



Effects of Sleep on Maximal Exercise

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Abstract

INTRODUCTION: Sleep is a function of the body that is essential for proper recovery physically and mentally. Necessary for tissue repair and growth, muscle relaxation and healthy balance of hormones. The average time of sleep for the body to function properly is approximately seven to eight hours a night. Sleep deficiency is common among adults and it can cause chronic health problems such as high blood pressure, heart disease, diabetes, stroke, and kidney disease. Research shows that sleep has no effect on maximal exercise. Maximal oxygen consumption (VO_{2max}) is the maximum capacity of the body to transport and utilize oxygen during incremental exercise. It is expressed either as an absolute rate in $liters$ of oxygen per minute (L/min) or as a relative rate in milliliters of oxygen per $kilogram$ of body weight per minute (ml/kg/min).

PURPOSE: The purpose of this study was to evaluate the effects of sleep on maximal exercise.

METHODS: Five men (21.5 ± 1.73 yrs) from the University of Texas at Arlington volunteered to participate in this study and four were able to complete it. Each subject performed two graded exercise tests on the treadmill with increasing speed and elevation until exhaustion. Prior to one test the subjects had a full night's rest (FR) and for the other test they had four hours of sleep (4Hrs). During each test heart rate (HR) and rate of perceived exertion (RPE) were recorded along with the maximal values measured by the metabolic cart, absolute maximal oxygen consumption (VO_{2max}) and time (min.). The alpha level for significance was set at $p \leq 0.05$.

RESULTS: The maximal values: VO_{2max} (FR: 3.3 ± 0.4 L/min; 4Hrs: 3.1 ± 0.4 L/min), HR (FR: 189.5 ± 7.1 bpm; 4Hrs: 187.8 ± 3.8 bpm), RPE (FR: 17.8 ± 1 ; 4Hrs: 17.8 ± 1.0), min.: (FR: 11.5 ± 1.1 min; 4Hrs: 11.4 ± 1.1 min) were not significantly different ($p > 0.05$) when comparing the amount of sleep obtained prior to the maximal exercise test.

CONCLUSION: The results of this study indicate sleep deprivation does not influence maximal exercise and is in agreement with previous studies where similar results have been found.

Purpose

The purpose of this study was to evaluate the effects of sleep on maximal exercise.

Methods

Participants

- 5 UTA male students (only 4 able to complete it)
- Moderate activity between the ages of 19-23 yrs.

Instrumentation

- Treadmill, HR monitor, headgear, nose clip, mouth piece, RPE chart, stopwatch, metabolic cart, and excel.
- Statistical analysis using t-test two-tail type one on excel.



Methods (cont'd)

