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Examining the Validity of the Polar Grit X Pro and Two Step Tests in Predicting VO2max

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ABSTRACT

Smartwatches and submaximal tests, such as step tests, are utilized to predict maximal oxygen consumption (VO_2max). The Polar Grit X Pro watch claims to predict VO_2max via its Fitness Test Function. However, this watch and its Fitness Test Function have not been validated. The purpose of this study was to determine if the Polar Grit X Pro watch, the Queens College Step Test, and the Forestry Step Test accurately predict VO_2max in experienced runners aged 18-22 (n=15). Participants included 7 males (20.29 ± 1.11 years) and 8 females (19.63 ± 1.06 years). All participants performed a graded maximal treadmill test, two submaximal step tests, and the Polar Fitness Test. It was hypothesized that all tests would be valid predictors of VO_2max. Data were analyzed using a repeated measures analysis of variance with a Bonferroni adjustment along with a Pearson's correlation. Results indicated that the Polar Grit X Pro watch (57.67 ± 7.86 ml/kg/min, p = 0.001) was not a valid predictor of VO_2max across the entire population's true VO_2max (47.15 ± 4.06 ml/kg/min). However, the Polar watch was a valid predictor of VO_2max in females (52.875± 6.47 ml/kg/min, p = 0.166) when compared to the criterion measure (45.7 ± 3.3 ml/kg/min). Both step tests were valid predictors of VO_2max in male and female experienced runners (p = 1.000). Therefore, female experienced runners could consider purchasing the Polar Grit X Pro to track cardiorespiratory fitness. Furthermore, both males and females could utilize either step test to predict VO_2max. Future research is needed to determine if these results can be expanded to other populations and whether a meaningful significance is present.

INTRODUCTION

- True VO_2max tests are considered the gold standard for measuring maximal oxygen consumption (8,10)
- The equipment required for VO_2max testing is expensive and trained specialists need to be present during the duration of the test
- Maximal tests involve intense physical exertion, which is restrictive for some populations (1)
- Submaximal step tests have several benefits such as being safer, more accessible, and less expensive (1)
- Two common validated submaximal step tests are the Forestry step test (6) and the Queens College step test (2,3,9). However, both tests were not validated in experienced runners
- Recent models of Polar watches predict VO_2max without performing physical activity (4,5,7,10,11)
- Previous models of Polar watches such as the A300 and the M430 have been validated in predicting VO_2max, but the Polar Grit X Pro watch has not been validated (4,7,10)
- There is a need to validate the watch and both step tests on a more trained population

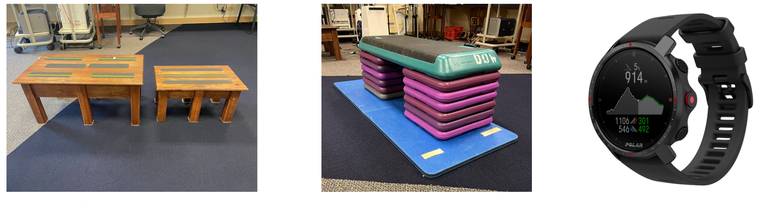

Figure 1. Step heights for the Forestry Step Test (left) and the Queens College Step Test (middle). Representation of the Polar Grit X Pro watch utilized for this study (right).

PURPOSE

The purpose of this study was to determine if the Polar Grit X Pro watch, the Queens College Step Test, and the Forestry Step Test accurately predict VO_2max in experienced runners.

HYPOTHESIS

It was hypothesized that all tests would be valid predictors of VO_2max in experienced runners.

