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ABSTRACT

Purpose: To understand the relationship between lactate accumulation in the blood during exercise and subjective measures of fatigue in cancer patients after a 12-week exercise intervention. **Hypothesis:** Exercise training will delay the onset of blood lactate accumulation (OBLA) during progressive exercise and this will be associated with a decrease in subjective perceptions of fatigue at rest. **Methods:** Participants were recruited upon referral by a physician to the UNCCRI Phase Program. Each participant performed an exercise-based assessment upon entry which included measures of fatigue and cardiorespiratory fitness (CRF). CRF was assessed using the UNCCRI treadmill protocol and blood lactate measurements were obtained every 2 minutes during this progressive exercise test. After the 12-week exercise intervention, all measures were repeated. Markers of performance such as the OBLA and the metabolic equivalent (MET) at OBLA were used in a correlation analysis with Piper Fatigue Scale scores. **Results:** After 12 weeks of exercise, participants showed a significant decrease in total fatigue (pre: 4.09 ± 1.78, post: 3.12 ±1.93, p < 0.01), behavioral fatigue (pre: 3.83 ± 2.46, post: 2.39 ± 2.22, p < 0.01), affective fatigue (pre: 4.25 ± 2.32, post: 3.43 ± 2.26, p < 0.05), sensory fatigue (pre: 4.71 ± 1.86, post: 3.49 ± 2.01, p < 0.001), and cognitive fatigue (pre: 3.88 ± 1.76, post: 3.17 ± 1.82, p < 0.05). After the intervention, participants showed a significant increase in MET at OBLA (pre: 5.76 ± 1.73, post: 6.91 ± 1.83, p < 0.001), time to termination of the treadmill protocol (pre: 8.76 ± 3.09, post: 9.92 ± 3.07 minutes, p < 0.001), MET at completion (pre: 5.9 ± 2.04, post: 6.78 ± 2.2, p < 0.001), and lactate concentration at the time of termination (pre: 5.65 ± 2.28, post: 6.63 ± 3.07 mmol, p < 0.05). Correlating MET at OBLA at the initial assessment with initial measures of fatigue showed a weak, negative correlation with all fatigue measures (total fatigue: r = - 0.21, behavioral fatigue: r = - 0.17, affective fatigue: r = - 0.25, sensory fatigue: r = - 0.16, cognitive fatigue: r = - 0.08). After 12 weeks of exercise, correlating MET at OBLA with follow-up fatigue measures showed improved correlation to all measure of fatigue except affective fatigue (total fatigue: r = - 0.22, behavioral fatigue: r = - 0.25, affective fatigue: r = - 0.17, sensory fatigue: r = - 0.18, cognitive fatigue: r = - 0.10). None of the correlation coefficients were statistically significant. **Conclusion:** These data indicate a weak relationship between OBLA and perception of fatigue. The lack of a significant correlation for any measure of fatigue and OBLA does not support the initial hypothesis. In turn, these data provide no strong evidence for a relationship between exercise OBLA and perception of fatigue at rest in a population of cancer patients after 12 weeks of exercise training.

METHODS

Participants were recruited upon referral by a physician to the UNCCRI Phase Program. Each participant performed an exercise-based assessment upon entry which included measures of fatigue and CRF. CRF was assessed using the UNCCRI treadmill protocol and blood lactate measurements were obtained every 2 minutes during this progressive exercise test. After the 12-week exercise intervention, all measures were repeated. Markers of performance such as the OBLA and the MET at OBLA were used in a correlation analysis with Piper Fatigue Scale scores.

RESULTS

After 12 weeks of exercise, participants showed a significant decrease in total fatigue (pre: 4.09 ± 1.78, post: 3.12 ±1.9, p < 0.01), behavioral fatigue (pre: 3.83 ± 2.46, post: 2.39 ± 2.22, p < 0.01), affective fatigue (pre: 4.25 ± 2.32, post: 3.43 ± 2.26, p < 0.05), sensory fatigue (pre: 4.7 ± 1.86, post: 3.49 ± 2.01, p < 0.001), and cognitive fatigue (pre: 3.88 ± 1.76, post: 3.17 ± 1.82, p < 0.05). After the intervention, participants showed a significant increase in MET at OBLA (pre: 5.76 ± 1.73, post: 6.91 ± 1.83, p < 0.001), time to termination of the treadmill protocol (pre: 8.76 ± 3.09, post: 9.92 ± 3.07 minutes, p < 0.001), MET at completion (pre: 5.9 ± 2.04, post: 6.78 ± 2.2, p < 0.001), and lactate concentration at the time of termination (pre: 5.65 ± 2.28, post: 6.63 ± 3.07 mmol, p < 0.05). Correlating MET at OBLA at the initial assessment with initial measures of fatigue showed a weak, negative correlation with all fatigue measures (total fatigue: r = - 0.21, behavioral fatigue: r = - 0.17, affective fatigue: r = - 0.25, sensory fatigue: r = - 0.16, cognitive fatigue: r = - 0.08). After 12 weeks of exercise, correlating MET at OBLA with follow-up fatigue measures showed improved correlation to all measure of fatigue except affective fatigue (total fatigue: r = - 0.22, behavioral fatigue: r = - 0.25, affective fatigue: r = - 0.17, sensory fatigue: r = - 0.18, cognitive fatigue: r = - 0.10). None of the correlation coefficients were statistically significant.

