Comparison of Body Composition Methods for the Assessment of Body Fat in Adolescent Soccer Players

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Abstract

Anthropometry, dual energy x-ray absorptiometry (DXA) and air displacement plethysmography (ADP) are widely used for assessing body fat percentage (%BF). The accuracy among body composition methods in different kind of populations such as children, adults, obese persons, and athletes has been studied but there are some discrepancies between them. **PURPOSE**: To compare %BF assessed by DXA, ADP and anthropometry in adolescent soccer players. **METHODS**: %BF was assessed in ninety-two soccer players (64 males, 13.3 ± 0.5 y; 28 females, 13.3 ± 0.6 y) by anthropometry, DXA and ADP. Anthropometry measurements were registered following the recommendations of the ISAK. Anthropometry %BF was calculated using the equation proposed by Slaughter et al for adolescents. ADP %BF was calculated with 3 different formulas: (i) the general Siri equation (ADPSiri); (ii) the age- and sex-specific equation by Lohman (ADPLohman) and (iii) the age- and sex-specific equation by Silva (ADPSilva). Agreement and differences between methods were assessed by two-paired samples t tests and calculating the 95% limits of agreement. **RESULTS**: In the whole sample, ADPSiri ADPLohman ADPSilva and anthropometry underestimated %BF by 2.0, 6.9, 6.2, and 6.0% respectively compared to DXA (all p<0.05). The 95% limits of agreement ranged from ±5.91% to ±10.78%. Similar results dividing by sex were found. **CONCLUSION**: Although the 3 used methodologies have been several times described as valid for the assessment of %BF, based in our data it seems that ADP, anthropometry and DXA are not interchangeable for the assessment of %BF in adolescent soccer players.

Methods

Participants: A total of ninety-two soccer players (64 males, 13.3 ± 0.5 y; 28 females, 13.3 ± 0.6 y) were recruited from 5 soccer clubs of Aragón (Spain). Eligibility into the sudy required participants: playing soccer, between the ages of 11-13, and Caucasian not taking medication affecting musculoskeletal system.

Fat mass: The %BF was estimated by anthropometry, DXA and ADP. Anthropometry measurements were registered following the recommendations of the ISAK[1]. Anthropometry %BF was calculated using the equation proposed by Slaughter et al.[2] for adolescents. ADP %BF was calculated with 3 different formulas: (i) the general Siri equation[3] (ADPSiri); (ii) the age- and sex-specific equation by Lohman[4] (ADPLohman) and (iii) the age- and sex-specific equation by Silva[5] (ADPSilva).

Statistical analysis: Agreement and differences between methods were assessed by two-paired samples *t*-tests and calculating the 95% limits of agreement.

Table 1. Descriptive characteristics of the participants.

	All (n=92)	Males (n=64)	Females (n=28)
Age (y)	13.3±0.5	13.4±0.6	13.4±0.6
Weight (kg)	49.6±10.5	48.3±10.9	52.6±9.1
Height (cm)	159.6±8.4	159.8±9.1	159.3±6.9
BMI (kg/cm^2)	19.3±2.8	18.7±2.7	20.6±2.8
Tanner Stage (I/II/III/IV/V)	1/11/34/36/10	0/7/28/22/7	1/4/6/14/3

BMI: Body mass index.

Introduction

Anthropometry, dual energy x-ray absorptiometry (DXA) and air displacement plethysmography (ADP) are widely used methods for assessing body fat percentage (%BF). The accuracy among body composition methods in different kind of populations such as children, adults, obese persons, and athletes has been studied but there are some discrepancies between them.

This study was designed to compare %BF assessed by DXA, ADP and anthropometry in adolescent soccer players.

Results

In the whole sample, ADPSiri ADPLohman ADPSilva and anthropometry underestimated %BF by 2.0, 6.9, 6.2, and 6.0% respectively compared to DXA (all p<0.05). The 95% limits of agreement ranged from ±5.91% to ±10.78%. Similar results dividing by sex were found.

Table 2. Body fat percentage (Mean ± standard deviation), differences between methods, limits of agreement 95%, and confidence intervals.

Model	Body Fat percentage	Differences within methods	95% limits of agreement	Confidence interval
Males (n=64)				
DXA	19.90±5.19	-	-	-
ADP Siri[3]	18.48±5.65*	1.42	5.13	(-3.72,6.55)
ADP Lohman[4]	13.89±6.09*	6.01	6.31	(-0.30,12.31)
ADP Silva[5]	14.13±6.11*	5.77	5.86	(-0.09,11.63)
Slaughter et al.[2]	15.95±6.29*	3.95	6.33	(-2.39,10.28)
Females (n=28)				
DXA	26.82±5.13	-	-	-
ADP Siri[3]	23.27±6.55*	3.55	6.60	(-3.05,10.15)
ADP Lohman[4]	17.88±7.36*	8.94	8.10	(0.84,17.04)
ADP Silva[5]	19.60±7.07*	7.22	7.44	(-0.22,14.66)
Slaughter et al.[2]	16.04±6.31*	10.78	12.99	(-2.21,23.78)

DXA: dual energy X-ray Absorptiometry; ADP air displacement plethysmography
**p<0.05*

Summary and Conclusion

Although the 3 used methodologies have been described several times as valid for the assessment of %BF, based on our data it seems that ADP, anthropometry and DXA are not interchangeable for the assessment of %BF in adolescent soccer players.

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Acknowledgments

Supported by Spanish Ministerio de Economía y Competitividad (Project DEP 2012-32724) and FPU Grant (AP12-2854).

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American College of Sports Medicine — May 31st— June 4th, 2016 — Boston — USA