Movement velocity in the sit-to-stand task in adults with Prader Willi syndrome

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Introduction

- Prader-Willi Syndrome (PWS) is a rare congenital disorder that results from the lack of paternally inherited genes or inactive maternal genes in the region of chromosome15. [1,2]
- PWS is the best characterized congenital cause for obesity and leads to increased body fat and reduced lean mass and growth hormone secretion.[2]
- A hallmark of PWS is the hyperphagia that sets on during childhood.[2]
- People with PWS often present with poor motor control function including decreased coordination, balance, and muscular power.[3,4]
- The sit to stand (STS) task is used in daily life actions such as raising from a chair.[5]
- The key parameters that contribute to a successful performance in the STS task are lower limb muscle power and balance. [6]
- Increased adiposity has a negative effect on muscle force production and balance. [7]
- Adults with PWS may exhibit a decreased performance in the STS task as they exhibit less muscular power and difficulties with balance.

Purposes

- To examine movement velocity differences during the STS in relation to PWS or excess adiposity.
- To determine if movement velocity is related to muscular strength.

Methods

- Participants were 10 adults with PWS (in which 7 of them were on growth hormone replacement therapy), 10 adults with obesity (Body mass index (BMI)>kg/m^2), and 10 adults with normal weight (NW) (BMI<25/ m^2).
- The study was approved by the California State University Fullerton Institutional Review Board (HSR#-17-0202)
- Participants completed 3 sets of 5 repetitions of the STS task with 2 minutes of rest in between.
- Reflective markers were placed on the ankle, knee, hip, and trunk. Motion capture analysis system was used to capture movement velocity.
- Velocity of the pelvis segment center of mass was used to estimate overall movement velocity (m/s). Average and peak velocity were obtained from each repetition during the rising portion of STS task (determined as when the vertical velocity exceeded and fell below 0.2 m/s). Data were averaged across all sets and repetitions for analysis (i.e. (15 repetitions total (3 sets x 5 repetitions)).
- Quadricep muscular strength was measured using an isokinetic dynamometer in which participants completed 3 maximal knee extension contractions of the preferred dominant limb.
- The study had a cross sectional design. One-way variance of analysis determines group differences for the movement velocity of the STS task between 3 groups. Pearson product correlations examined the association between movement velocity and quadricep strength.

Results

Table 1. Participant descriptives for adults with PWS, NW, and obesity presented as mean ± standard deviation (SD), (N=30)

	Adults with PWS (n=10)	Adults with obesity (n=10)	Adults with NW (n=10)
Sex	7M/3F	7M/3F	7M/3F
Age (y)	22.70 ± 5.21	22.96 ± 2.39	22.85 ± 2.19
Stature (m)	1.66 ± 0.15	1.74 ± 0.90	1.67 ± 0.67
Body mass (kg)	79.09 ± 21.29*,**	105.45 ± 15.46	63.57 ± 5.03
Lean mass (kg)	44.73 ± 11.01**	58.68 ± 12.18	46.74 ± 7.31
Body fat (%)	40.61 ± 7.78*	42.40 ± 5.62	23.42 ± 7.83

