Indices of Adiposity by Weight Status in Children With and Without Prader-Willi Syndrome

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ABSTRACT

Body mass index (BMI), an indicator of weight status, is used to estimate body composition or health risk. Prader-Willi Syndrome (PWS), a form of early childhood obesity, is characterized by abnormally high adiposity. It is unknown whether BMI categories are good indicators of adiposity in PWS and how indices of adiposity compare between children with and without the syndrome. **PURPOSE:** To characterize indices of adiposity by BMI within PWS and then compare these values to controls within each BMI category (healthy [HW: 5-84th], overweight [OW: 85-94th], obese [OB: ≥ 95th %ile]). **METHODS:** Thirty-five PWS (8 HW, 7 OW, 20 OB) and 120 controls (38 HW, 11 OW, 71 OB) participated. Anthropometrics (stature, body mass, waist circumference [WC]) and body fat parameters obtained through DXA (body fat [BF], trunk fat [TF]) were measured. Classifications for WC (normal: <75th, moderate: 75-89th, high: ≥90th %ile) and BF (healthy: 2nd-84th, overweight: 85-94th, obese: ≥95th %ile) were identified within each BMI category. ANOVA determined group differences (p<0.05). **RESULTS:** Within PWS, HW<OB for body mass and WC, while HW<OW and OB for BF and TF (p<0.01 for all). For WC, 28.6% of HW PWS and 3.3% of HW controls had moderate values; all other HW children were normal. In OW, 50% of PWS and controls had moderate and/or high WC. Conversely, 75% of OB PWS and 79.4% of OB controls had a high WC; all others were moderate. For BF, 75% of HW PWS and 34.2% of HW controls were identified as overweight/obese. Further, OW and OB children were all identified as obese for BF. Lastly, PWS>controls for BF and TF within all BMI categories (p≤0.01 for all). In contrast, WC was similar in all children within each BMI category. **CONCLUSION:** Even with HW PWS presenting a better adiposity profile than OW and OB PWS, excessive adiposity was prevalent compared to controls, regardless of BMI classification. BMI was not a good estimate of adiposity, exemplified by the distributions of moderate WC and overweight/obese BF in all HW children. Further, in PWS, WC was unable to estimate increased adiposity (total and trunk) in comparison to controls by BMI category. It is suggested that other adiposity surrogates are evaluated in PWS that may better address the pattern of adiposity inherent to the syndrome.

INTRODUCTION

Body mass index (BMI), an indicator of weight status, is used to estimate body composition, particularly body fat, and identify potential health risk. Prader-Willi Syndrome (PWS) is a neurodevelopmental disorder that presents early onset morbid childhood obesity [1]. Weight management is crucial in this population [2]. However, PWS is characterized by an abnormally high adiposity and low lean mass [3] raising the question as to whether BMI categories or waist measurements are good indicators of adiposity in PWS.

PURPOSE

To characterize indices of adiposity by BMI categories within children with PWS and to then compare these values to controls of similar age without PWS.

METHODS

Measurements and calculations [4]

- stature
- body mass
- waist circumference (WC)
- total body fat (BF%) (GE Lunar Prodigy, Madison, WI)
- trunk fat (TF%) (GE Lunar Prodigy, Madison, WI)
- BMI

Table 1. Weight status categories based on percentiles for sex and age for BMI, WC and BF%.

	Sex and age percentiles		
Weight status categories	**BMI**	**WC**	**BF%**
Healthy / Normal	5th – 84th	<75th	2nd – 84th
Overweight / Moderate	85th – 94th	75th – 89th	85th – 94th
Obese / High	≥95th	≥90th	≥95th

Notes: BMI [5], WC [5, 6] and BF% [7].

