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ORIGINAL ARTICLE

Fat mass index performs best in monitoring management of obesity in prepubertal children☆,☆☆

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KEYWORDS
Body mass index;
Fat mass index;
Monitoring;
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Abstract
Objective: An early and accurate recognition of success in treating obesity may increase the compliance of obese children and their families to intervention programs. This observational, prospective study aimed to evaluate the ability and the time to detect a significant reduction of adiposity estimated by body mass index (BMI), percentage of fat mass (%FM), and fat mass index (FMI) during weight management in prepubertal obese children.
Methods: In a cohort of 60 prepubertal obese children aged 3–9 years included in an outpatient weight management program, BMI, %FM, and FMI were monitored monthly; the last two measurements were assessed using air displacement plethysmography. The outcome measures were the reduction of >5% of each indicator and the time to achieve it.
Results: The rate of detection of the outcome was 33.3% (95% CI: 25.9–41.6) using BMI, significantly lower ($p < 0.001$) than either 63.3% using %FM (95% CI: 50.6–74.8) or 70.0% (95% CI: 57.5–80.1) using FMI. The median time to detect the outcome was 71 days using FMI, shorter than 88 days using %FM, and similar to 70 days using BMI. The agreement between the outcome detected by FMI and by %FM was high (kappa 0.701), but very low between the success detected by BMI and either FMI (kappa 0.231) or %FM (kappa 0.125).
Conclusions: FMI achieved the best combination of ability and swiftness to identify reduction of adiposity during monitoring of weight management in prepubertal obese children.
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☆☆ Study linked to the Nutrition Lab, Hospital de Dona Estefânia, Centro Hospitalar de Lisboa Central, Lisbon, Portugal.
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PALAVRAS-CHAVE
Índice de massa corporal;
Índice de massa gorda;
Monitoramento;
Percentual de massa gorda;
Crianças pré-púberes;
Obesidade

Índice de massa gorda apresenta melhor desempenho no monitoramento do tratamento da obesidade em crianças pré-púberes

Resumo
Objetivo: O reconhecimento precoce e preciso do sucesso no tratamento da obesidade pode aumentar a adesão de crianças obesas e suas famílias a programas de intervenção. Este estudo observacional prospectivo visa avaliar a capacidade e o tempo de detecção de uma redução significativa na adiposidade estimada pelo índice de massa corporal (IMC), no percentual de massa gorda (% MG) e no índice de massa gorda (IMG) durante o controle de peso em crianças obesas pré-púberes.
Métodos: Em uma coorte de 60 crianças obesas pré-púberes com idades entre 3 e 9 anos, incluídas em um programa ambulatorial de controle de peso, o IMC, o % MG e o IMG foram monitorados mensalmente, e as duas últimas medições avaliadas foram feitas utilizando pletismografia por deslocamento de ar. As medições resultantes foram redução de > 5% de cada indicador e atingir o tempo para tanto.
Resultados: A taxa de detecção do resultado foi de 33,3% (IC de 95% 25,9-41,6) utilizando IMC, significativamente menor (p < 0,001) que 63,3% utilizando % MG (IC de 95% 50,6-74,8) ou 70,0% (IC de 95% 57,5-80,1) utilizando IMG. O tempo médio para detectar o resultado foi de 71 dias utilizando o IMG, menos que 88 dias utilizando %MG e semelhante a 70 dias utilizando o IMC. A concordância entre o resultado detectado pelo IMG e pelo % MG foi elevada (kappa 0,701), porém muito baixa entre o sucesso detectado pelo IMC e pelo IMG (kappa 0,231) ou %MG (kappa 0,125).
Conclusões: O IMG atingiu a melhor combinação de capacidade e precocidade para identificar redução na adiposidade durante o monitoramento do controle de peso em crianças obesas pré-púberes.
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Introduction

While definition of obesity is based on excessive adiposity,[1] the best measurement for degree of body fatness remains controversial.[2] The heterogeneity of outcome measures used to assess the effectiveness of interventions in childhood obesity has made it difficult to compare results.[3]

In large-scale population surveys and clinical or public health screening, body mass index (BMI) is commonly used as a surrogate measure for body fat content[1,4]; it is typically adjusted for age and sex, and expressed as centiles or Z-scores.[5] While BMI is a good index of cardio-metabolic risk, it may be not a good index of adiposity.[6] In a recent meta-analysis, BMI was found to have high specificity but low sensitivity for detection of excess adiposity in children.[7] BMI may be particularly biased as a proxy for longitudinal adiposity assessment in children since strong correlations exist between BMI and components of weight other than body fat mass (FM), such as lean mass and bone mass.[6,8] In addition, it is not certain that a child tracking along a given BMI centile will also maintain this position in the distribution of body fat.[9] Consequently, BMI may not be recommended to monitor adiposity changes in children.[9–11]

The percentage of fat mass (%FM), defined as fat mass/body weight × 100, has been commonly used as a more reliable index of body-size-adjusted adiposity.[1] Being a proportion, with FM included both in numerator and denominator (as component of body mass), %FM may be difficult to interpret either as a measure of adiposity[2] or as an indicator of its changes.[9] Adjusting FM to an unrelated measure of body size, such as a linear measure (*i.e.*, height), has been suggested as a strategy to improve interpretation.[12] The FM index (FMI), defined as FM (kg) divided by height squared (m^2), has been proposed to better discriminate adiposity than %FM,[2] and reference values for children have been published.[8,13]

Air displacement plethysmography (ADP) is a reliable two-compartment model to evaluate changes in adiposity in children by measuring FM and %FM.[14] It has been validated in children aged 7–10 years.[15]

Performance of BMI, %FM, and FMI in detecting adiposity changes has been assessed and compared in growing children,[9–11,16] but data are scarce on the performance of these indicators in obese children participating in weight management programs.[17] It is postulated that earlier positive reinforcement will contribute to the success of weight management programs.

This study evaluated the performance of BMI, %FM, and FMI in monitoring adiposity changes during weight management intervention in prepubertal obese children, in order to identify which indicator has the highest early detection rate of adiposity reduction. The authors hypothesize that FMI is a better early indicator of adiposity reduction than %FM and BMI.

Methods

This prospective, observational study included a convenience cohort of 60 prepubertal obese children (34 females) consecutively referred during a period of one year to a tertiary pediatric hospital outpatient clinic for confirmed childhood obesity. Obesity was defined as BMI over the 95th

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