SEDENTARY BEHAVIOR IS NEGATIVELY ASSOCIATED WITH HIP BONE MINERALIZATION IN YOUTH WITH PRADER-WILLI SYNDROME



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ABSTRACT

Increased time in sedentary behavior (SED) negatively influences bone health in children. Youth with Prader-Willi Syndrome (PWS) engage in less ambulatory and high-intensity physical activity than their peers and prefer sedentary activities, possibly putting those with PWS at higher risk for fracture incidence and early onset of osteoporosis. **PURPOSE:** To evaluate the relationship between SED and bone parameters in youth with PWS. **METHODS:** Participants included 23 youth with PWS (age: 11.0 ± 2.0 y, height: 142.3 ± 11.3 cm, lean mass [LM]: 29.0 ± 10.4 kg). SED was measured via accelerometry for eight consecutive days. Bone mineral content (BMC), density (BMD) and BMD z-score (BMD₂) were measured at the hip and total body minus the head (body) by dual energy x-ray absorptiometry. Separate hierarchical regression models were completed for all bone parameters, SED (step 1) and select covariates (age [BMC models only], height and LM) added in step 2. **RESULTS:** SED and covariates explained 79.6% and 51.2% of the variance in hip BMC and BMD, respectively ($p \le 0.001$ for both). SED was a significant predictor of hip BMD when adjusted for covariates (step 1: $\beta = -0.404$, p = 0.056; step 2: $\beta = -0.375$, p = 0.026). SED was a significant predictor of hip BMD, when adjusted for covariates (step 1: β = -0.520, p = 0.011; step 2: β = -0.484, p = 0.025). SED and covariates explained 63.3% and 66.6% of the variance in body BMC and BMD, respectively ($p \le 0.001$ for both). However, SED was not a significant predictor of body BMC or BMD, even when controlling for covariates (p > 0.050for all). SED and covariates did not explain a significant portion of the variance in body BMD_{2} (p > 0.050 for all). Height was a significant predictor of hip and body BMC ($\beta = 0.542$, β = 0.753, respectively; p = 0.001 for both). LM was a significant predictor of hip and body BMD ($\beta = 0.558$, $\beta = 0.759$, respectively; $p \le 0.050$). **CONCLUSION:** LM explained most of the variance in BMD in this sample, indicating that muscle strengthening activities that build LM may benefit bone health in this population. SED was negatively associated with hip BMD and BMD₇, suggesting that reducing SED may benefit bone mineralization at the hip in youth with PWS.

Prader-Willi Syndrome (PWS) is a rare genetic disorder originating on the paternal chromosome 15 (1). Individuals with PWS present low lean mass, high fat mass, short stature, hypotonia and growth hormone deficiency, which can negatively affect bone mineral density (BMD) (1, 4).

In contrast to the positive osteogenic impact of weight-bearing physical activity (6), prolonged sedentary behavior (SED) has a negative influence on bone health (2). Youth with PWS prefer sedentary activities, such as watching TV, computer/electronic games, and arts and crafts, and engage in less ambulatory and high-intensity physical activity than their peers (3, 7), possibly increasing their risk for fracture incidence and early onset of osteoporosis.

PURPOSE

To evaluate the relationship between SED and bone parameters in youth with PWS.

- Participants included 23 youth with PWS
- (Actigraph GT3X, Pensacola, FL).
- (5).
- Prodigy, Madison, WI).

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INTRODUCTION

METHODS

• Accelerometers were worn for eight consecutive days

• Time that involved <100 counts/min was classified as SED

 Bone mineral content (BMC), BMD, and BMD z-score (BMD,) of the hip and total body minus the head (body) were obtained by dual energy x-ray absorptiometry (GE Lunar

RESULTS

Participant characteristics and SED are presented in Table 1. Total adjusted variance (R²) and standardized β-coefficients are presented for separate hierarchical regression models for each bone parameter of the hip (Table 2) and body (Table 3).

- SED and covariates explained 79.6% and 51.2% of the variance in hip BMC and BMD, respectively. SED was a significant predictor of hip BMD and BMD, when adjusted for covariates (p < 0.030 for both).
- SED and covariates explained 63.3% and 66.6% of the variance in body BMC and BMD, respectively. SED was not a significant predictor of body BMC or BMD when controlling for covariates (p > 0.050 for all).

Table 1. Participant characteristics and SED, presented as

 frequencies or mean (minimum-maximum).

Characteristics	Mean (min-max)			
Sex (M/F)	11/12			
Age (y)	11 (8-14)			
Body Mass (kg)	60.56 (25.70-130.30)			
Height (cm)	142.3 (125.0-159.5)			
Body Fat Mass (%)	46.0 (17.9-60.8)			
Lean Mass (kg)	29.01 (16.50-55.57)			
Hip BMC (g)	18.80 (5.92-28.94)			
Hip BMD (g/cm ²)	0.81 (0.49-1.07)			
Hip BMDz	-0.32 (-2.80-2.30)			
Body BMC (g)	1125.09 (476.40-1829.60)			
Body BMD (g/cm ²)	0.84 (0.58-1.06)			
Body BMD _z	0.37 (-2.10-3.30)			
SED (min/day)	664.7 (414.3-804.0)			

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Table 2. Regression models presenting the association between hip bone parameters and SED in youth with PWS.

	Hip BMC		Hip BMD		Hip BMD _z	
	R ²	β	R ²	β	R ²	β
Model 1						
SED	-0.034	-0.112	0.123	-0.404	0.235*	-0.520*
Model 2						
SED	0.796**	-0.154	0.512**	-0.375*	0.195	-0.484*
LM		0.516*		0.558*		0.217
Height		0.542**		0.150		-0.084
Age ^a		-0.010				

Notes: ^aCovariate for BMC models only; *p < 0.050, **p < 0.010.

Table 3. Regression models presenting the association between body bone parameters and SED in youth with PWS.

	Body BMC		Body BMD		Body BMD _z	
	R ²	β	R ²	β	R ²	β
Model 1						
SED	-0.028	-0.163	0.045	-0.309	0.130	-0.420
Model 2						
SED	0.633**	-0.050	0.666**	-0.057	0.138	-0.310
LM		0.335		0.759**		0.331
Height		0.753**		0.143		0.002
Age ^a		-0.153				

Notes: ^aCovariate for BMC models only; *p < 0.050, **p < 0.010.

- Height explained most of the variance in hip and body BMC, suggesting that normal height for age should be monitored during pre-pubertal growth in youth with PWS.
- Lean mass explained most of the variance in hip and body BMD, suggesting that muscle-strengthening activities that build lean mass may benefit bone health in this population.





SUMMARY

 SED was negatively associated with hip BMD and BMD₂, suggesting that reducing SED may benefit bone mineralization at the hip in youth with PWS.

CONCLUSION

Youth with PWS, who engaged in an average of 665 min/day of sedentary behavior during waking hours, demonstrated a negative association between SED and hip bone mineralization.

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