.001	.233	.002	.286	<.001
Model 3	.168	.084	.230	.023	.142	.157	.114	.265	.200	.042	.239	.015	.214	.026	.222	.023	.155	.116	.233	.017

β= Beta standardized coefficients; Model 1 and 2: physical fitness components were introduced one by one in regression analysis Model 1: analyses were adjusted for age, sex, age (years), and parental occupational level; Model 2: analyses were adjusted for model 1 plus body mass index; Model 3: analyses were adjusted for model 2 and physical fitness components were simultaneously included in the regression analyses. ‡z-score computed from handgrip strength (kg/kg) and standing long jump (cm) tests. *The lower the score in the 4x10m shuttle run test (i.e. fewer seconds to cover a fixed distance) the higher the performance (i.e. the faster and agiler the child is). Statistically significant values are shown in bold.

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