Impact of Melatonin Administration on Sleep Deprivation and Visual Reaction Time in Male Players

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Abstract

Sleep deprivation are common in athletes competing in events and it is well established that the sleep loss has negative effect on motor and mental performance. Thus this study estimate how far these changes vary due to melatonin supplementation. Sixty college male players were selected for this study and they were divided into six groups of 10 each. They were designated as **A)** Disturbed sleep deprivation for 48 hours, **B)** Complete sleep deprivation for 48 hours. **C)** Disturbed sleep deprivation for 48 hours with melatonin supplementation, **D)** Complete sleep deprivation for 48 hours with melatonin supplementation. **E)** Normal sleep with melatonin supplementation and **F)** Normal sleep. Melatonin is hormone secreted from pineal gland and known for its sleep promotion action and melatonin supplementation are widely used to treat sleep problems, 6mg of melatonin was administered orally for sleep deprived group and placebo for non-supplemented group. The parameter tested were visual reaction time using standard procedures. The collected data on visual reaction time was analyzed using one way analysis of variance. The result revealed that, the reduction in speed as a result of 48 hours of disturbed and complete sleep deprivation group. Visual reaction time has reduced in melatonin supplementation group compared to placebo group.

KEYWORDS: Sleep Deprivation, Melatonin supplementation, Visual Reaction Time, Male Players

Introduction

Sleep deprivation is the term used to describe the condition of insufficient sleep or experiencing lack of sleep. After few days of sleep deprivation studies have shown that, there is decline in motor performance and increase reaction time. After 4-5 days of sleep deprivation, there is decline in cognitive function. EEG changes and psychological symptoms become prominent. Melatonin is a hormone secreted from pineal gland. It is synthesized by consecutive acetylation and methylation of L-tryptophan and secreted only during the night it promotes sleep in human. There is a diurnal rhythm of melatonin synthesis and secretion. It is stimulated by darkness and inhibited by light. It regulate the natural sleep wake cycle. When administered orally, Melatonin is absorbed rapidly; it is metabolized in the liver and is secreted mainly by the kidney. Apart from regulation of sleep it has many pleiotropic roles: maintenance of immune system, efficient antioxidant and powerful free radical scavenger**.** Melatonin supplementation has been found to be an effective stress reliever and may delay aging process indicated in circadian rhythm sleep disorder, the relationship between the pineal and pubertal development is well

established. In our country generally players travel one day prior to sports competition, It leads to sleep deprivation resulting in changes in Visual reaction time, how for these changes vary due to the supplementation of melatonin have not been examined so far. So the present study investigates the influence of melatonin supplementation during sleep deprivation on Visual reaction time in sports players.

Purpose of the Study

To explore the influence of disturbed sleep deprivation and complete sleep deprivation on visual reaction time.

To find out the influence of melatonin supplementation during disturbed and complete sleeps deprivation on visual reaction time.

To find out the influence of melatonin supplementation during normal sleep on visual reaction time.

Methodology

The study was conducted in 60 healthy college male players in Pondicherry. They were divided into 6 groups, each group consist of 10 players. The age of the subjects were ranged from 19 to 21 years. All the subjects were hostellers. Hence, the nutrient status and day-to-day activities of the entire subject were almost the same during the experimental period. The experimental protocol was explained to them and informed consent was obtained prior to the experimentation.

The parameters tested are visual reaction time. 6 mg of melatonin is supplemented for sleep deprived players. The tablet is given half an hour before dinner around 7.00 PM. Placebo was given to non-supplementation group.

The study was restricted to two types of sleep deprivation, namely disturbed sleep deprivation for 48 hours and complete sleep deprivation for 48 hours. The dependent variables selected were visual reaction time. The independent variables were sleep deprivation with and without supplementation.

Experimental Design

The experimental design used for the present investigation was 6 x 3 factorial designs with the last factor being repeated measures, using randomly selected 60 volunteers. The first factor indicates six groups of **A)** Disturbed sleep deprivation for 48 hours, **B)** Complete sleep deprivation for 48 hours. **C)** Disturbed sleep deprivation for 48 hours with melatonin supplementation, **D)** Complete sleep deprivation for 48 hours with melatonin supplementation. **E)** Normal sleep with melatonin supplementation and **F)** Normal sleep. The second factor denotes three testing periods of basal, 48 hours after sleep deprivation and after 24 hours of recovery. Placebo was given to non-supplementation group and there by double blind placebo method was followed.

