Influence of Melatonin Supplementation during Sleep Deprivation on Selected Motor Ability in Sports Men

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Abstract

Sports Performances is influenced by training load, diet and rest. Generally players travel one day prior to sports competition. It leads to sleep deprivation and resulting reduction in motor ability. Thus this study estimates how far these reductions are compensated 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. Six mg of melatonin was administered orally for sleep deprived groups and placebo for non supplemented group. The parameter tested were agility and eye hand co-ordination using standard procedures. The collected data on motor ability was analyzed using one way analysis of variance. The result reveled that the reduction in agility as a result of 48 hrs of disturbed and complete sleep deprivation and in melatonin supplementation it was not statically significant. There is reduction in eye hand coordination after 48 hours of disturbed and complete sleep deprivation do not differ significantly. Due to melatonin supplementation eye hand co-ordination have increased in the disturbed sleep deprivation group and do not differ significantly in complete sleep deprivation.

Key words: Melatonin supplementation, Sleep deprivation, Motor ability, Sports men.

Introduction

Experimental deprivation of sleep is an important method aimed at finding out the important functions of sleep. Studies have shown that after few days of sleep deprivation there is decline in motor ability and an increase in reaction time. After a few days of sleep deprivation, the EEG recording shows a gradual diminishing of an alpha activity, with increase in lower frequency activity. After four and five days of sleep deprivation, psychological symptoms become prominent. Initially there is a decrease in attention span, easy distractibility, drowsiness, decreased initiative to perform. On prolonged deprivation of sleep psychotic symptoms appear and finally frank delirium occurs.

Melatonin (N –acetyl-5-methoxytryptamine) is an indole neurohormone secreted from the pineal gland in the brain. It is synthesized from L-tryptophan via serotonin as an intermediate precursor by consecutive action of a cascade of enzymes. 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. Apart from regulation of sleep it has many pleiotrophic 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. The relationship between the pineal and pubertal development is well established. In our country generally players travel one day prior to sports competition

which leads to sleep deprivation resulting in reduction in motor ability. How far these changes are compensated due to the supplementation of melatonin has not been examined so far. Hence, an attempt was made to investigate the influence of melatonin supplementation during sleep deprivation on motor ability in sports man.

Objectives of the Study

1. To explore the influence of disturbed sleep deprivation and complete sleep deprivation on selected motor ability such as agility and eye hand co-ordination.
2. To find out the influence of melatonin supplementation during disturbed and complete sleep deprivation on agility and eye hand co-ordination.
3. To explore the recovery after sleep deprivation with melatonin supplementation on agility and eye hand co-ordination.

Methods and Materials

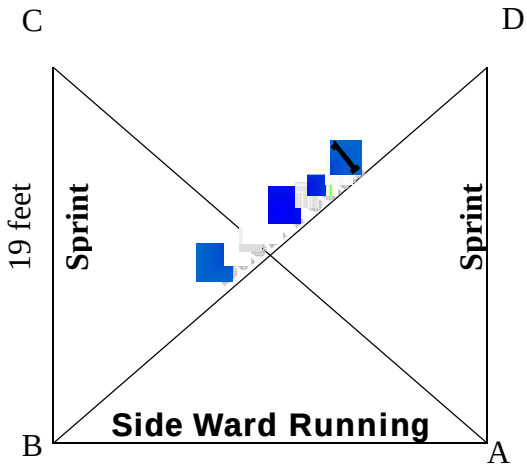
The study was conducted in 60 healthy college male players in Pondicherry. They were divided into 6 groups, each group has 10 players. The study was restricted to two types of sleep deprivation, namely, disturbed sleep deprivation for 48 hours and complete deprivation for 48 hours. The age of the subjects 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. Six mg of melatonin was supplemented for sleep deprived players. The tablet was given orally half an hour before dinner around 7.00 pm. When administered orally melatonin is absorbed rapidly and it is metabolized in the liver and secreted by kidney. Placebo was given to non supplementation group and there by double blind placebo method was followed.

The dependent variables selected were agility and eye hand co-ordination. The independent variables were sleep deprivation with and with out supplementation.

