Tri-Ponderal Mass Index. A good anthropometric index to evaluate adiposity in children and adolescents

Klünder-Klünder Miguel[1], Bravo-Peregrina Myrna[2], López-González Desirée[3], Clark Patricia[3], Miranda-Lora América Liliana[2].

Research Division[1]; Evidence-Based Medicine Research Unit[2]; Clinical Epidemiology Research Unit[3]; Hospital Infantil de México Federico Gómez.

Contact: klunderk@gmail.com

Introduction

The adiposity measurement by reliable methods such as dual X-ray absorptiometry (DXA) is not feasible in routine medical care. Instead of this, the anthropometric methods are used in clinical practice to evaluate the overweight and obesity status[1,2]. However, these methods could be inaccurate to estimate the body fat content.

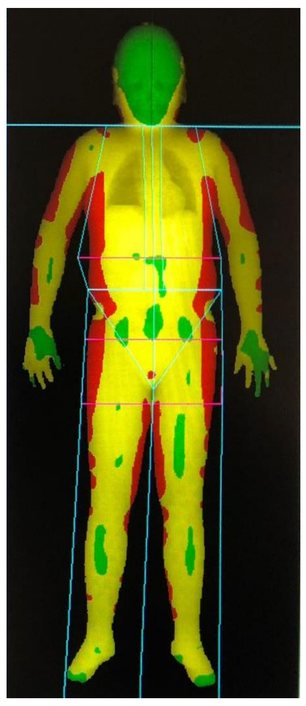
In addition, in pediatric patients, some anthropometric indexes require percentiles or Z-scores for their interpretation, like the body mass index (BMI) or the waist circumference (WC). Although anthropometric indexes with a single cut-off point, such as tri-ponderal mass index (TMI [weight / height^3]) or waist-to-height ratio (WHtR) have been proposed as an alternative to adiposity assessment, it is important to evaluate their accuracy.

Objective

Evaluate different anthropometric methods to estimate body fat content by DXA (bfDXA) in children and adolescents.

Methods

A cross-sectional study was conducted in 1,513 children and adolescents between 5 to 18 years old. In all participants we measure weight, height and WC by standardized methods and BMI, TMI and WHtR were calculated. The body fat content was evaluated by whole body less head DXA with GE Lunar iDXA equipment. A linear regression analysis was performed of each anthropometric parameter to estimate bfDXA. We also analyzed ROC curves for the detection of overweight/obesity (≥p85 bfDXA) and we identified the optimal cut-off value for TMI in our population at point where the Youden´s index is maximum. We compared the diagnostic performance of BMI-Z, WC, WHtR and TMI. Ethic approval by the local Research Committee HIM-2015-055.



Results

Characteristics of the study population, by gender

	Boys n=746 (53%)	Girls n=666 (47%)
	Mean SD	Mean SD
Age (years)	11.7 ± 3.6	11.4 ± 3.7
BMI (kg/m^2)	19.7 ± 4.2	20.0 ± 4.5
BMI-Z WHO	0.6 ± 1.4	0.6 ± 1.2
BMI-Z NCHS-CDC	0.3 ± 1.2	0.5 ± 1.1
TMI (kg/m^3)	13.5 ± 2.4	14.2 ± 2.5
WC WHO (cm)	69.0 ± 12.7	67.2 ± 11.9
WC NIH (cm)	71.2 ± 13.5	70.6 ± 13.0
%bfDXA	28.0 ± 8.6	34.6 ± 6.9
Pubertal n(%)	395 (52.95)	422 (63.36)
OW/OB by DXA n(%)	108 (14.5)	97 (14.6)
OW/OB by BMI-Z WHO n(%)	277 (37.1)	254 (38.1)

SD: standard deviation. OW: overweight. OB: obesity. BMI: body mass index. BMI-Z: Z score of BMI. TMI: triponderal mass index. WC: waist circumference. DXA: dual X-ray absorciometry. WHO: World Health Organization. NCHS: National Center for Health Statistics. CDC: Center for Disease Control and Prevention

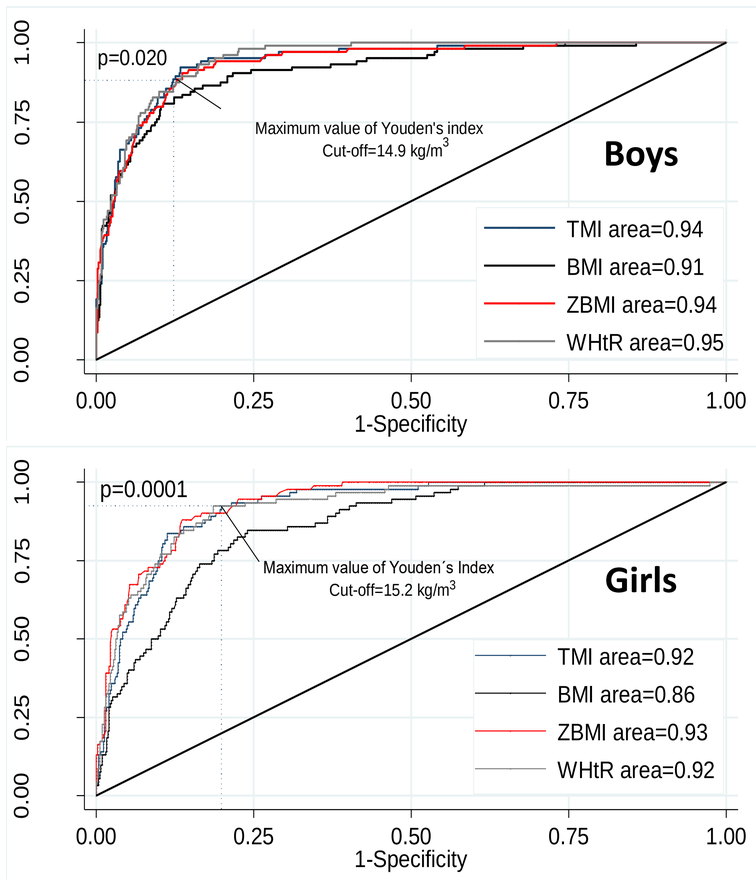
Results (cont.)

