

Assessment of obesity in children with Achondroplasia and Hypochondroplasia

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Introduction

- ◆ Obesity is one of common complications in achondroplasia (ACH) and hypochondroplasia (HCH). Obesity can be a risk factor for excessive load on joints or lower spines in aged, worsen sleep apnea and develop metabolic syndrome.
- ◆ Dual X-ray absorptiometry (DXA) has been known to be a powerful tool to assess body composition accurately.
- ◆ In this study, DXA as well as anthropometric measurement were performed to evaluate the degree of obesity in our cohort.

Objective

To assess their obesity using % body fat (DXA) and body index obtained from anthropometric measurement for children with ACH and HCH and find an anthropometric parameter is accordance with obesity criteria by %BF (DXA)

Subjects

Table 1. patient background	total	male	female
Participants (ACH, HCH)	37 (27, 10)	21 (16, 5)	16 (11, 5)
Age	10.7 ± 4.2	9.6 ± 3.5	11.9 ± 4.4
11 < age < 19	16	7	9
3 < age < 11	21	14	7
GH	29	18 (14, 4)	11 (8, 3)
past GH treatment	6	2 (2, 0)	4 (2, 2)
No GH treatment	2	1	1
Leg lengthening	6(4, 2)	2 (1, 1)	4 (3, 1)

Methods

1. %BF (DXA) was measured by a Hologic Discovery A DXA scanner (Hologic Inc. MA).
2. BMI-SD, BMI percentile, obesity index (indicating BW comparable to standard height), waist/height were extracted from the medical records then, these parameters were compared with %BF (DXA).
3. %BF (BIA) was measured by Tanita 320 dual frequency body composition analyzer (Tanita Corp. Tokyo) using bioelectrical impedance analysis (BIA).
4. Distribution of these parameters in age was presented.
5. Secondly, the correlation between %BF (DXA) and other parameters was investigated.
6. Next, supposed %BF by DXA is a standard criteria, examined specificity and sensitivity of BMI-SD, BMI percentile, obesity index, waist to height ratio and %BF by BIA.
7. Finally, correlation between %BF (DXA) and HOMA-R was presented.
8. All statistical analyses were performed using IBM SPSS Statistics software.

Definition of obesity

Male < 18 age : obesity index > 20% and %body fat > 25%
female ≥11 age : obesity index > 20% and %body fat > 35%
< 11 age : obesity index > 20% and fat percentage > 30%
(obesity index: expressing how much percentage is above compared with standard body weight.)

In addition, cases fulfilling the following criteria are regarded as obese

- BMI percentile (> 2 year of age)
85th < BMI percentile < 95th →overweight
BMI percentile ≥ 95th →obese
- BMI SD BMI-SD > 2.0SD →obese
- Waist to height ratio Waist/height ≥ 0.5

Discussion

- Our data showed no age dependency to fulfill obesity criteria from the point of %BF.
- Obesity criteria by way of each parameter found any difference between boys and girls
- High % body fat might indicate an elevated HOMA-R
- An extensive research is required to verify the validity of %BF by DXA for the definition of obesity in ACH and HCH

