Body composition parameters, systemic inflammation and Metabolic syndrome manifestations in children and adolescents

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Introduction

Increased adiposity has been associated with smoldering systemic inflammation and metabolic syndrome manifestations, leading to further morbidity by increasing the risk for type 2 diabetes mellitus and cardiovascular disease in adults. Similar analyses have not been performed systematically in children and adolescents.

Hypothesis

This study investigates the interrelations between body composition parameters and indices of inflammation and metabolic syndrome.

Participants

One hundred twenty-one normal weight (40), overweight (22) and obese (59) children and adolescents (43 boys and 78 girls) were studied: Normal weight BMI z-score -0.1923 ± 0.6, Overweight BMI z-score 0.922 ± 0.4 and obese BMI z-score 2.669 ± 1.3 children aged 5-15 years (Table 1).

Table 1. Subjects characteristics and the differences between the two groups. The mean values of each variable are presented along with the estimated standard deviations.

	Normal (N=40)	Overweight and obese (N=81)	p-value
Age	8.74 ± 2.14	9.017 ± 2.276	P=0.522
Sex	70% Female, 30% male	61.7% Female, 38.3%male	P=0.375
BMIz-score	-.1923 ± .596	2.195 ± 1.43	p<0.001
Tanner stage	90% prepubertal 6.5% midpubertal 3.5% postpubertal	80.6% prepubertal 13.9% midpubertal 5.6% postpubertal	P=0.279
Waist to Hip ratio	0.85 ± 0.53	0.9128 ± 0.61	p<0.001
Total Body Water (%of BW)	60.2 ± 8.38	48.47 ± 6.80	p<0.001
Extracellular Water (% of BW)	52.58 ± 4.72	46.88 ± 5.05	p<0.001
Fat Free Mass (% of BW)	89.9 ± 6.18	70.72 ± 7.48	p<0.001
Fat Mass (% of BW)	10.1 ± 6.18	29.28 ± 7.48	p<0.001
Glycogen (% of BW)	0.74 ± 0.13	0.81 ± 0.11	P=0.001
Free glucose	0.03 ± 0,011	0,019±0,013	p<0.001

Methods and Materials

Multifrequency bioimpedance analysis (Biotekna srl. Venice, Italy), blood sampling and anthropometric measurements (height, weight, waist and hip circumferences) were gathered after a 12 hour fasting (overnight) between 8:30 and 10:00 am. The specific full-body hand-to-foot mutlifrequency bioimpedance (BIA) device uses two different frequencies -1.5 kHz and 50 kHz -to estimate more accurately the levels of Extracellular Water (ECW).
The children underwent a standard clinical examination by a pediatrician, including assessment of the pubertal status.

Results

Body fat mass (BFM) both as an absolute value in Kg and as a percentage of body mass was positively associated with morning fasting insulin (Figure2) (rho=0.547, p<0.001 and rho=0.548, p<0.001 respectively), hsCRP (Figure 1) (rho=0.344, p<0.001 and rho=0.397, p<0.001, respectively), ferritin (rho=0.250, p=0.014 and rho=0.305, p<0.001, respectively), uric acid (rho=0.376, p<0.001 and rho=0.431, p<0.001 respectively), triglycerides (rho=0.322, p=0.001 and rho=0.366, p<0.001, respectively), SGPT (rho=0.214, p=0.042 and rho=0.235, p=0.006, respectively) and γGT(rho=0.37, p<0.001 and rho=0.387, p<0.001, respectively) concentrations. BFM as an absolute value in Kg and as a percentage was negatively associated with high density lipoprotein (rho=-0.309, p=0.002 and rho=-0.339, p<0.001, respectively) and iron (rho=-0.325, p=0.002 and rho=-0.298, p<0.001, respectively) concentrations. Extracellular water percentage was negatively associated with insulin (rho=-0.474, p<0.001) and hsCRP (rho=-0.321, p=0.011), while skeletal muscle mass both as an absolute value in Kg and as a percentage (%) of body mass were also respectively associated with insulin (rho=0.415, p<0.001 and rho=0.534, p<0.001) and hsCRP (rho=0.249, p=0.05 and rho=0.327, p=0.009) concentrations. Moreover, insulin levels correlated positively with glucose levels estimated by the BIA-ACC apparatus (rho=0.352, p<0.001). All the above statistical analyses were adjusted for sex and Tanner pubertal stages.