Semo Agility Test

Agility was quantified by conducting Semo Agility Test. The subjects were asked to stand at the starting point that is in zone A. For the signal "ready, go" the subject ran sideward from A to B and then back pedal from B to D then forward sprint from D to A. Then back pedal from A to C then sprint forward C to B and ran sideward from B to the finishing zone A. The test was administered for two trials with rest in between. The better of two trials was considered as the final score in seconds.

Figure-1
Floor Making for Semo Agility Test



Eye Hand Steady Meter Test

On the command "Ready, start", the subject inserted the small rod into the hole of 4.5 mm diameter accurately as fast as possible for one minute. The correct method of insertion was to insert the rod into the hole without touching the side. When it is touched the side the bell was rang as the caution for error. When there was no bell sound, the insertion was correct. The number of correct insertion made within one minute was counted and recorded.

Experimental Design

The experimental design used for the present investigation was 6x3 factorial designs with the last factor being repeated measures, using randomly selected 60 volunteers. The first factor indicates six group 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 motor ability were collected 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 identically during above mentioned periods. The identical conditions were kept by using the same apparatus, testing personnels 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 influence of melatonin supplementation during sleep deprivation on motor ability, 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 after sleep deprivation and 24 hours of recovery. Whenever the F ratio was significant, Scheffe's test was used as a post-hoc test to determine to which of the paired mean differed significantly. The data was analyzed in computer using Standard Statistical Package.

Analysis of Agility

The data pertaining to the changes on agility among six groups during basal, after sleep deprivation and after recovery have been analysed statistically and the details are given in table I.

Table–I
Analysis of Variance on Agility for Mean Difference 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**	16.06	5	3.21	3.85	0.01
	Within groups	44.85	54	0.83		
Basel Hours Of sleep deprivation value adjusted for 24 hours after recovery	**Between groups**	6.46	5	1.29	1.52	Not Significant
	Within groups	45.68	54	0.84		
Basel value adjusted for 24 hours after recovery	**Between groups**	7.78	5	1.55	11.59	0.01
	Within groups	7.25	54	0.13		

The tabulated F Value for 0.05 = 2.39 0.01= 3.42 B=Between groups W=Within groups NS=Not Significant

It is observed from the table I that the obtained F ratio 3.85 for the basal value adjusted for 48 hours of sleep deprivation is significance at 0.01 level. It is inferred that significant variation occurred on agility among six groups are due to 48 hours of sleep deprivation from the basal condition.

The results of Scheff's test are presented in table II.

Figure-2
Graphical Representation on Agility during Basal, After Sleep Deprivation and After Recovery among Six Groups