Collection of Data

The data on visual reaction time were collected by polygraph with computer feeding method during basal condition, after 48 hours sleep deprivation and 24 hours after sleep recovery for all 6 groups. Much care was taken to administer the tests during above

mentioned periods. The identical conditions were kept by using the same apparatus, testing personnel's and testing procedures.

Statistical Technique

The data collected from the control and experimental groups were treated statistically. The descriptive statistics was computed separately for each group. To examine the effect of melatonin supplementation during sleep deprivation on visual reaction time, one way analysis of variance was computed for the mean gain score for the data collected from control and experimental groups during basal, 48 hours variables and after 24 hours of recovery. Whenever the F ratio was significant Scheffe's test was used as a post hoc test to determine which of the paired mean differed significantly. The data was analyzed by using SPSS V.17 Package.

Analysis of Visual Reaction Time

The data pertaining to the changes on visual reaction time among six groups, basel, after sleep deprivation and after recovery have been analyzed statistically and the details are given in table 1

Table-1

Analysis of Variance on Visual Reaction Time among Six Groups During Basal, After Sleep Deprivation and After Recovery

Testing Period	Source of variance	Sum of square	df	Mean Square	F Ratio	Level of Significance
Basel Value Adjusted for 48 Hours of Sleep Deprivation	Between Groups	108788.70	5	21757.73	30.20*	0.01
	Within Groups	388998.30	54	720.33		
Basal value Adjusted for 24 Hours of Sleep Deprivation	Between Groups	16108.53	5	3221.70	6.37*	0.01
	Within Groups	27286.80	54	505.31		
Basel Value Adjusted for 24 Hours After recovery	Between Groups	164630.30	5	32926.05	25.40*	0.01
	Within Groups	69998.70	54	1296.27		

* Significant at 0.01 level confidence.

The tabulated F value for 0.05 = **2.39** and 0.01 = **3.42**

It is observed from the table I that the obtained F ratio 30.20 for the basal value adjusted for 48 hours of sleep deprivation was significant at 0.01 level. It was inferred that significant variation occurred on visual reaction time among six groups were due to 48 hours of sleep deprivation from the basal condition.

The results of scheffe's test for the differences between the adjusted means of basal value for 48 hours of sleep deprivation on visual reaction time between six groups are presented in table-2.

Table-2

Scheffe's Test for the Differences between the Adjusted Means of Basal Value for 48 Hours of Sleep Deprivation on Visual Reaction Time Between Six Groups

Sl.No.	Adjusted Post-Test Means for Different Groups						MD	Levels of Significance
	A	B	C	D	E	F		
1.	-37.40	-30.30					7.10	NS
2.	-37.40		21.40				58.80*	0.01
3.	-37.40			92.60			130.00*	0.01
4.	-37.40				14.70		52.10*	0.01
5.	-37.40					3.90	41.30	NS
6.		-30.30	21.40				51.70*	0.01
7.		-30.30		92.60			122.90*	0.01
8.		-30.30			14.70		45.00	NS
9.		-30.30				3.90	34.20	NS
10.			21.40	92.60			71.20*	0.01
11.			21.40		14.70		6.70	NS
12.			21.40			3.90	17.50	NS
13.				92.60	14.70		77.90*	0.01
14.				92.60		3.90	88.70*	0.01
15.					14.70	3.90	10.80	NS

***Confidence Interva**l (CI) required for the significant at 0.01 is **49.57**

A)Disturbed Sleep Deprivation, **B)** Complete Sleep Deprivation, **C)** Disturbed Sleep Deprivation with Supplementation, **D)** Complete Sleep Deprivation with Supplementation, **E)** Normal Sleep with Supplementation, **F)** Normal Sleep, **NS** - Not Significant.

It is clear from table 2 shows that the basal value adjusted means for 48 hours sleep deprivation on visual reaction time for disturbed sleep deprivation group differ significantly at 0.01 level with disturbed Sleep Deprivation with supplementation group, complete sleep deprivation with supplementation groups and sleep with supplementation groups and the two groups were not significant. Further, the complete sleep deprivation group differs significantly at 0.01 level with disturbed sleep deprivation with supplementation group and complete sleep deprivation with supplementation groups while other two groups were not significant. Table 2 also shows that the disturbed sleep deprivation with supplementation group differ significantly at 0.01 level with complete sleep deprivation with supplementation group and other two groups were not significant Further, the complete sleep deprivation with supplementation group differ significantly at 0.01 level with normal sleep with supplementation group and normal sleep group.