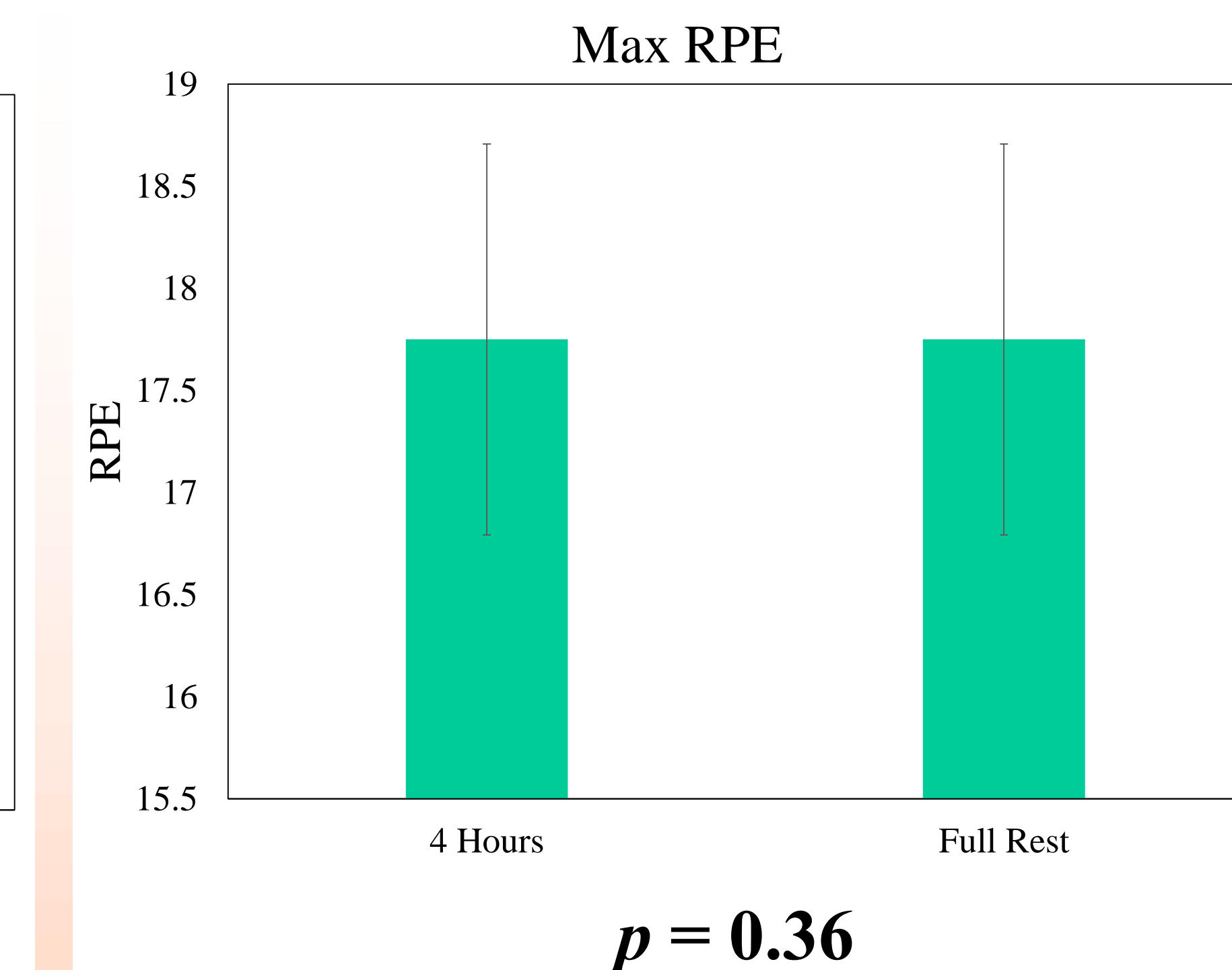