Results

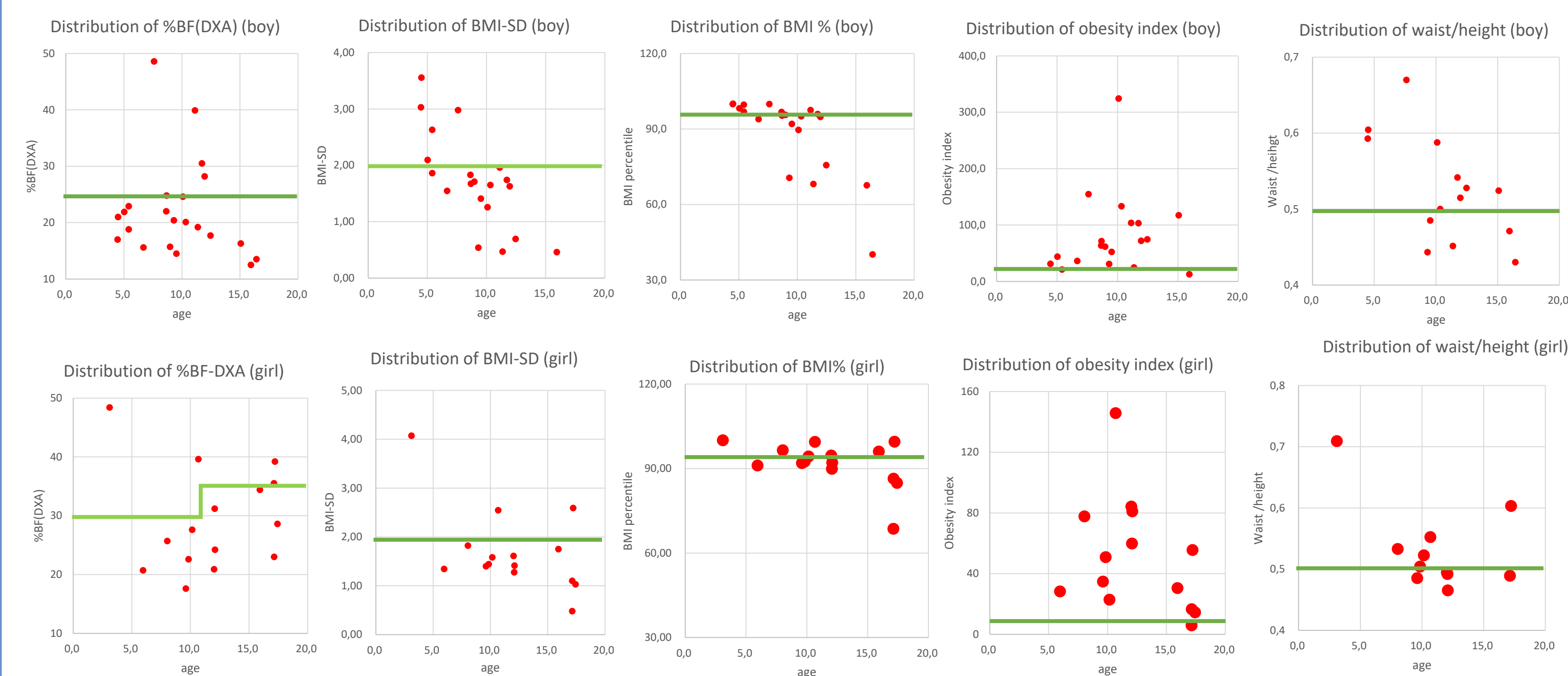


Figure 1. distribution of each parameter by age

Table 2. Regression analysis between %BF (DXA) and each parameter

	BMI-SD	BMI percentile	Obesity index	Waist/height	%BF (BIA)
Correlation coefficient r ²	0.239	0.106	0.078	0.440	0.829
p value	0.001	0.015	0.065	0.000	0.000

Table 3. concordance rate between %BF(DXA) and other parameters, under the condition %BF (DXA) is defined as a criteria of obesity.

