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The association between vitamin D status, muscle strength, power and cardiorespiratory fitness in adolescents from the Young Hearts Study

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Skeletal muscle is a major target organ of the vitamin D endocrine system⁽¹⁾. Whilst adolescence is a critical period for musculoskeletal development, few studies have investigated the effect of vitamin D status on muscle function and physical fitness in this age group^(2, 3). The aim of this study was to investigate the association between vitamin D status and muscle strength, muscle power and cardiorespiratory fitness (CRF) in adolescents.

A total of 1015, 12- and 15-y-olds from the Young Hearts Study 2000 had serum 25-hydroxyvitamin D (25(OH)D) concentrations quantified using enzyme linked immunoassay (OCTEIA[®], IDS, Ltd., UK). Total skinfolds were used to calculate absolute fat free mass (FFM; kg) and FFM corrected for height (fat free mass index (FFMI); kg/m²). Sargent jump test results were used to calculate peak muscle power (kW)⁽⁴⁾. Muscle strength (kg) was measured by hand grip dynamometry (Takei Scientific Instrument Company Limited, Japan) and VO₂ max, a measure of CRF, was estimated from 20-metre shuttle test scores.

	12-y-old boys		12-y-old girls		15-y-old boys		15-y-old girls	
	n 266		n 260		n 239		n 250	
	β	S.E.	β	S.E.	β	S.E.	β	S.E.
Muscle strength (kg)								
High vs. low tertile	-0.02	0.72	0.92	0.88	3.33*	1.08	0.67	0.86
High vs. middle tertile	0.26	0.71	0.81	0.75	0.30	0.90	0.31	0.80
Muscle power (kW)								
High vs. low tertile	-1.63	1.01	0.05	1.04	-0.56	1.05	-1.07	1.09
High vs. middle tertile	0.77	0.95	-0.35	0.88	0.34	0.97	-0.75	0.80
VO₂max (ml/kg/min)								
High vs. low tertile	0.71	1.11	0.11	1.04	2.76*	1.30	0.63	1.03
High vs. middle tertile	-0.09	1.08	-1.11	0.89	-1.29	1.15	0.79	0.92

Regression analyses to compare the relationship between tertiles of serum 25(OH)D concentration (low, middle and high) and muscle strength, muscle power and cardiorespiratory fitness (VO₂ max), controlling for season, FFMI, energy adjusted protein intake, pubertal status and physical activity scores. *P < 0.05.

Muscle strength and CRF were significantly higher in 15-y-old boys in the high tertile of serum 25(OH)D concentration (>75 nmol/L), compared to those in the low tertile (<50 nmol/L). This association was not evident in any of the other age-sex groups and there were no associations between serum 25(OH)D concentration and muscle power, in any age-sex group. These results confirm the relationship between vitamin D status and muscle strength and CRF; the difference in these relationships between age-sex groups highlights a fast-changing hormone profile during adolescence and warrants further research in this age group.

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