

## Purpose

This study aimed to identify the relationship between heat and pressure pain thresholds and aerobic performance during a graded exercise test (GXT) on a cycle ergometer.

## Methods

Healthy female participants (n=13, age=21.46 years ± 2.67, height= 166.31 cm ±6.76, weight=66.27 kg ±13.17, VO<sub>2</sub>peak= 27.31 ml/kg/min ±5.22, recreationally active, no known cardiovascular or metabolic disease) completed pain threshold tests before doing a GXT on a cycle ergometer. At the same time, peak oxygen consumption rate (VO<sub>2</sub> peak), peak power output (PPO), and time to exhaustion (TTE) were measured. All tests were performed under standardized laboratory conditions (22°C, 45% relative humidity, testing between 0800-1300). Pain threshold tests were done via heat pain threshold (HPT) and pressure pain threshold (PPT), and each stimulus was applied to the participant's dominant forearm (FA) and thigh (TH) two times. The two measurements were then averaged for analysis. During HPT and PPT, heat and pressure increased, respectively, and participants were instructed to say "stop" when the stimulus first became painful. The GXT began at 50 Watts (W) and increased by 25 W every two minutes until volitional fatigue. Stepwise regression was used to identify significant predictors of TTE during a cycling test, if any. Variables included: PPT FA, PPT TH, HPT FA, HPT TH, and TTE. An alpha level of p<0.05 was set a priori.

## Pressure pain threshold in the thigh is a significant predictor of time to exhaustion in a graded exercise test on a cycle ergometer.

Predictor	Coefficient (β)	SE	t	p	95% CI
PPT TH	<b>0.0065</b>	0.0016	4.01	<b>&lt; 0.001</b>	[0.0032, 0.0099]
Intercept (β <sub>0</sub> )	4.010	1.806	2.22	0.034	[0.317, 7.703]



## Results

Stepwise regression identified PPT TH as the only significant predictor of time to exhaustion (TTE), with a coefficient of 0.0065 (p = 0.0004). This indicated that a 1-unit increase in PPT TH is associated with a 0.0065-minute increase in TTE. PPT FA and all HPT tests had no significant interactions..

## Conclusions

In conclusion, PPT TH was a significant predictor of TTE, accounting for 35.7% of the variability in TTE (R<sup>2</sup>= 0.357). However, additional factors may influence TTE that were not taken into account in this analysis, such as a participant's sleep or nutrition.

## Practical Application

These findings suggest a potential link between pain perception in a locally exercised muscle and its endurance capacity. Future research could explore pain thresholds in greater detail to further clarify the relationship between these thresholds and fitness levels.