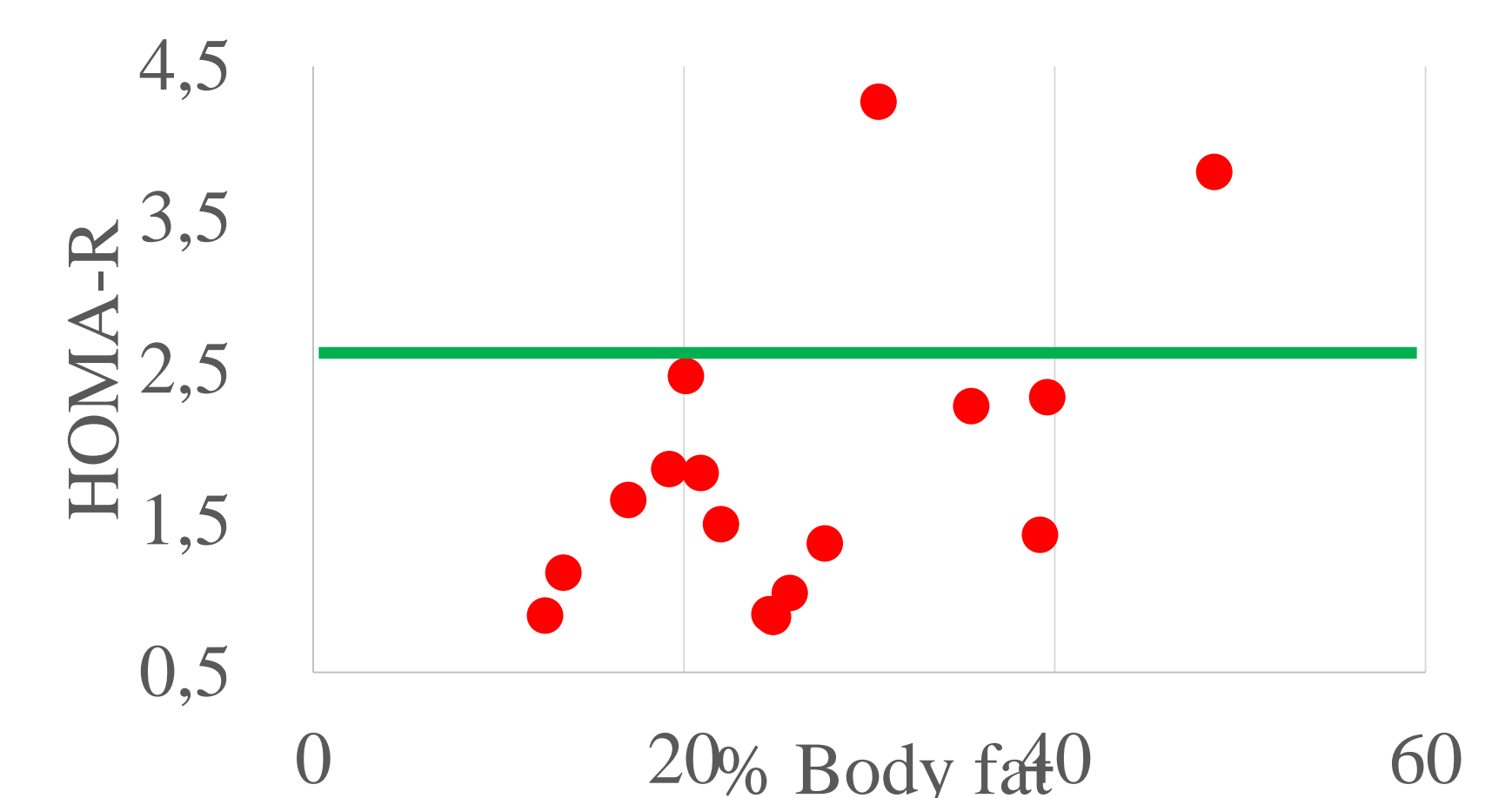
Eight patients were regarded as obese and 27 patients were regarded as non obese on basis of %BF(DXA).

false positive*	BMI-SD	BMI percentile	Obesity index	W/ H	BIA
total	0.148 (4/27)	0.37 (10/27)	0.88 (22/25)	0.714(15/21)	0.182 (4/22)
boy	0.235 (4/17)	0.53 (9/17)	0.93 (14/15)	0.667 (8/12)	0.167 (2/12)
girl	0.0 (0/10)	0.1 (1/10)	0.80 (8/10)	0.778 (7/9)	0.2 (2/10)
false negative#					
total	0.5 (4/8)	0.25 (2/8)	0.167 (1/6)	0 (0/6)	0 (0/7)
boy	0.667 (2/3)	0.333 (1/3)	0 (0/2)	0 (0/3)	0 (0/3)
girl	0.40 (2/5)	0.20 (2/5)	0.25 (1/4)	0 (0/3)	0 (0/4)

*false positive = obese patient in other parameters / non obese patient in %BF (DXA)
#false negative = non obese patient in other parameters / obese patient in %BF (DXA)

Figure 3. Regression analysis between %BF (DXA) and HOMA-R

r²: 0.294
p value : 0.007



Summary

- BMI-SD, BMI percentile, waist/height had a significant correlation with %BF by DXA.
- BMI-SD, %BF (BIA) showed high specificity and waist to height ratio, %BF(BIA) presented high sensitivity.
- Two boys whose %BF (DXA) was 30.5% and 48.6% have represented insulin resistance, while three children (boy and girl) with %BF more than 35% shows no insulin resistance.

Conclusion

Any anthropometric parameter was not reliable to detect obesity in children with ACH and HCH.

Reference

1. Hecht JT. 1987. Mortality in achondroplasia. Am J Hum Genet 41: 454- 464.
2. Wynn J. Mortality in Achondroplasia Study: A 42-Year Follow-Up. Am J Med
3. Hecht JT. Obesity in achondroplasia. Am J Med Genet 1988; 31:597-602.
4. Hoover-Fong J. Age-appropriate body mass index in children with achondroplasia: interpretation in relation to indexes of height. Am J Clin Nutr 2008; 88:264-71