Table 1 Initial and Post Fatigue and Correlation with MET at OBLA

	Initial (n = 43)	Post (n = 43)	Initial Pearson Correlation	Post Pearson Correlation
Total	4.09 ± 1.78	3.12 ± 1.93*	- 0.21	- 0.22
Behavioral	3.38 ± 2.46	2.39 ± 2.22*	- 0.17	- 0.25
Affective	4.25 ± 2.32	3.43 ± 2.26*	- 0.25	- 0.17
Sensory	4.71 ± 1.83	3.49 ± 2.01*	- 0.16	- 0.18
Cognitive	3.88 ± 1.76	3.17 ± 1.82*	- 0.08	- 0.10

Values represent sample mean (± standard deviation) of the given population. * Denotes significance from initial to post-intervention values within the subject population at alpha = 0.05 (p < 0.05).

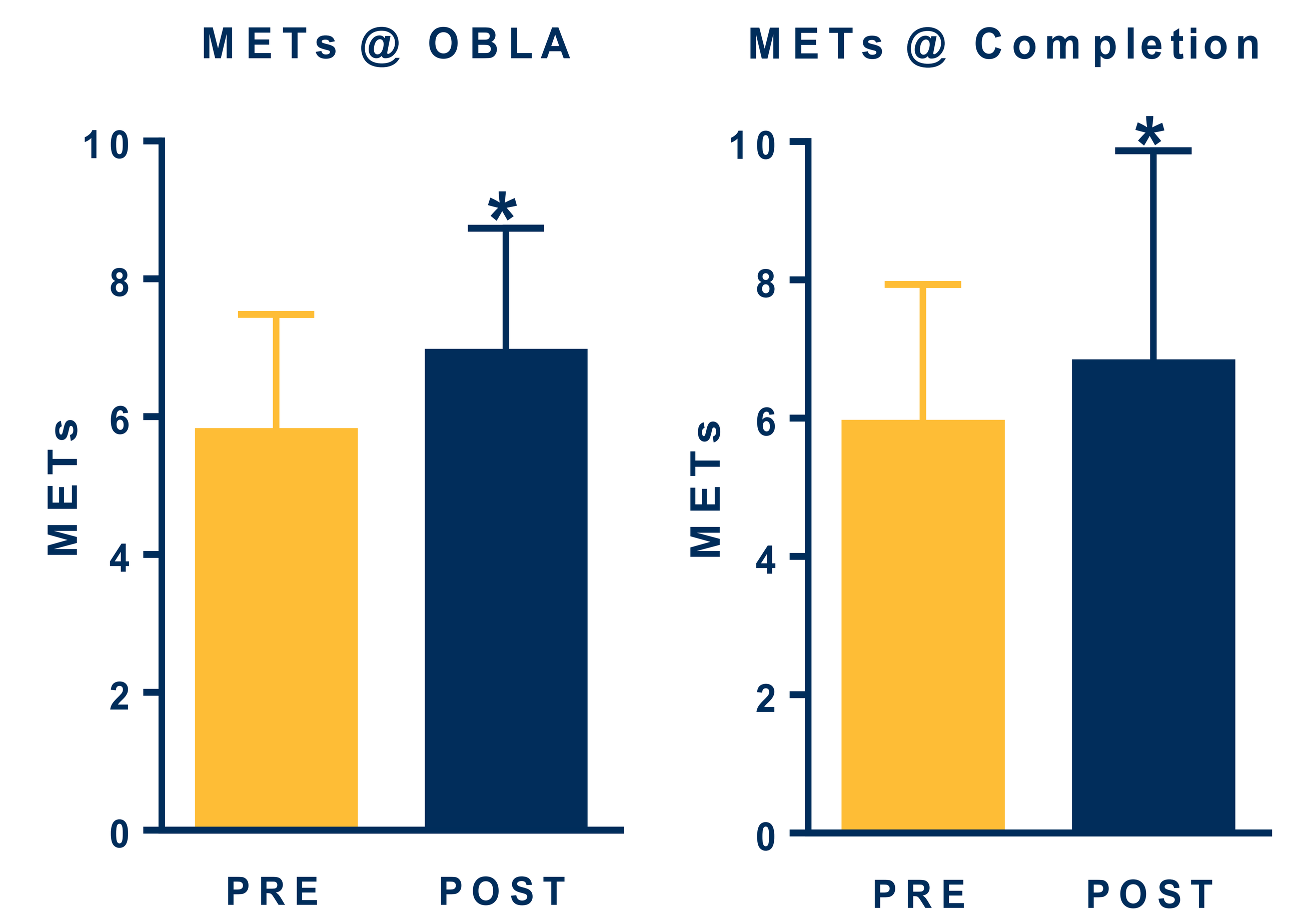


*Figure 1 METS at OBLA and METs at Completion. *Denotes significance from pre to post-intervention values within the subject population at alpha = 0.05 (p < 0.05).*

