Comparison of treadmill preferred walking speed tests: test-retest reliability

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Summary

Studies of treadmill gait often require participants to walk at their preferred walking speed (PWS). Here, we introduce a novel test for determining the PWS of healthy young adults— the University of New South Wales (UNSW) PWS Test—and compare it to three commonly used protocols. We found similar intraclass correlation coefficients (ICC), rate of perceived exertion (RPE) and subjective comfort ratings across three of the four tests, but the UNSW PWS Test protocol produced the lowest smallest detectable change (SDC) and shortest administration time.

Introduction

Participants often walk at their PWS during treadmill-based gait studies. PWS is assumed to reflect the speed an individual would choose to walk at for a given experimental condition and may be useful for standardising the relative effort/challenge across individuals. While several protocols exist for determining the PWS, their reliability has not been directly compared. Here, we aimed to evaluate the reliability, RPE (Borg scale), subjective comfort rating (visual analogue scale; VAS) and administration time of a newly proposed treadmill PWS test, the 'UNSW PWS Test', and compare it to three commonly used PWS tests adapted from the literature.

Methods

This study was approved by the UNSW Human Research Ethics Committee. Healthy adults (N=20, male: 12, female: 7, non-binary: 1; mean age: 22.5) attended two sessions within seven days. In each session, they completed four PWS tests in a randomised order. One was developed through extensive pilot testing (UNSW), and the remaining three (Dingwell, Jordan, Dal) were adapted from the literature. For each, the resulting PWS, RPE (Borg scale), comfort (VAS) and test administration time were recorded. Test-retest reliability was evaluated via ICCs and SDC (calculated using $1.96 * \sqrt{2} * SEM_{agreement}$, where $SEM_{agreement}$ is the squared, summed and square-rooted value of the standard error of measurement). Statistical analyses were performed in RStudio and consisted of linear mixed effects models and ANOVAs. PWS protocols were:

UNSW PWS Test: Treadmill speed increased from 0.6 m/s to 1.8 m/s, then decreased until the preferred speed was identified. Treadmill speed decreased by 0.1 m/s, and the participant was asked whether they preferred the original speed or the new, lower speed. If the participant preferred the lower speed, the confirmation process was repeated until they preferred the faster speed (recorded as PWS).

Dingwell PWS Test [1]: Treadmill speed increased from 0.7 m/s until a faster-than-preferred speed was reached, then decreased to reach a slower-than-preferred speed, which was repeated three times (average of six speeds recorded as PWS).

Jordan PWS Test [2]: Treadmill speed increased from 0.7 m/s until the preferred speed was reached, then increased by 0.4 m/s and reduced until the preferred speed was reached. Process was repeated until two preferred speeds were within 0.1 m/s (average of two speeds recorded as PWS).

Dal PWS Test [3]: Participants walked 10 m overground, with the middle 6 m timed, repeated four times (average speed recorded as PWS).

Results and Discussion

Data are presented in Table 1. The Dal PWS Test had the highest ICC but the lowest comfort score and highest exertion. The remaining treadmill-based tests had similar ICCs, RPE and comfort scores. The UNSW PWS Test had the lowest SDC and shortest administration time.

Table 1: ICC and SDC, with additional data rows presented as pooled means (SD) from both sessions.

	UNSW	Dingwell	Jordan	Dal
Walking speed (m/s)	1.34 (0.13)	1.25 (0.19)*	1.37 (0.19)	1.56 (0.19)*
ICC	0.73	0.73	0.71	0.86
SDC (m/s)	0.12	0.17	0.17	0.17
Comfort (0-100%)	83.0 (11.4)	86.9 (10.8)	79.7 (11.3)	66.4 (19.9)*
RPE (6-20)	8.8 (1.6)	8.2 (1.6)*	9.3 (1.8)	10.8 (2.4)*
Admin. time (s)	107.4 (16.5)	273.0 (45.8)*	243.2 (75.3)*	42.0 (9.2)*

*Significantly different from UNSW test ($p < 0.05$).

Conclusions

When implementing a PWS test for healthy young adults, we encourage our colleagues to consider the test-retest reliability and subjective perceptions of their test of choice.

References

[1] Dingwell et al. (2006). *J.Biomech*, **39**: 444-52.
[2] Jordan et al. (2007). *G&P*, **26:** 128-34.
[3] Dal et al. (2010). *G&P,* **31**: 366-9