The result of scheffe's test for the differences between the adjusted means of 48 hours of sleep deprivation value for 24 hours after recovery on visual reaction time between six groups are presented in table-3.

Table -3

Scheffe's Test for the Differences between the Adjusted Means of 48 Hours of Sleep Deprivation Value for 24 Hours after Recovery on Visual Reaction Time Between Six Groups

Sl.No.	Adjusted Post-Test Means for Different Groups						MD	Levels of Significance
	A	B	C	D	E	F		
1.	8.20	-35.70					43.90*	0.01
2.	8.20		-15.70				23.90	NS
3.	8.20			13.50			5.30	NS
4.	8.20				-15.20		23.40	NS
5.	8.20					-5.10	13.30	NS
6.		-35.70	-15.70				20.00	NS
7.		-35.70		13.50			49.20*	0.01
8.		-35.70			-15.20		20.50	NS
9.		-35.70				-5.10	30.60	NS
10.			-15.70	13.50			29.20	NS
11.			-15.70		-15.20		0.50	NS
12.			-15.70			-5.10	10.60	NS
13.				13.50	-15.20		28.70	NS
14.				13.50		-5.10	18.60	NS
15.					-15.20	-5.10	10.10	NS

*** Confidence Interval** (CI) required for Significant at 0.01 level is **41.51**

A)Disturbed Sleep Deprivation, **B)** Complete Sleep Deprivation, **C)** Disturbed Sleep Deprivation with Supplementation, **D)** Complete Sleep Deprivation with Supplementation, **E)** Normal Sleep with Supplementation, **F)** Normal Sleep, **NS** - Not Significant.

From table 3 it is clearly shows that for 48 hours of sleep deprivation value adjusted means for 24 hours after recovery on visual reaction time the disturbed sleep deprivation group differ significantly at 0.01 level with complete sleep deprivation group and other groups do not differ significantly. Complete sleep deprivation group differ significantly at 0.01 level with complete sleep deprivation with supplementation group, The Rest of the groups did not differ significantly.

The result of scheffe's test for the differences between the adjusted means of basal value adjusted for 24 hours after recovery on visual reaction time between six groups are presented in table-4.

Table-4

Scheffe's Test for the Differences between the Adjusted Means of Basal Value for 24 Hours after Recovery on Visual Reaction time Between Six Groups

Sl.No.	Adjusted Post-Test Means for Different Groups						MD	Levels of Significance
	A	B	C	D	E	F		
1.	-29.20	-66.00					36.80	NS
2.	-29.20		5.70				34.90	NS
3.	-29.20			106.10			135.30*	0.01
4.	-29.20				0.50		28.70	NS
5.	-29.20					-1.20	28.00	NS
6.		-66.00	5.70				71.70*	0.01
7.		-66.00		106.10			712.10*	0.01
8.		-66.00			0.50		65.50	NS
9.		-66.00				-1.20	64.80	NS
10.			5.70	106.10			100.40*	0.01
11.			5.70		0.50		6.20	NS
12.			5.70			-1.20	6.90	NS
13.				106.10	0.50		106.60*	0.01
14.				106.10		-1.20	107.30*	0.01
15.					0.50	-1.20	-0.70	NS