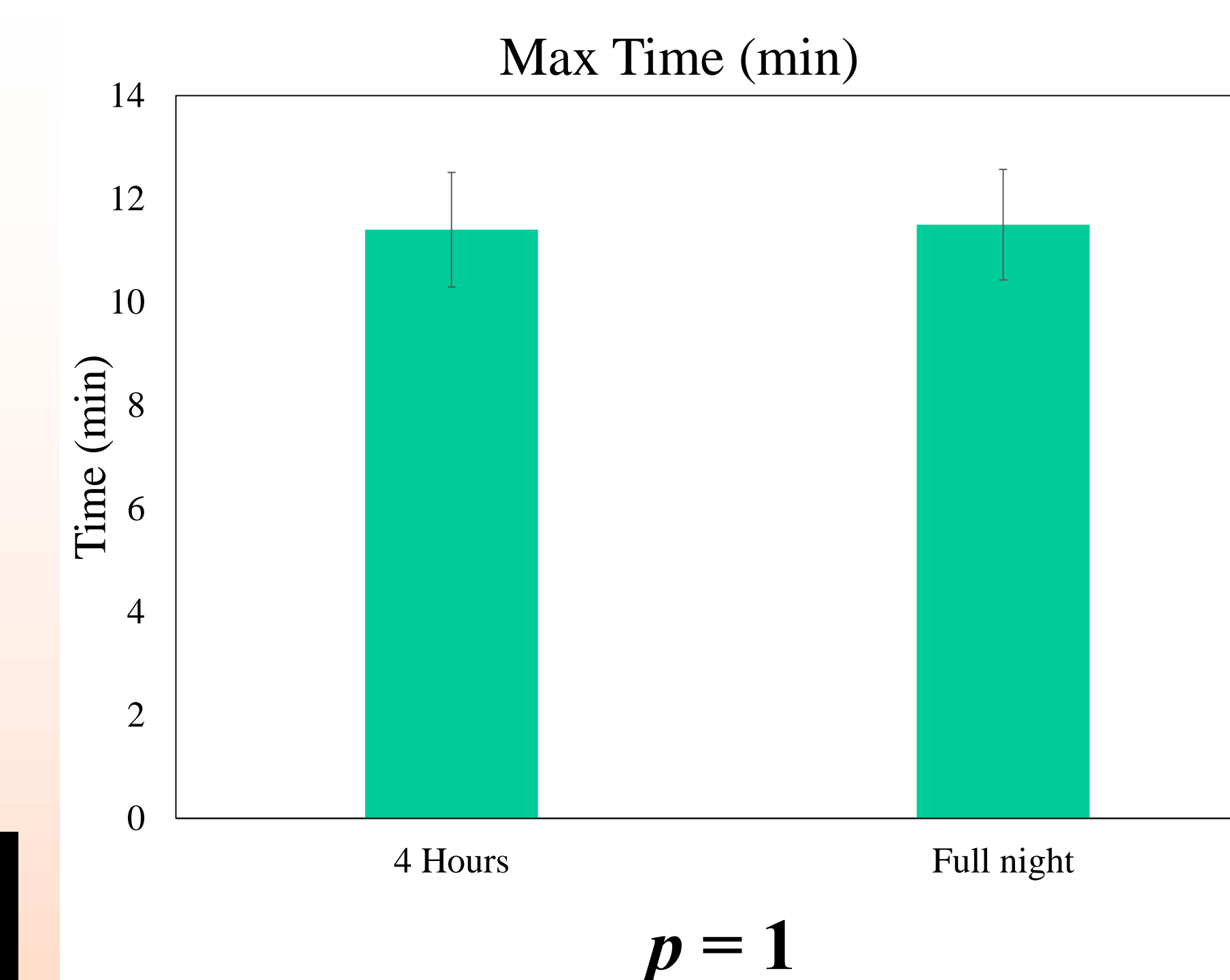
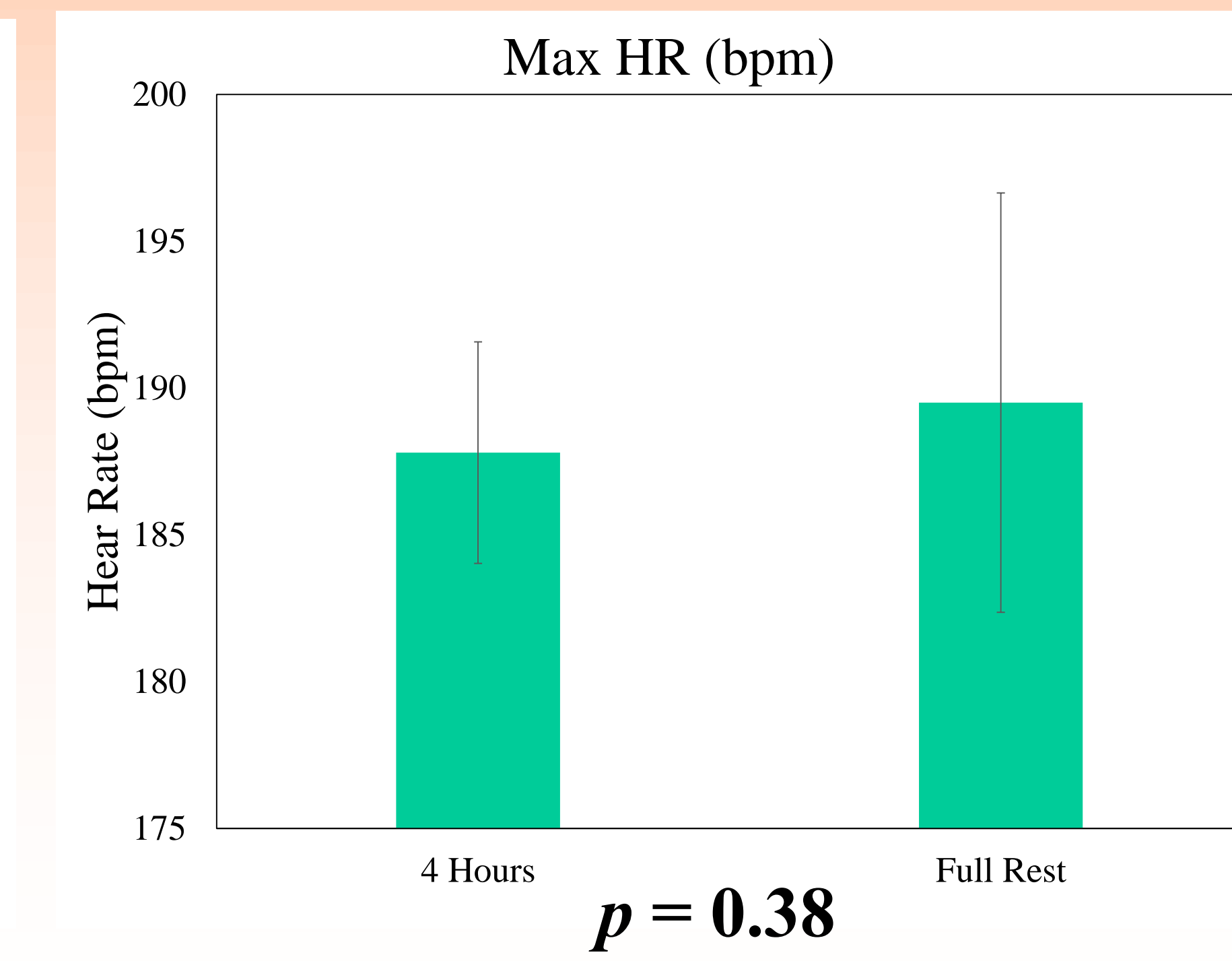