Determination coefficients between the anthropometric indexes and bfDXA

	Boys R^2	Girls R^2
WC NIH-Fernández[3]	0.28	0.58
WC WHO-Klünder[4]	0.28	0.60
BMI	0.36	0.64
BMI-Z NCHS-CDC	0.61	0.63
TMI	0.65 (0.64)[5]	0.60 (0.72)[5]
BMI-Z WHO	0.67 (0.38)[5]	0.66 (0.66)[5]
WHtR	0.76	0.65

TMI: triponderal mass index. BMI: body mass index. BMI-Z: Z score of BMI. WC: waist circumference. WHO: World Health Organization. NCHS: National Center for Health Statistics. CDC: Center for Disease Control and Prevention.

ROC curves of the anthropometric indexes for overweight/obesity (≥p85 bfDXA)

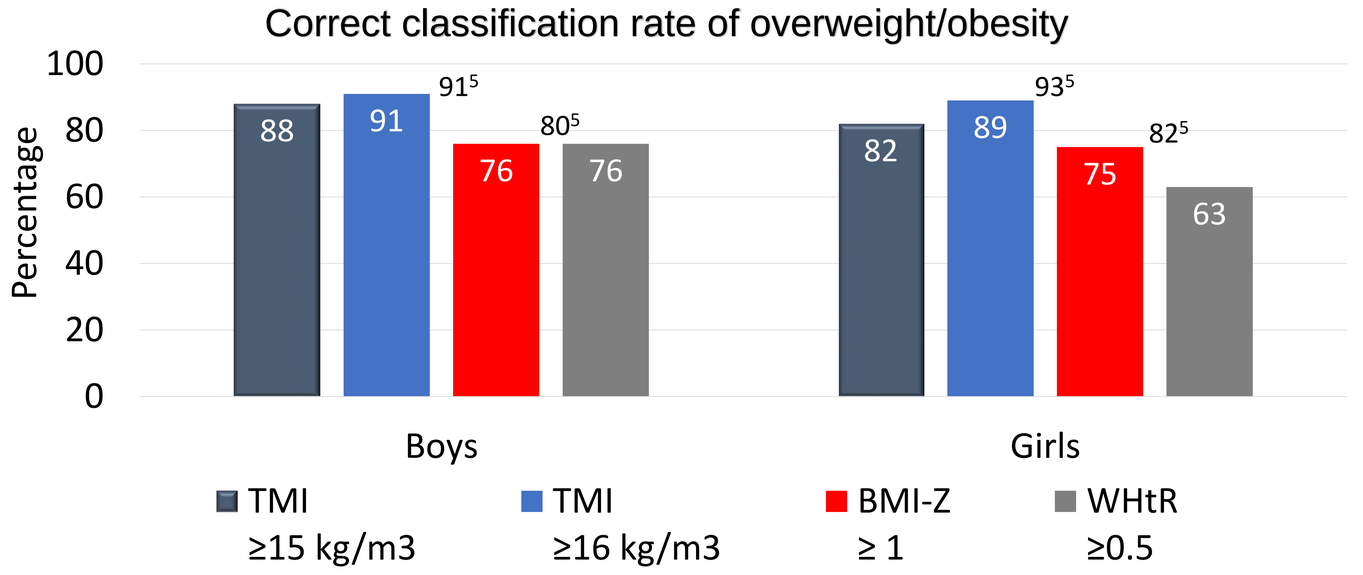


Diagnostic performance of the anthropometric indexes to detect overweight/obesity (≥p85 bfDXA)

	Boys				Girls			
	Sen (95% CI)	Spe (95% CI)	PPV (95% CI)	NPV (95% CI)	Sen (95% CI)	Spe (95% CI)	PPV (95% CI)	NPV (95% CI)
BMI-Z WHO ≥1	96 (92-100)	73 (69-76)	38 (32-43)	99 (98-100)	96 (91-100)	71 (68-75)	37 (30-43)	99 (98-100)
WHtR ≥0.5	99 (97-100)	73 (69-76)	38 (32-44)	100 (99-100)	97 (93-100)	57 (53-61)	27 (22-32)	99 (98-100)
TMI ≥15 kg/m^3	**87 (78-95)**	**89 (87-92)**	**57 (47-66)**	**98 (95-99)**	**93 (83-99)**	**80 (78-82)**	**45 (35-55)**	**99 (97-100)**
TMI[5] ≥16 kg/m^3	74 (65-83)	93 (92-95)	66 (57-75)	96 (94-97)	65 (55-75)	93 (91-95)	62 (52-72)	94 (92-96)

CI: confidence interval. PPV: positive predictive value. NPV: negative predictive value. Sen: Sensitivity. Spe: Specificity

Correct classification rate of overweight/obesity



Conclusions

TMI is an easy and acceptable tool to estimate body fat content in children and adolescents. TMI has a better diagnostic performance for an adequate classification of adiposity in comparison of BMIZ and WHtR

References

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The authors declare no conflict of interests related to this study