Figure 1. Body Fat percentage correlated positively with High sensitivity CRP (Rho=0.397, p-value=0.001)

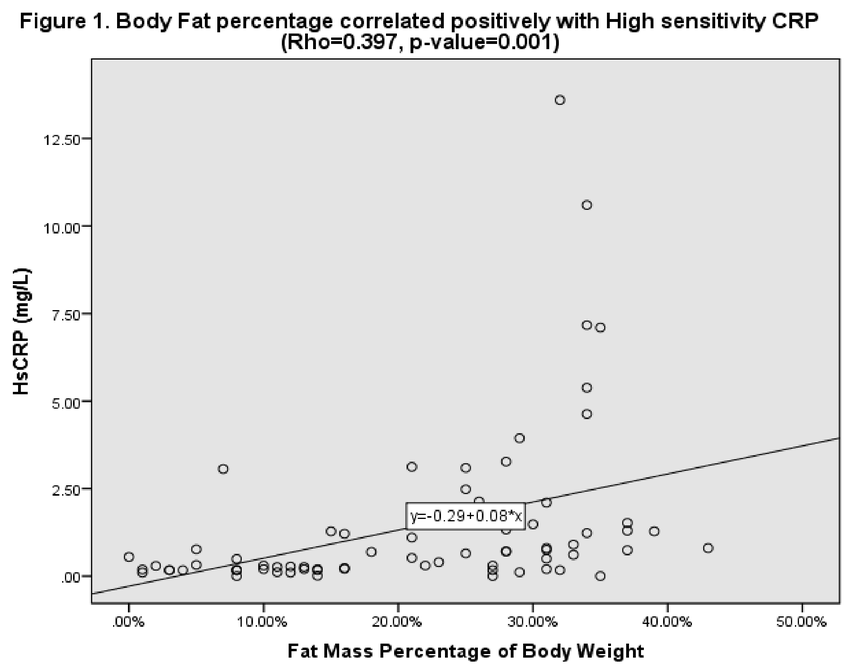
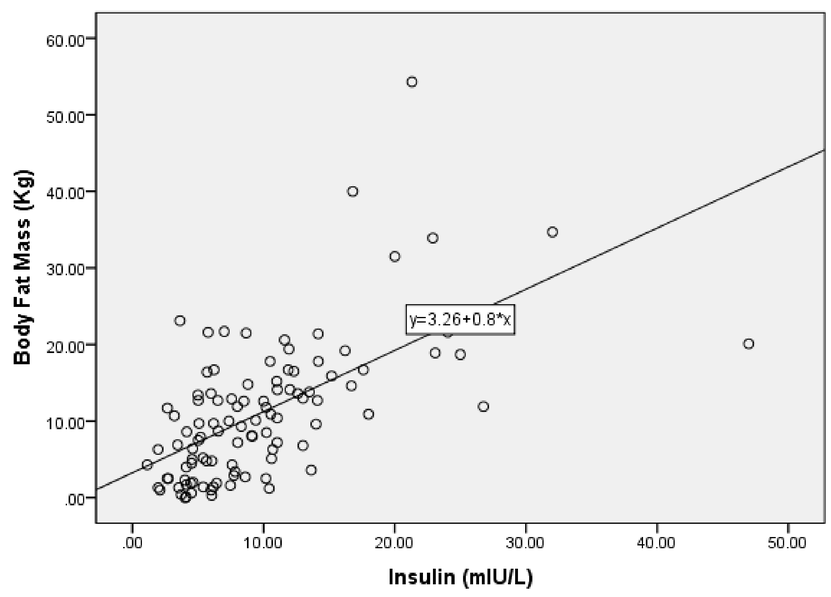


Figure 2. Body fat mass (BFM) as an absolute value in Kg was positively associated with morning fasting insulin (Rho=0.547, p=0.000)



Conclusion

Body fat accumulation in children is associated with elevated inflammatory and metabolic syndrome markers. Bioelectric impedance can be a direct screening and monitoring tool for the assessment of metabolic disorders in children and adolescents. Further studies are needed to evaluate the pathophysiologic mechanisms mediating these effects in children.

Sources of research support

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