RESULTS

Participants

- 35 children diagnosed with PWS, ages 8-12 years
- 120 controls, ages 8-12 years

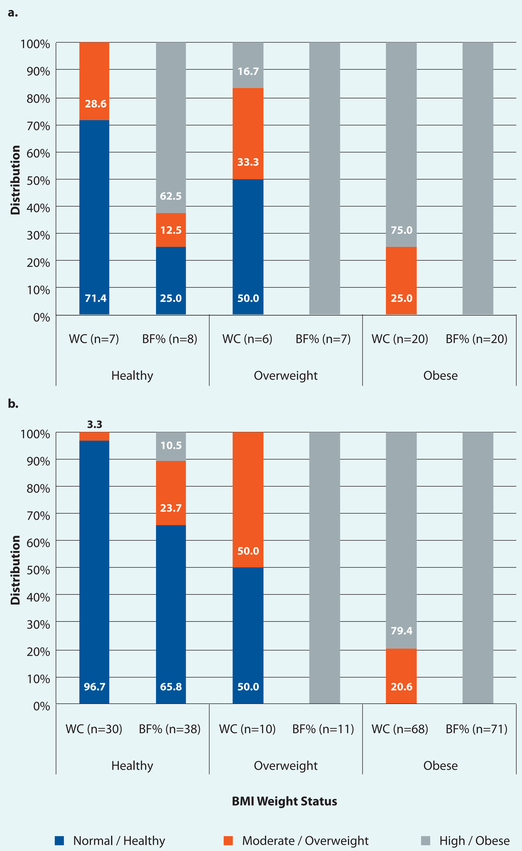
Participant demographics and physical characteristics are presented in Table 2. Distribution of WC and BF% classifications are presented in Figures 1a and 1b.

Table 2. Participant demographics and physical characteristics by weight status (BMI) category contrasting PWS and controls, presented as mean ± SE.

	Healthy		Overweight		Obese	
	PWS (n=8)	Control (n=38)	PWS (n=7)	Control (n=11)	PWS (n=20)	Control (n=71)
Sex (M/F)	4/4	21/17	2/5	4/7	13/7	42/29
Age (y)	9.6 ± 0.5	9.7 ± 0.2	10.7 ± 0.7	9.5 ± 0.4	9.4 ± 0.3	9.7 ± 0.1
Stature (cm)	141.5 ± 4.8	142.1 ± 1.7	141.8 ± 4.8	143.0 ± 2.2	141.8 ± 2.3	**146.9 ± 1.0**
Body mass (kg)	35.53 ± 3.07	34.77 ± 1.09	50.39 ± 6.53	42.45 ± 1.95	58.78 ± 3.47*	63.16 ± 1.98
BMI (kg·m^{-2})	17.48 ± 0.56	17.08 ± 0.23	24.71 ± 2.46	20.65 ± 0.44	29.15 ± 1.52*	28.90 ± 0.59
BMIz	0.22 ± 0.16	-0.02 ± 0.10	1.54 ± 0.20*	1.21 ± 0.09	2.26 ± 0.08*,†	2.25 ± 0.04
WC (cm)	66.87 ± 2.36	62.09 ± 1.06	80.04 ± 3.27	75.62 ± 1.68	93.95 ± 3.57*	94.78 ± 1.51
BF (%)	31.4 ± 2.5	**21.2 ± 1.2**	47.2 ± 2.5*	**34.6 ± 1.2**	51.2 ± 1.3*	**45.4 ± 0.6**
TF (%)	30.7 ± 2.5	**20.1 ± 1.4**	48.3 ± 2.8*	**35.8 ± 1.4**	50.9 ± 1.7*	**47.2 ± 0.6**

Notes: Within PWS: * = different than healthy, † = different than overweight; Between groups: **bolded value** = PWS different than control; $p \leq 0.01$.

Figure 1. Distribution of WC and BF% classifications in **a)** PWS and **b)** controls by weight status (BMI) category.



Note: WC was not measured in two PWS (one healthy, one overweight) and 12 controls (eight healthy, one overweight and three obese).

SUMMARY & CONCLUSION

- BMI was not a good estimate of adiposity in all participants because:
  1) BMI was unable to estimate the excessive adiposity prevalent in PWS compared to controls, regardless of weight status and
  2) a large proportion of participants with healthy BMI with and without PWS were classified as being overweight or obese weight status based on BF%.
- WC was unable to estimate the excessive adiposity (total and trunk) present in PWS compared to controls for all BMI weight statuses, indicating that WC could not describe the unique body fat distribution in children with PWS [3].
- Other adiposity surrogates should be evaluated in PWS that may better address the pattern of adiposity inherent to the syndrome.

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