Effect of Circadian Rhythm on Speed and Anaerobic Power between College Sprinters and Jumpers

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Abstract – The purpose of the study was to determine the variations in selected speed and anaerobic power resulting from circadian rhythm. Twenty inter college sprinters and jumpers were selected as one of the independent variable and four different times of the day such as 06:00, 10:00, 14:00 and 18:00 hours were selected as other independent variables. The collected data were statistically analysed for significance using two factor analysis at variance (ANOVA) with repeated measure on second factor whenever the 'F' ratio found to be significant for interaction the simple effect followed by Scheffe's test was used as follow up test. In all the cases .05 level was fixed as a level of confidence. It was concluded that the changes in speed and anaerobic power showed significant variation between inter college sprinters and jumpers at different times of the day.

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INTRODUCTION

The alternation of day and night is an obvious feature of the world in which we live. This is due to the rotation of the earth about its vertical axis once every 24 hours. We organize our work, leisure, eating schedules and time for sleep within this solar day. Indeed, humans have ingrained timing mechanisms whereby cycles in physiological functions coincide with the period of light and darkness.

Biological factors, rhythms of man's nature and environment play a vital role in athletic performance. Major sports contests are not evenly distributed over a sufficiently broad span of the day to yield conclusions about the optimal time for competing. The sports events are scheduled many days, weeks, even months in advance. This may impair performances by forcing the athlete to perform at a time several hours before or after peak circadian performance times. The athlete, in this case, must be prepared to perform at any time on the day of competition.

Motor and psychomotor performance which exhibit rhythmicity (**Reilly**, **1987**) include simple reaction time, co-ordination as measured by a pursuit motor task, agility and tapping speed. The close correlation between body temperature and motor performance persists in shift workers during adaptation of both rhythms to a nocturnal regimen. The optimal core and muscle temperature for exercise is about 38.3oC and 40oC respectively, the resting temperature is the closest to these values in the evening.

In a new training schedule one must also consider the qualifying rounds, which often seal a player's fate because they are fixed at a time of the day to which the athlete is not accustomed. Generally, circadian rhythms to affect performance and the coach must take this into account when measuring physical performance and coordination skill as well as in daily training and competition. Therefore, the findings of this study will be of significance in the following way. The results of the study may provide guideline, which will help the physical educators and coaches in preparing the training schedules, and travel plans for their players in their respective athletes.

The purpose of the study was to determine the variations in selected physical variables resulting from circadian rhythm

METHODOLOGY

To achieve the purpose of the study twenty male sprinters and jumpers subjects were selected who had participated in the intercollegiate athletic meet. The subjects were divided into two groups as Sprinters and

jumpers. The study was confined to the male athletes only and their age ranged from 20 to 25 years.

Intercollegiate Sprinters and jumpers were selected one of the independent variable and four different times of the day such as 06:00, 10:00, 14:00 and 18:00 hours were selected another independent variable. Speed, and anaerobic power were selected as dependent variables. The following tests were conducted on the subjects; for Speed is 50 M run and for anaerobic power is Markaria Kalamen anaerobic power test..

Analysis of Data

The experimental design for the study was 2 x 4 factorial design with second factor repeated measures. The first factor consisted of two categories of athletes such as sprinters and jumpers. The second factor consisted of circadian variations measured at four different times of the day (06:00, 10:00, 14:00 and 18:00 hours). If the interaction were significant, Simple effect test was used further to find out, if any, difference between the each rows and columns (athletes and different times of the day), the Scheffe's test was used as post hoc test, if any, find out the paired mean differences were found to be significant. All the hypotheses were tested for significance at .05 level of confidence. The data was analysed and presented in the following table.

1. SPEED

Table I

MEAN OF SPEED AMONG INTER COLLEGIATE ATHLETES AT DIFFERENT TIMES OF THE DAY

Category	Mean ± Standard Deviation			
	06:00	10:00	14:00	18:00
Sprinters	7.4 ± 0.158	7.2 ± 0.116	7.6 ± 0.103	7.7 ± 0.125
Jumpers	7.6 ± 0.151	7.8 ± 0.127	7.3 ± 0.164	7.4 ± 0.195

(Speed is expressed in 1/10 Seconds).