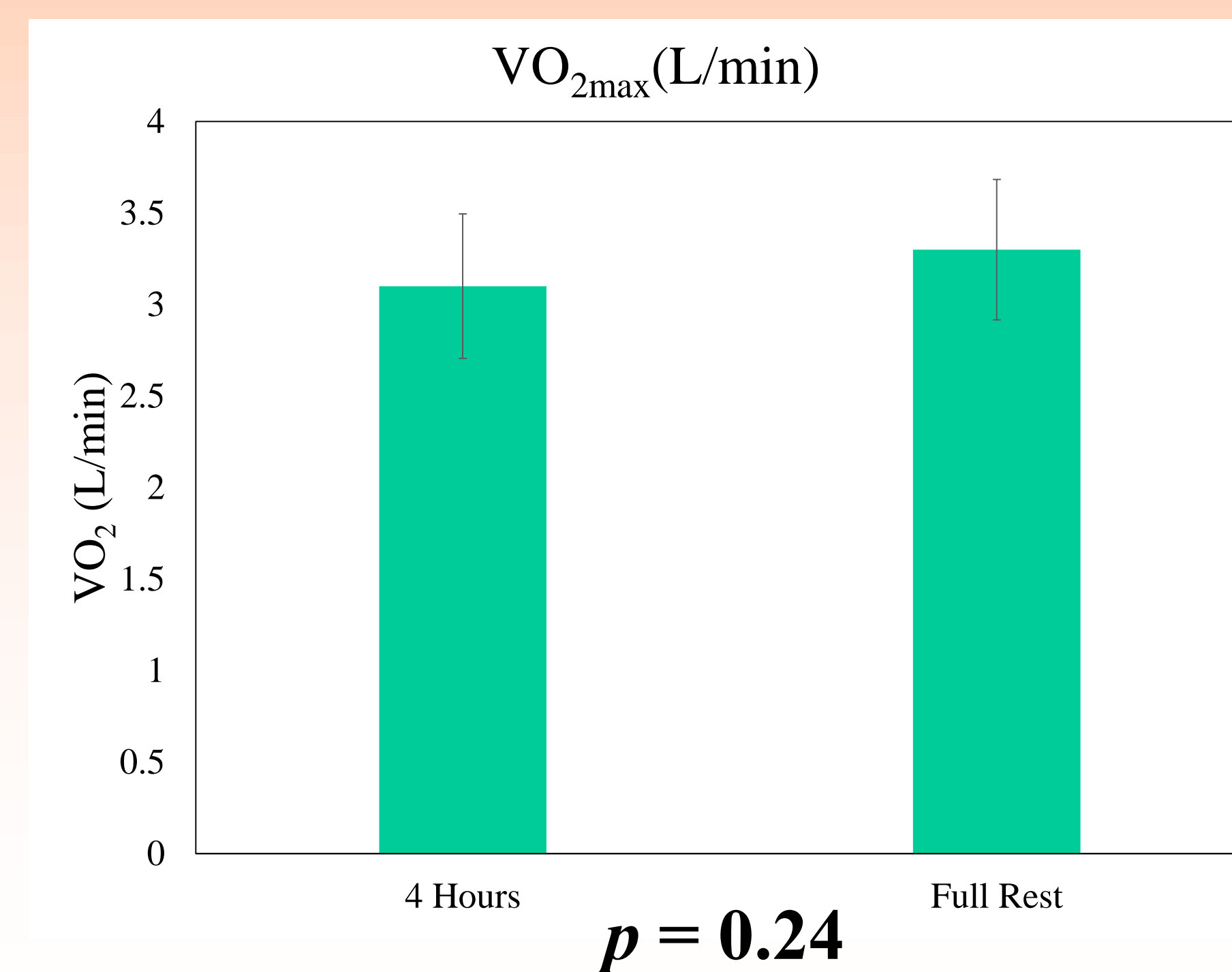
Procedures