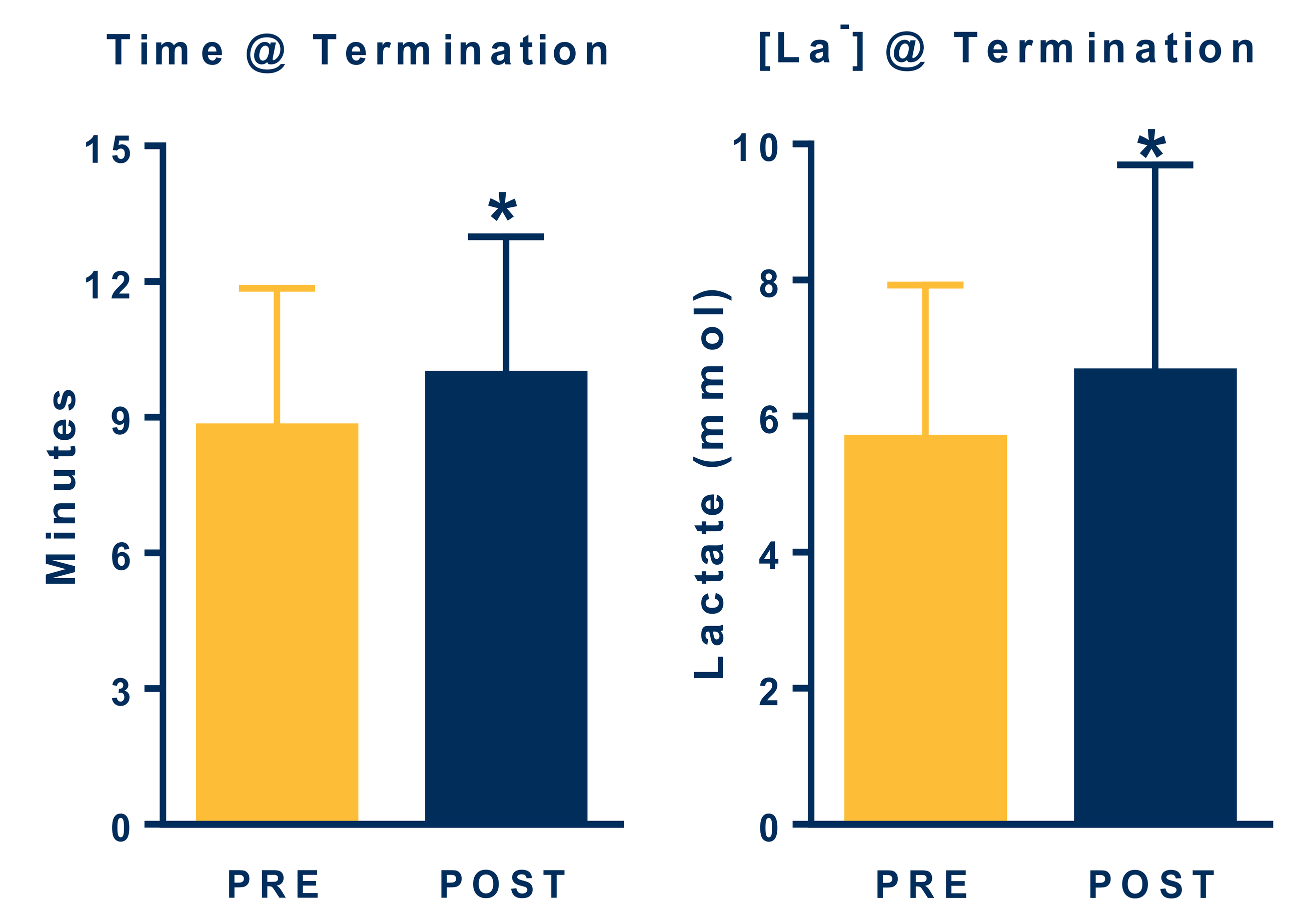
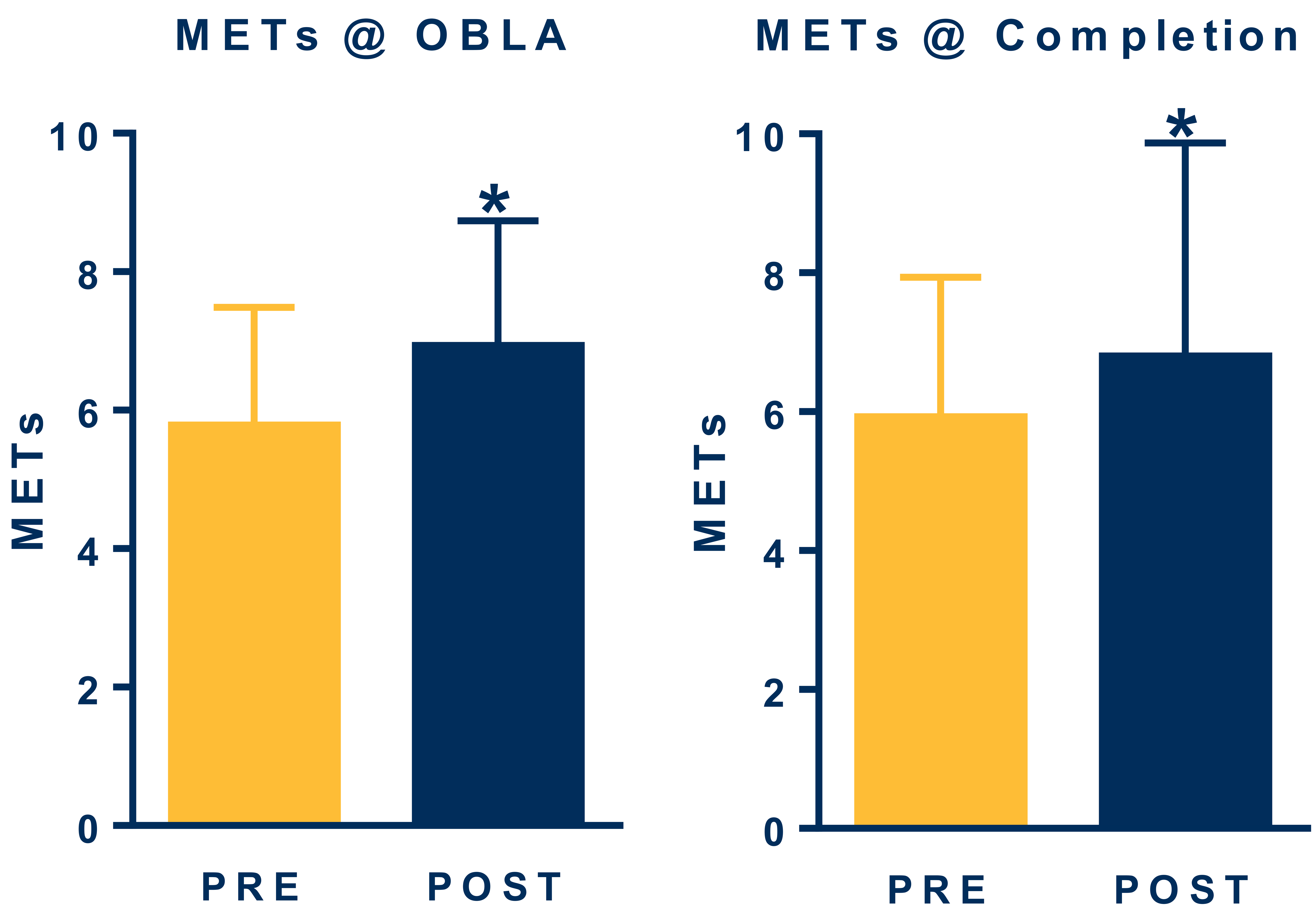
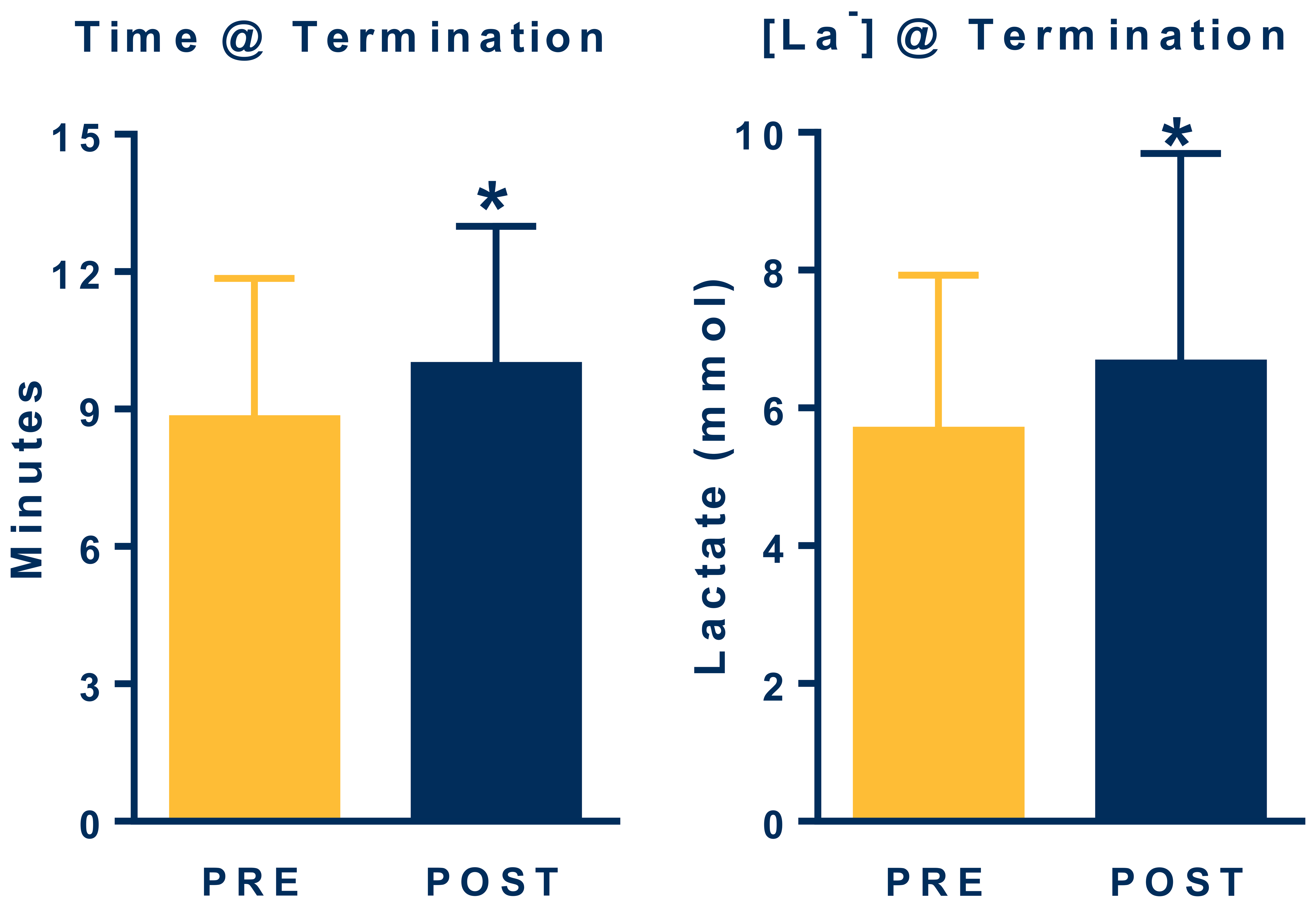


Figure 2 Time at Termination and Lactate at Time of Termination. Denotes significance from pre to post-intervention values within the subject population at alpha = 0.05 (p < 0.05).

CONCLUSIONS

- These data indicate a weak relationship between OBLA and perception of fatigue.
- These data provide no strong evidence for a relationship between exercise OBLA and perception of fatigue at rest in a population of cancer patients after 12 weeks of exercise training.


METs @ OBLA
METs @ Completion
METs
0
2
4
6
8
10
*
PRE
POST



Time @ Termination
15
12
9
6
3
0
Minutes
*
PRE
POST
[La-] @ Termination
10
8
6
4
2
0
Lactate (mmol)
*
PRE
POST