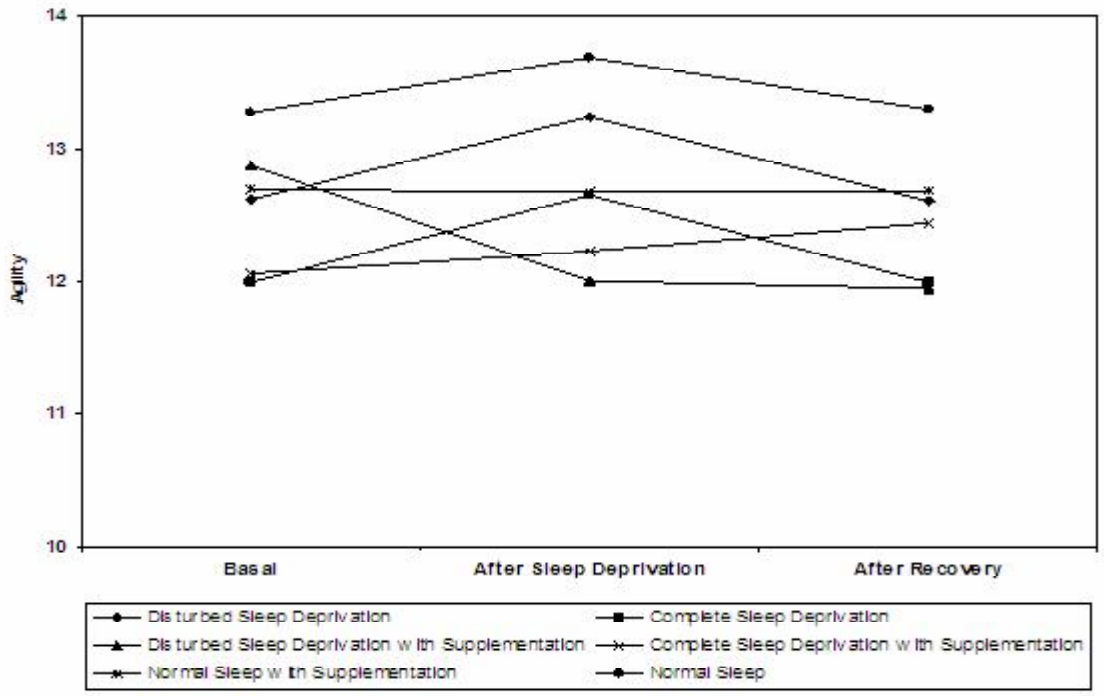


Table II shows that the basal value adjusted for 48 hours of sleep deprivation on agility do not differ significantly with name of the group.

An examination of the table I indicate that the obtained F radio 1.52 for the 48 hours of sleep deprivation value adjusted for 24 hours after recovery is not significant. It implies that there is no significant difference on agility among six groups after 24 hours of recovery.

Table I further shows that the obtained F radio 11.59 for the basal value adjusted for 24 hours after recovery is significant at 0.01 level. It indicates that significant variations occurred on agility among six groups after 24 hours of recovery from basal condition.

The results of Scheff's test are presented in table II.

Table–II
Scheffe's Test of Significance for Basal Value Adjusted for 48 Hours of Sleep Deprivation on Agility among Six Groups

SI No	Adjusted Post-Test Means for Different Groups						MD	Level of significance
	*A	B	C	D	E	F		
1	-0.61	-0.64					0.03	NS
2	-0.61		0.85				1.47	NS
3	-0.61			0.03			0.64	NS
4	-0.61				0.02		0.63	NS
5	-0.61					-0.40	0.21	NS
6		-0.64	0.85				1.49	NS
7		-0.64		0.03			0.67	NS
8		-0.64			0.02		0.66	NS
9		-0.64				-0.40	0.24	NS
10			0.85	0.03			0.82	NS
11			0.85		0.02		0.83	NS
12			0.85			-0.40	1.25	NS
13				0.03	0.02		0.00	NS
14				0.03		-0.40	0.43	NS
15					0.02	-0.40	0.42	NS

*A = Disturbed Sleep Deprivation D = Complete Sleep Deprivation with Supplementation
B = Complete Sleep Deprivation E = Normal Sleep with Supplementation
C = Disturbed Sleep Deprivation F = Normal sleep with Supplementation
NS = Not significant
Confidence interval (CI) required for the significant at 0.01 level is 1.68.

The result of Scheffe's test is presented in table III.