1. Having a well-rested sleep of around 8 hours or a regular full sleep on one visit. The other visit was having sleep of 4 hours with communication maintained to monitor that subjects complied to sleeping 4 hours. The order of which was done first was chosen at random.
2. After a full rested sleep or 4 hours of sleep a Bruce protocol VO_{2max} test was performed.
3. The experimental testing sequence as follows:
 - a) Preparation: subject and equipment. Fitting HR monitor and headgear, mouthpiece and tubing preparation.
 - b) Resting: a five-minute rest period during which heart rate (HR) was taken during the 5th minute.
 - c) Exercise: Bruce protocol began. During exercise, HR is taken during the last 15 sec and 30 sec, respectively, of minute 3, along with RPE. The workloads will progressively increase every 3 minutes. Exercise will continue to volitional exhaustion.
4. A follow up of a next exercise test with same experiment testing but either fully rested or 4 hours of sleep, depending on what was done on the first test.

Results

Variable	Group	Mean	\pm SD
VO_{2max} (L/min)	4 Hours	3.1	± 0.39
	Full Rest	3.3	± 0.38
Max HR (bpm)	4 Hours	187.8	± 3.8
	Full Rest	189.5	± 7.1
Max Time (min)	4 Hours	11.4	± 1.1
	Full Rest	11.5	± 1.1
Max RPE	4 Hours	17.75	± 0.96
	Full Rest	17.75	± 0.96

Results (cont'd)



Conclusions

- There were no significant differences in the variables depending on the amount of sleep the subjects received.
- A beginning trend started on an increase in VO_{2max} and Max HR on the maximal test when fully rested from four hours of sleep.
- Max time and max RPE remained relatively equal.
- Recommendations for the future is having subjects more familiar with the maximal test and including a larger sample.