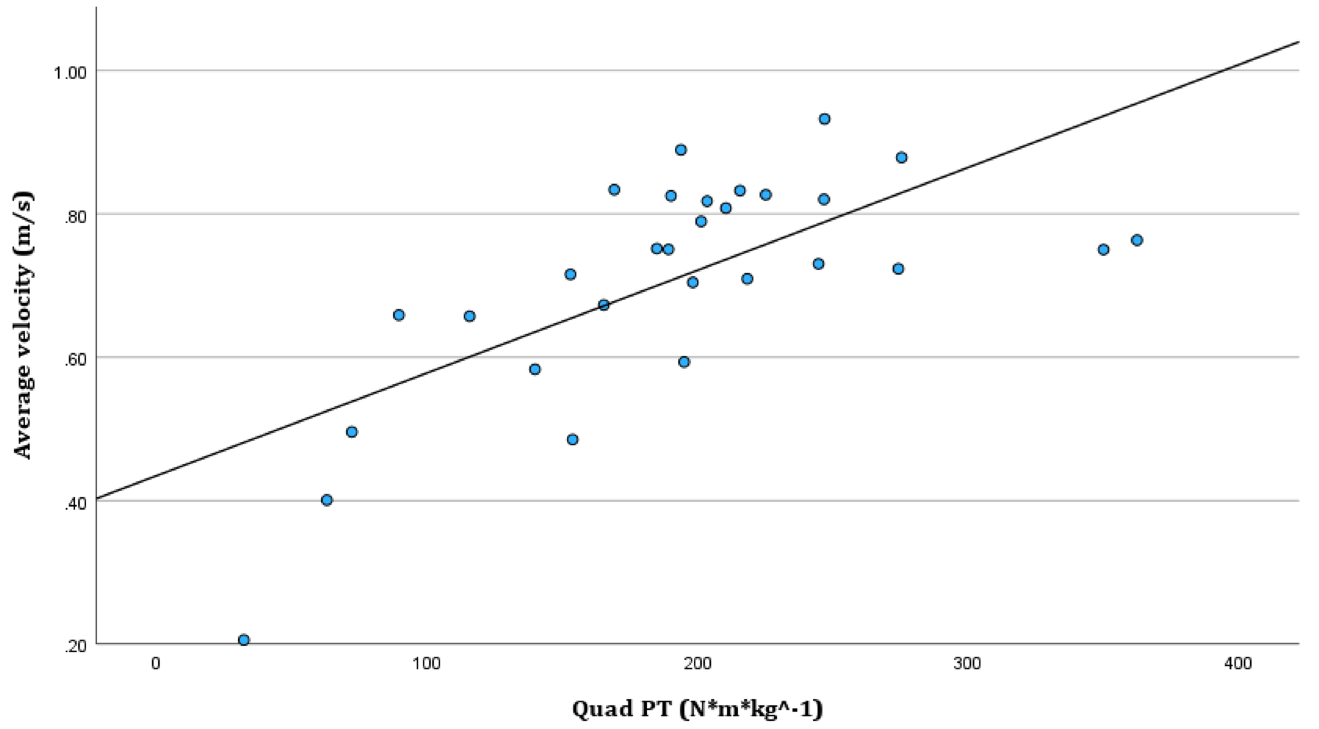
*PWS significantly different from NW group (p<.05)
**PWS significantly different from obesity group (p<.05)

Table 2. Movement velocities of the STS task and quadricep muscular strength presented as mean ± standard deviation (SD), (N=30)

	Adults with PWS (n=10)	Adults with obesity (n=10)	Adults with NW (n=10)
STS average velocity (m/s)	0.61 ± 0.20*	0.71 ± 0.13	0.79 ± 0.08
STS peak velocity (m/s)	0.85 ± 0.26*	0.98 ± 0.22	1.09 ± 0.13
Quadriceps peak torque (N*m*kg^{-1})	172.59 ± 103.201	175.45 ± 60.98	218.89 ± 54.08

*PWS significantly different from NW group (p<.05)
**PWS significantly different from obesity group (p<.05)

Figure 1: Association between quadricep peak torque and movement velocity of the STS task



Pearson correlation coefficient (r)= .702

Conclusion

- The results suggest that excess adiposity is not a contributing factor in the movement velocity of the STS task.
- Potentially, lower movement velocity in PWS is related to decreased capacity to activate large motor units quickly.[4] The found association between average movement velocity and muscular strength support this speculation.
- In PWS, lower movement velocity maybe related to difficulties with maintain postural control[7] which are needed for the stabilization phase of the STS task.
- Further studies should evaluate whether balance is related to the velocity in the STS task to confirm this speculation.

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Acknowledgements

This project was supported by the California State University Research and Scholarly Activity Incentive Grant Program 2017-2018 (Rubin DA, Pamukoff D). Ricabar M was supported by the LINK program (U.S. Department of Agriculture's National Institute of Food and Agriculture Award #2021-77040-34904.