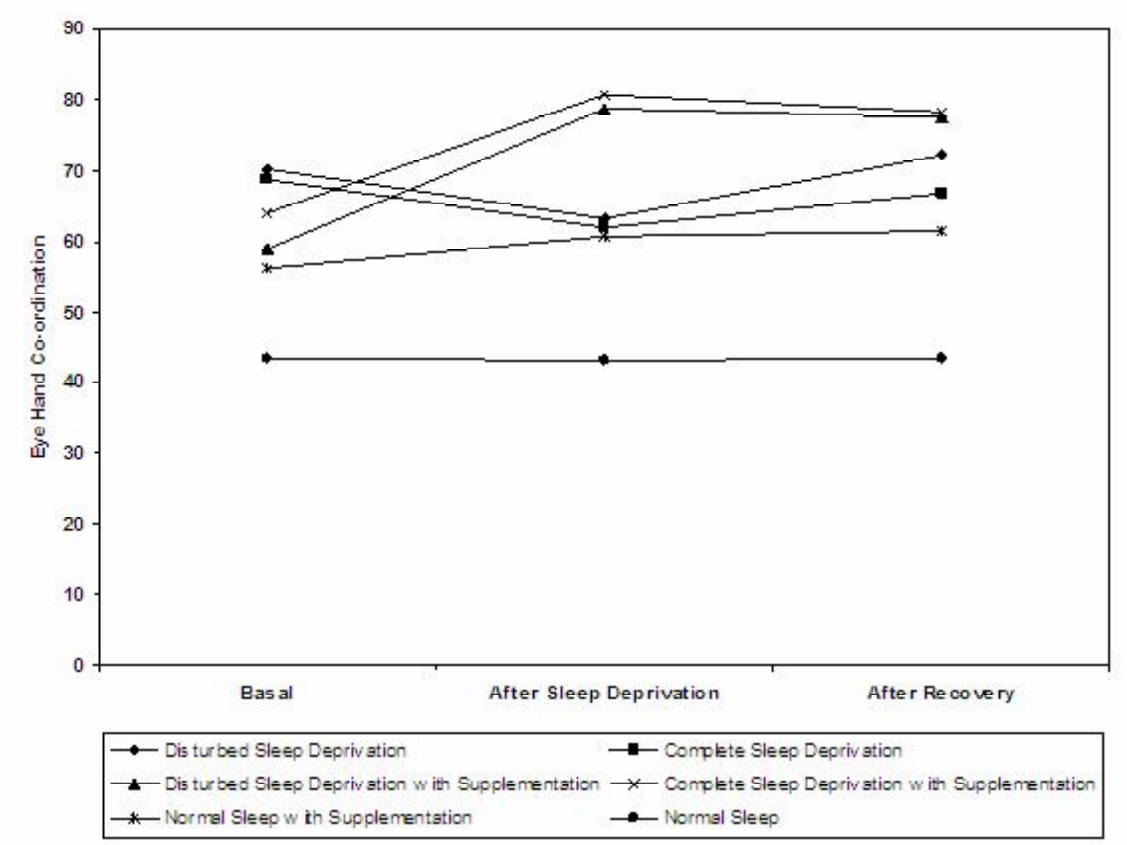
Table - III
Scheffe's Test of Significance for Basal Value Adjusted for 24 Hours after Recovery on Agility among Six Groups

Sl. No.	Adjusted post-test means for different groups						MD	Level of significance
	*A	B	C	D	E	F		
1	0.01	0.00					0.00	NS
2	0.01		0.91				0.90	0.01
3	0.01			-0.81			0.19	NS
4	0.01				0.01		0.00	NS
5	0.01					0.00	0.01	NS
6		0.00	0.91				0.90	0.01
7		0.00		-0.18			0.18	NS
8		0.00			0.01		0.00	NS
9		0.00				0.00	0.00	NS
10			0.91				1.09	0.01
11			0.91	-0.18	0.01		0.89	0.01
12			0.91			0.00	0.91	0.01
13				-0.18	0.01		0.20	NS
14						0.00	0.17	NS
15					0.01	0.00	0.01	NS

Confidence Interval (CI) required for significant at 0.01 level is 0.67.

Table III shows that, the basal value adjusted for 24 hours after recovery on agility for disturbed sleep deprivation group is significant with complete sleep deprivation while other groups do not differ significantly. The complete sleep deprivation groups differ significantly with disturbed sleep deprivation with supplementation group while rest of the three groups does not differ significantly. Table III also shows that disturbed sleep deprivation with supplementation group differ significantly with all the three groups. All the remaining groups do not differ significantly in their agility.

Figure- 3
Graphical Representation on Eye Hand Co-ordination during Basal, After Sleep Deprivation and After Recovery among Six Groups



Analysis of Eye Hand Co-ordination

The data pertaining to the changes on eye hand coordination among six groups during basal, after sleep deprivation and after recovery have been analysed statistically and the details are given in table - IV.

Table- IV
Analysis of Variance on eye Hand Co-ordination for Mean Difference 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 group**	7520.93	5	1504.18	19.40	0.01
	Within group	4187.00	54	77.53		
Basel Hours of sleep deprivation value adjusted for 24 hours after recovery	**Between group**	891.33	5	178.26	1.66	Not significant
	Within group	5789.60	54	107.21		
Basel value adjusted for 24 hours after recovery	**Between group**	3856.93	5	771.38	7.83	0.01
	Within group	5319.40	54	98.50		

The tabulated F value for 0.05 = 2.39 0.01 = 3.42 B = Between groups W = Within groups
NS = Not Significant

It is observed from the table IV that the obtained F ratio 19.40 for the basal value adjusted for 48 hours of sleep deprivation is significance at 0.01 level. It is inferred that significant variation occurred on eye hand co-ordination among six groups due to 48 hours of sleep deprivation from the basal condition.

