

Interrelationships between anthropometric variables and overweight in childhood

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Background:

Sex and age-adjusted BMI is the most common variable for defining overweight in childhood, although other anthropometric traits give an extended picture of fat distribution and health risk beyond BMI. Among these are waist circumference and skinfolds in different combinations. The purpose of this study was to analyze how BMI and other variables of weight status in children associate during different age groups.

Questions:

- 1) How does BMI correlate to Waist circumference (WC), Waist to Height ratio (WHtR), Waist to Sittingheight ratio (WSHtR), Subscapular (SSF) and Triceps (TSF) skinfolds during different ages in childhood?
- 2) Which weight-related variable contributes most to variation in BMI during childhood?

Methods:

Data on BMI, Height (H), Sittingheight (SH), WC, WHtR, WSHtR, SSF and TSF from 4576 Norwegian children (2309 boys) 4.00-15.99 years of age, and participating in the Bergen Growth Study (2003-06), were transformed to standard deviation scores (SDS) and studied using correlation and multiple regression analyses.

Results:

Estimated correlation between BMI SDS and five standardized anthropometric scores, according to sex and age groups

SEX	Age	WC	WHtR	WSHtR	SSF	TSF
Boys	4-6	0.76	0.66	0.61	0.61	0.58
	7-9	0.86	0.81	0.78	0.78	0.77
	10-12	0.90	0.84	0.80	0.86	0.79
	13-15	0.84	0.79	0.69	0.76	0.67
Girls	4-6	0.81	0.74	0.69	0.72	0.62
	7-9	0.87	0.83	0.79	0.81	0.77
	10-12	0.87	0.81	0.76	0.81	0.76
	13-15	0.84	0.82	0.74	0.74	0.72

Pearsons correlation coefficient. All P < 0.001.
Age: 4-6: 4.00-6.99 years etc.

Multiple linear regression analysis of BMI SDS on seven standardized (SDS) anthropometric variables adjusted for sex and age group

Variable	b	95% CI	P
Intercept	0.018	(-0.01, 0.05)	0.193
Sex(male)	-0.005	(-0.03, 0.02)	0.677
Age group			<0.001
4-6	-0.015	(-0.05, 0.02)	
7-9	-0.032	(-0.07, 0.00)	
10-12	-0.079	(-0.12, -0.04)	
13-15	0.000	(ref)	
H SDS	-0.099	(-0.18, -0.01)	0.022
SH SDS	0.129	(0.05, 0.21)	0.002
WC SDS	0.467	(0.37, 0.56)	<0.001
WHtR SDS	0.407	(0.26, 0.56)	<0.001
WSHtR SDS	-0.256	(-0.40, -0.12)	<0.001
SSF SDS	0.215	(0.19, 0.24)	<0.001
TSFSDS	0.161	(0.14, 0.18)	<0.001

R²: 0.814 (R² adj: 0.814).

Age 4-6: 4.00-6.99 years etc. Abbr: b: regression coefficient; CI: confidence interval; P: P-value from F-test; R²: determination coefficient.

Conclusion: Interrelationships between BMI SDS and five standardized weight related anthropometric variables were dependent on age, being weakest in the youngest age group, and strongest between 7-12 years. WC contributed most strongly to variation in BMI SDS for both sexes and through all ages.