Table II

RESULTS OF TWO FACTOR ANOVA WITH REPEATED MEASURE

Source of Variance	Sum of Squares	Df	Mean Squares	F – ratio
Different Athletes	0.04	1	0.04	0.33
Error I	4.54	38	0.12	
Different times of the day	0.09	3	0.03	0.50
Interaction (Athletes x Times)	2.12	3	0.71	11.83*
Error II	6.29	114	0.06	

* Significant at .05 level of confidence.

Table values required for significance at .05 level for df (1 and 38) and (3 and 114) are 4.10 and 2.68 respectively.

From the table II, the obtained F-ratio value of interaction A x B (Athletes x Different times of the day combined) is 11.83 which is higher than the table value 2.68 with df 3 and 114 required for significant at 0.05 level of confidence. The result of the study shows that there is significant difference exists among the paired means of interaction A x B on speed. To determine which of the rows and column mean had a significant difference, the Simple effect test for Speed at different times of the day and selected athletes interaction have been presented in Table III.

Table III

Simple Effect Scores for Speed on selected Athletess at Different Times of the Day

Source of Variance	Sum of Squares	df	Mean Squares	F – ratio
Categories of Athletes				
at 06:00 hours	0.07	1	0.07	0.01
at 10:00 hours	1.50	1	1.50	25.00*
at 14:00 hours	0.33	1	0.33	5.50*
at 18:00 hours	0.26	1	0.26	4.33*
Categories of Athletes				
Sprinters	0.80	3	0.27	4.50*
Jumpers	0.41	3	0.14	2.33
Error II	6.29	114	0.06	

* Significant at .05 level of confidence. Table values required for significant at .05 level for df (1 and 114) and (3 and 114) are 3.92 and 2.68 respectively.

Table V shows that the obtained F ratio values for categories of Athletes at 10:00 hours, 14:00 hours and 18:00 hours are higher than the table value 3.92 with df 1 and 114 required for significance at .05 level of confidence. And from the above table, the obtained F ratio for categories of the athletes at 06:00 is less than the table value of 3.92 with df 1 and 114 required for significance at 0.05 level of confidence.

Table V also shows that F-ratio values obtained for Jumpers irrespective of different times of the day is less than the table value of 2.68 with df 3 and 114 required for significance at .05 level of confidence. And also F-ratio value obtained for Sprinters irrespective of different times of the day is higher than table value of 2.68 with df 3 and 114 required for significance at .05 level of confidence. Since the F ratio value obtained for the Volleyball players irrespective of different times of the day is significance at .05 level of confidence, the Scheffe's post hoc test was followed and presented in Table IV.

Table IV

Scheffe's Test for Difference Between the paired means oN speed of SPRINTERS at four different times of the day

06:00 hours	10:00 hours	14:00 hours	18:00 hours	Mean Difference
7.4	7.2			0.20*
7.4		7.6		0.20*
7.4			7.7	0.30*
	7.2	7.6		0.40*
	7.2		7.7	0.50*
		7.6	7.7	0.10*

Significant at .05 level. CI Value is 0.18 with df 3 and 114.

Table IV shows that the paired mean difference in speed for Sprinters between 06:00 and 10:00 hours, 06:00 and 14:00 hours, 06:00 and 18:00 hours, 10:00 and 14:00 hours, and between 10:00 and 18:00 hours are greater than the confidence interval value 0.18 which shows significant difference at .05 level of confidence. However, insignificant variation in speed for sprinters is noted in the paired means between 14:00 and 18:00 hours of the day. It was concluded that the speed for Sprinters at 10:00 hours was better than 06:00, 14:00 and 18:00 hours of the day.

2. ANAEROBIC POWER

Table V

MEAN OF ANAEROBIC POWER AMONG INTER COLLEGIATE ATHLETES AT DIFFERENT TIMES OF THE DAY

Category	Mean ± Standard Deviation			
	06:00	10:00	14:00	18:00
Sprinters	108.03 ± 2.67	103.81 ± 3.13	100.53 ± 1.45	100.15 ± 4.24
Jumpers	103.99 ± 3.88	100.87 ± 2.13	98.91 ± 3.40	97.34 ± 4.47

(Anaerobic power is expressed in 1/10 Seconds).