The results of Scheffe's test is presented in table V

Table-V
Scheffe's Test of Significance for Basal Value Adjusted for 48 Hours of Sleep Deprivation on Eye Hand Co-ordination among Six Groups

Sl. No	Adjusted post-test means for different groups						MD	Level of significance
	A	B	C	D	E	F		
1	9.60	6.80					2.80	NS
2	9.60		-19.90				29.50	0.01
3	9.60			-16.70			26.30	0.01
4	9.60				-4.60		14.20	NS
5	9.60					0.40	9.20	NS
6		6.80	-19.90				26.70	0.01
7		6.80		-16.70			9.96	NS
8		6.80			-4.60		11.40	NS
9		6.80				0.40	6.40	NS
10			-19.90	-16.70			3.20	NS
11			-19.90		-4.60		15.30	NS
12			-19.90			0.40	19.50	0.01
13				-16.70	-4.60		12.10	NS
14				-16.70		0.40	17.10	0.01
15					-4.60	0.40	5.00	NS

Confidence interval (CI) required for the significant at 0.01 level is 16.26.

Table V shows that for the basal value adjusted for 48 hours of sleep deprivation on eye hand coordination for disturbed sleep deprivation group differ significantly with disturbed sleep deprivation with supplementation group and complete sleep deprivation with supplement groups while other three groups do not differ significantly. Further, complete sleep deprivation group differ significantly with disturbed sleep deprivation with supplementation group while other three groups are not significant. Disturbed sleep deprivation with supplementation group differs significantly with normal sleep group and rests of the two groups are not significant. Complete sleep deprivation with supplementation group is significant with normal sleep group and normal sleep supplementation group is not significant.

An examination of the table IV indicate that the obtained F ratio 1.66 for the 48 hours of sleep derivation value adjusted for 24 Hours after recovery is not significant. It implies that there is no significant variation on eye hand co-ordination among six groups after 24 hours of recovery.

Table IV further shows that the obtained F ratio 7.83 for the basal value adjusted for 24 hours after recovery is significant at 0.01 level. It indicates that significant variations occurred on eye hand co-ordination among six groups after 24 hours of recovery from basal condition.

The result of Scheffe's test is presented in table VI

Table - VI
Scheff's Test of Significance for Basal Value Adjusted for 24 Hours after Recovery on Eye Hand Co-ordination among Six Groups

Sl. No	Adjusted post-test means for different groups						MD	Level of significance
	*A	B	C	D	E	F		
1	1.00	2.20					1.20	NS
2	1.00		-18.60				19.60	0.01
3	1.00			-12.40			13.40	NS
4	1.00				-5.50		6.50	NS
5	1.00					0.10	1.10	NS
6		2.20	-18.60				20.80	0.01
7		2.20		-12.40			16.60	NS
8		2.20			-5.50		7.70	NS
9		2.20				0.10	2.10	NS
10			-18.60	-12.40			4.20	NS
11			-18.60		-5.50		13.10	NS
12			-18.60			0.10	18.70	0.01
13				-12.40	-5.50		6.90	NS
14				-12.40		0.10	12.50	NS
15					-5.50	0.10	5.60	NS

Confidence Interval (CI) required for Significant at 0.01 level is 18.33

From Table VI it is clear that the basal value adjusted for 24 hours after recovery on eye had co-ordination for disturbed sleep deprivation is significant with disturbed sleep deprivation with supplementation and other four groups do not differ significantly. Further, complete sleep deprivation group differ significantly with disturbed sleep deprivation with supplementation group only and rest of the groups are not significant. Table VI also shows that disturbed sleep deprivation with supplementation is significant with normal sleep group and the rest of the groups are not significant.

Conclusions

I. The result of the present study reveals that the reduction in agility as a result of 48 hours of disturbed and complete sleep deprivation have no significant difference.

II. As a result of melatonin supplementation agility performance has not changed significantly for both disturbed and complete sleep deprivation groups.

III. The recovery in the case of agility does not differ significantly for none of the group.

IV. The reduction in eye hand coordination after 48 hours of disturbed and complete sleep deprivation do not differ significantly.

V. Due to melatonin supplementation eye hand coordination have increased significantly for disturbed sleep deprivation and do not differ significantly for the group of complete sleep deprivation.

VI. The recovery of eye hand coordination does not differ significantly for none of the groups.

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