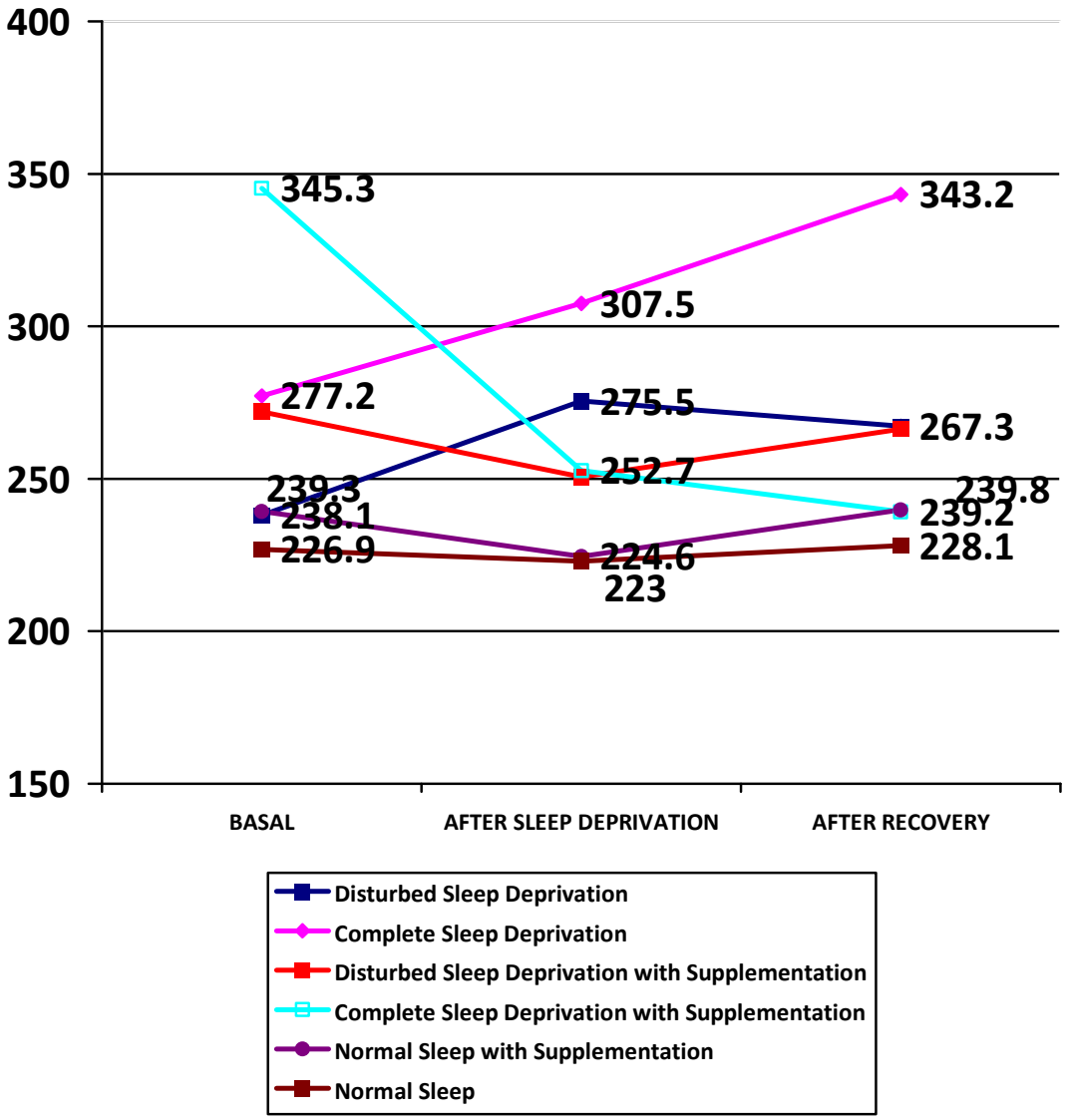
*** Confidence Interval** (CI) required for Significant at 0.01 level is **66.49**

A)Disturbed Sleep Deprivation, **B)** Complete Sleep Deprivation, **C)** Disturbed Sleep Deprivation with Supplementation, **D)** Complete Sleep Deprivation with Supplementation, **E)** Normal Sleep with Supplementation, **F)** Normal Sleep, **NS** - Not Significant.

Table 4 shows that for basal value adjusted for 24 hours after recovery on visual reaction time the disturbed sleep deprivation group differ significantly at 0.01 level with complete sleep deprivation with supplementation group and other four groups were not significant. Further complete sleep deprivation group differ significantly at 0.01 level with deprivation with supplementation groups and other two groups were not significant. Table-4 also shows that the disturbed sleep deprivation with supplementation group differ significantly at 0.01 level with complete sleep deprivation with supplementation group and other two groups were not significant. Further the complete sleep deprivation with supplementation group differ significantly at 0.01 level with normal sleep with supplementation group and normal sleep groups. The Rest of the groups did not differ significantly.

Figure-1

Graphical Representation on Visual Reaction Time During Basal, After Sleep Deprivation and After Recovery among Six Groups



Conclusions

- As a result of 48 hours of disturbed and complete sleep deprivation visual reaction time has increased and it did not differ significantly.
- Due to melatonin supplementation visual reaction time has reduced significantly for complete sleep deprivation group.

- The recovery of visual reaction time differs significantly for disturbed sleep deprivation group. The recovery process of disturbed sleep and disturbed sleep with supplementation group did not differ significantly in their visual reaction time. While the recovery of visual reaction time completes sleep deprivation and complete sleep deprivation with supplementation group differ significantly.

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