EFFECT OF DAYTIME MELATONIN ADMINISTRATION ON TYMPANIC TEMPERATURE HEART RATE AND ENDURANCE CAPACITY

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Abstract: The purpose of this study is to know the effect of pre-cooling strategy using 3mg of melatonin during daytime on tympanic temperature, heart rate and endurance capacity. Twenty four physically active and healthy males were randomly classified into two groups namely melatonin and placebo, each constitute of 12 players. The age, height and body mass were 21.13 ± 0.80 yr, 1.79 ± 0.5 m, 78.4 ± 5.1 kg, respectively. Tympanic temperature, heart rate and endurance capacity was selected as criterion variable. Single dose of Melatonin (3g) and placebo were supplemented to respective group around 10:00. ANCOVA was administered. The results of this study indicate that the 3 mg of melatonin significantly affected the tympanic temperature (F (1&21) = 12.68, p = 0.002) and heart rate (F (1&21) = 6.48, p = 0.019). However endurance capacity did not show any changes (F (1&21) = 2.308, p = 0.144). It is inferred from the results of the present study that 3mg of melatonin significantly affect the tympanic temperature and heart rate but failed to show any impact on endurance capacity.

Keywords: *Melatonin, Placebo, Heart rate, Tympanic temperature, Endurance and athletes.*

Introduction

Athletes train and compete in various climates, but frequently they train and compete in hot environment. When endurance exercise is performed in hot environment it is limited when a critical core temperature is attained. Therefore to improve endurance performance, reducing body temperature pre- exercise would cause greater heat storage and delay onset of hyperthermic fatigue.

In order to improve endurance capacity whole-body cooling prior to activity has the potential to reduce thermal strain and fatigue. There are several pre-cooling techniques such as cold shower or baths, are unpleasant and require considerable time for a significant reduction in body temperature to be achieved. Manipulating body temperature by use of supplements is known to affect performance. Atkinson et al., (2003, 2005) reported that vasodilatory effect of melatonin led to the enhancement of endurance by promoting heat loss [1, 2]. Melatonin is secreted In pineal gland and peaks between 03:00 to 04:00 hours and being suppressed by daylight [3,4]. When melatonin is supplemented during daytime alters body temperature of 0.1°C to 0.3°C [4, 5]. The purpose of this study is to know the effect of pre-cooling strategy using 3mg of melatonin during daytime on tympanic temperature, heart rate and endurance capacity.

Methods

Subjects

Twenty four physically active and healthy males provided written consent to participate in the experiment, which was approved by Annamalai University Institutional Human Ethics Committee, Rajah Muthiah Medical College, Tamilnadu, India. The age, height and body mass were 21.13 ± 0.80 yr, 1.79 ± 0.5 m, 78.4 ± 5.1 kg, respectively. These players were randomly classified into two groups namely melatonin and placebo, each constitute of 12 players. On average, the players had 4.9 ± 2.1 years of playing experience and represented Annamalai University in Inter University competition and underwent regular morning training between 06:30 to 08:30 and evening practice between 16:30 to 18:30 regularly prior to the commencement of this study.

Variables

Tympanic temperature, heart rate and endurance capacity was selected as criterion variable. The Bruce exercise protocol for treadmill fitness tests was used as it is of an appropriate test to predict endurance capacity of active and sedentary men [6]. Experimental testing was performed two times before and after administration of 3mg of melatonin and placebo to respective groups. Experimental testing took place at 12:00 hour in the month of June, during maximum daylight hours. The subjects were asked to arrive 20 minutes before testing. All testing sessions were identical and lasted less than an hour. Session begin with 15 minutes of rest followed by tympanic temperature measured via infrared ear thermometer (Baurn thermo scan IRT 4000) followed by heart rate (Omron blood pressure monitor, Japan). After the rest measures endurance capacity was measured by treadmill test, which was strictly the same for all test session.