METHODS

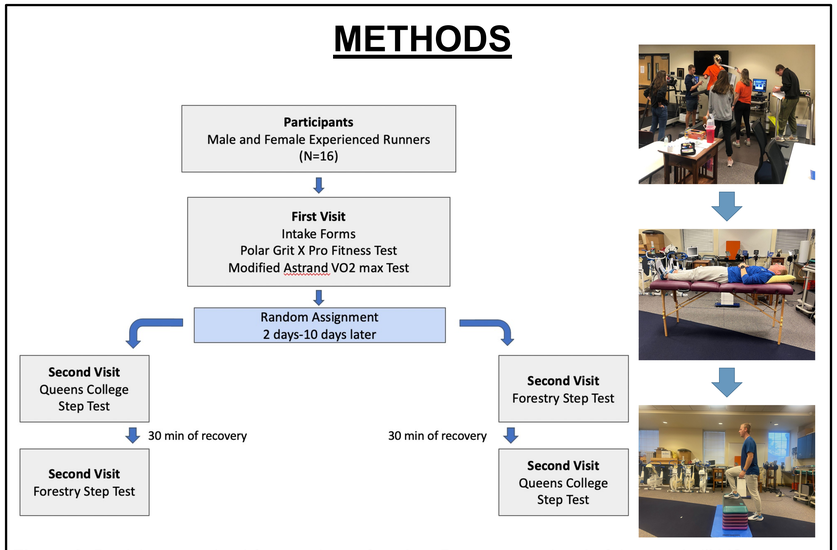

Figure 2. Participants arrived for two days of testing. Day one consisted of the treadmill VO_2max test and the Polar Grit X Pro VO_2max test. Day two consisted of the Queens College Step Test and the Forestry Step Test, completed in a randomized order.

ACKNOWLEDGEMENTS

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RESULTS

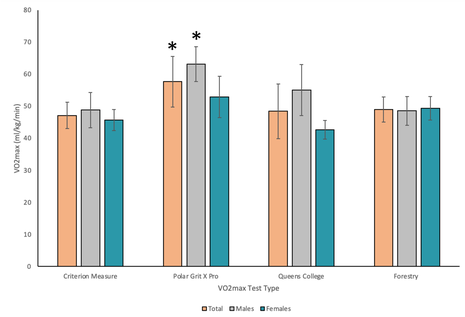

Figure 3. Displays the comparison of the predicted VO_2max values obtained from the Polar Grit X Pro, the Queens College Step Test, and the Forestry Step Test to the criterion VO_2max. The total averages were compared, and data was further compared between males and females. Significant differences are represented by asterisks and non-significant differences indicated valid predictors of VO_2max. The Polar Grit X Pro was not a valid predictor of VO_2max for male experienced runners as well as the total population.

Table 1. Displays the means and standard deviations for the VO_2max values obtained from the criterion treadmill test and the three submaximal tests. The Queens College and Forestry step tests were valid predictors of VO_2max for male and female experienced runners. The Polar Grit X Pro was a valid predictor of VO_2max for females, but not males.

Sex	Age (years)	Treadmill VO_2 ($ml*kg^{-1}*min^{-1}$)	Watch VO_2 ($ml*kg^{-1}*min^{-1}$)	P-Value	Queens VO_2 ($ml*kg^{-1}*min^{-1}$)	P-Value	Forestry VO_2 ($ml*kg^{-1}*min^{-1}$)	P-Value
M	20.3±1.1	48.8±4.5	63.1±5.5	0.003	55.1±7.9	0.075	48.6±4.5	1.000
F	19.6±1.1	45.7±3.3	52.9±6.5	0.166	42.6±2.9	0.907	49.4±3.6	0.514
Total	19.9±1.1	47.2±4.1	57.7±7.9	0.001	48.4±8.5	1.000	49.0±3.9	1.000

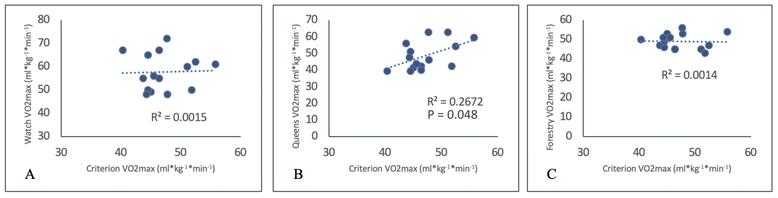

Figure 4. Displays the correlation between the criterion VO_2max and the submaximal VO_2max predictions. A) No correlation between the Polar Grit X Pro and the criterion. B) Moderate correlation between the criterion and the Queens College Step Test (r=0.52). C) No correlation between the criterion and the Forestry Step Test.

CONCLUSION

- Females: All submaximal tests were valid predictors of VO_2max
- Males: Queens College Step Test and Forestry Step Test were valid predictors of VO_2max while the Polar Grit X Pro was not a valid predictor

Implications

- Females could consider purchasing the Polar Grit X Pro to track cardiorespiratory fitness over an exercise program
- Experienced runners could utilize either step test to predict their VO_2max

Limitations

- Fewer participants than previous validation studies
- Results cannot be generalized to different populations
- Polar Grit X Pro was found to only provide VO_2max for Caucasians

Future Research

- Validation of smartwatches and submaximal tests in other populations
  - Elite runners, sedentary individuals, young/old, increased diversity
- Test athlete's VO_2max across a season to determine if submaximal tests remain consistent
- Determine if statistical significance corresponds to meaningful significance