Table VI

RESULTS OF TWO FACTOR ANOVA WITH REPEATED MEASURE

Source of Variance	Sum of Squares	df	Mean Squares	F – ratio
Different Athletes	324.81	1	324.81	27.27*
Error I	452.67	38	11.91	
Different times of the day	1265.08	3	421.69	39.26*
Interaction (Athletes x Times)	229.51	3	76.50	7.12*
Error II	1224.59	114	10.74	

* Significant at .05 level of confidence. Table values required for significance at .05 level for df (1 and 38) and (3 and 114) are 4.10 and 2.68 respectively.

From the table VI, the obtained F-ratio value of interaction A x B (Athletes x Different times of the day combined) is 7.12 which is higher than the table value 2.68 with df 3 and 114 required for significant at 0.05 level of confidence. The result of the study shows that there is significant difference exists among the paired means of interaction A x B on anaerobic power. To determine which of the rows and column mean had a significant difference, the Simple effect test for Anaerobic power at different times of the day and selected athletes interaction have been presented in Table VII.

Table III

Simple Effect Scores for Anaerobic power on selected Athletess at Different Times of the Day

Source of Variance	Sum of Squares	Df	Mean Squares	F – ratio
Categories of Athletes				
at 06:00 hours	195.95	1	195.95	19.60*
at 10:00 hours	86.44	1	86.44	8.05*
at 14:00 hours	26.13	1	26.13	2.43
at 18:00 hours	78.46	1	78.46	7.31*
Categories of Athletes				
Sprinters	76.49	3	25.50	2.37
Jumpers	476.82	3	158.94	14.80*
Error II	1224.59	114	10.74	

* Significant at .05 level of confidence. Table values required for significant at .05 level for df (1 and 114) and (3 and 114) are 3.92 and 2.68 respectively.

Table VII shows that the obtained F ratio values for categories of Athletes at 06:00 hours, 10:00 hours and 18:00 hours are higher than the table value 3.92 with df 1 and 114 required for significance at .05 level of confidence. And from the above table, the obtained F ratio for categories of the athletes at 14:00 is less than the table value of 3.92 with df 1 and 114 required for significance at 0.05 level of confidence.

Table VII also shows that F-ratio values obtained for Sprinters irrespective of different times of the day is less than the table value of 2.68 with df 3 and 114 required for significance at .05 level of confidence. And also F-ratio value obtained for Jumpers irrespective of different times of the day is higher than table value of 2.68 with df 3 and 114 required for significance at .05 level of confidence. Since the F ratio value obtained for the Volleyball players irrespective of different times of the day is significance at .05 level of confidence, the Scheffe's post hoc test was followed and presented in Table VIII.

Table VIII

Schaffer's Test for Difference Between the paired means on anaerobic power of Jumpers at four different times of the day

06:00 hours	10:00 hours	14:00 hours	18:00 hours	Mean Difference
103.99	100.87			3.12*
103.99		98.91		5.08*
103.99			97.35	6.64*
	100.87	98.91		1.96
	100.87		97.35	3.52*
		98.91	97.35	1.56

Significant at .05 level. CI Value is 2.40 with df 3 and 114.

Table VIII shows that the paired mean difference in anaerobic power for Jumpers between 06:00 and 10:00 hours, 06:00 and 14:00 hours, 06:00 and 18:00 hours, and between 10:00 and 18:00 hours are greater than the confidence interval value 2.40 which shows significant difference at .05 level of confidence. However, insignificant variation in anaerobic power for Jumpers is noted in the paired means between 10:00 and 14:00 hours and 14:00 and 18:00 hours of the day. It was concluded that the anaerobic power for Jumpers at 06:00 hours was better than 10:00, 14:00 and 18:00 hours of the day.

CONCLUSIONS

The following conclusions were drawn from the results of the study.

1. There was significant difference in speed and anaerobic power among intercollegiate sprinters and jumpers except in muscular endurance at different times of the day.

2. There was significant difference in speed for sprinters among different times of the day.

3. There was significant difference in anaerobic power among jumpers at different times of the day.

4. There was significant difference in speed between sprinters and jumpers at 10:00 hours, 14:00 hours and 18:00 hours of the day.

5. There was significant difference in speed between sprinters and jumpers at 06:00 hours, 10:00 hours and 18:00 hours of the day

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