Melatonin and Placebo details

The experimental variable selected in the present study was day time administration of 3mg of melatonin (Aristo Pharmaceuticals Ltd, Mumbai, India) and placebo tablets (Aristo Pharmaceuticals Ltd, Mumbai, India) around 10:00. In this study single dose of melatonin and placebo was fixed.

Statistical technique

The data were analysed using statistical package for social sciences (SPSS) for window version 11.5. ANCOVA was carried out between melatonin and placebo groups before and after administration of 3 mg of melatonin and placebo to respective groups. Statistical significance was accepted at $p < 0.05$.

Results

The descriptive analysis of data collected on tympanic temperature, heart rate and endurance capacity before and after single dose administration of 3 mg of melatonin and placebo is presented in Table-1. The results of this study indicate that the 3 mg of melatonin significantly affected the tympanic temperature (F (1&21) = 12.68, $p = 0.002$) and heart rate

(F (1&21) = 6.48, p = 0.019). However endurance capacity did not show any changes (F (1&21) = 2.308, p = 0.144). It is inferred from the results of the present study that 3mg of melatonin significantly affected the tympanic temperature and heart rate but failed to show any impact on endurance capacity.

Table 1
Analysis of Covariance on tympanic temperature, heart rate and endurance capacity of melatonin and placebo groups

Variable	Groups	Tests		F value		
		Pre	Post	Pre	Post	Adjusted
Tympanic temperature (°C)	Melatonin	36.80±0.04	36.46±0.25	0.059 (p = 0.810)	13.32* (p = 0.001)	12.68* (p = 0.002)
	Placebo	36.81±0.31	36.85±0.26			
Heart rate (beats/min)	Melatonin	62.90±6.66	56.70±5.78	0.251 (p = 0.622)	6.927* (p = 0.015)	6.48* (p = 0.019)
	Placebo	64.23±6.37	63.40±6.65			
Endurance capacity (ml/kg/min)	Melatonin	58.58±5.02	61.05±4.02	0.014 (p = 0.907)	1.868 (p = 0.185)	2.308 (p = 0.144)
	Placebo	58.83±5.08	58.69±4.41			

*significant at 0.05 level of confidence

Discussion on findings

Manipulating body temperature by use of melatonin supplement is known to affect performance. Exogenous melatonin has been found to reduce body temperature at rest when ingested during the hours of daylight [6]. Kräuchi et al. (1997) found that rectal temperature reached a minimum at 60–90 min after lying down, but a further decrease was then observed after ingestion of 3 mg of melatonin [7]. Moreover, a 3-hr pre-exercise period of complete rest would not be externally valid to athlete behaviour prior to real sports competitions. Decreasing core temperature low prior to endurance exercise has potential ergogenic effects, so too has a warm-up before performance commences. Exercise of short duration and high intensity is enhanced when muscle temperature is moderately elevated [8]. In contrast, prolonged sub- maximal exercise is impaired as a result of accompanying elevations in body temperature above an optimal level [9].

In our study we found a mean decrease in tympanic temperature and heart rate of approximately 0.34°C and 6.2 (beats. min^{-1}) in the melatonin group. The mechanisms responsible for these changes and identification of the theoretical optimum are complex, as changes in core and muscle temperatures alter a host of responses, including metabolic, cardiovascular and thermoregulatory measures, any of which – singly or together – will impact on exercise capability. Atkinson et al. (2003, 2005) reported that the vasodilatory effects of melatonin led to the enhancement of endurance performance by promoting heat loss [1, 2]. However, we found a mean increase in endurance capacity of approximately 2.47 ($ml.kg^{-1}.min^{-1}$) in the melatonin group.

Conclusion

It is concluded that ingestion of 3 mg of melatonin decreases the tympanic temperature and heart rate. Although melatonin induced the hypothermic effects showed no significant changes in endurance capacity. Moreover, it is still unclear whether the hypothermic effects

of melatonin might lead to improved endurance performance. Future research work into the precooling properties of melatonin could append a time trial or time to exhaustion protocol to the period of proscribed exercise in order to elucidate fully any link between melatonin-mediated hypothermia during exercise and endurance performance.

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