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Rest-Physical Activity Pattern Of Physical Education Students

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Abstract
Aim of the present study was to assess and evaluate the rest-physical activity pattern of sports persons. The data was collected from total 10 apparently sports persons. All the subjects were the regular participant of physical activity. Data was retrieved with the help of Actiheart-2 in one minute epoch length. The data was analyzed by Cosinor rhythmometry and power spectrum. Result indicated that all the sports persons exhibited higher MESOR and amplitude in physical activity rhythm. The autocorrelation was found significant for all subjects. The studied subjects experienced sound sleep.

Keywords: *rest-physical activity, sleep, sports persons, dichotomy, autocorrelation*

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I. Introduction

Study of rest-physical activity using actigraphy has become an essential tool in sleep medicine. Measurement of the rest- physical activity rhythm as a major circadian clock output provides a simple tool for evaluating circadian system function in healthy and unhealthy persons (Mormont *et al.*, 1998). Some researchers have used wrist actigraphy to study rest activity cycles of shift workers (Park *et al.*, 2000). This technique of actigraphy has also been routinely used for the assessment of sleep quality and fatigue among shift workers in addition to study of rest-activity patterns (Petrilli *et al.*, 2006). Several studies, based on wrist actigraphy, have been carried out in shift workers (Moreno *et al.*, 2003; Lamond *et al.*, 2005; Arendt *et al.*, 2006) but it is hard to find evidence on sports persons.

Sleep is a natural and essential part of every individual's life. All most all individuals spend about one-third of lives asleep. It is not only something option to fill time when a person is inactive but is a required activity. Sleep is important for normal motor and cognitive function. Appropriate sleep leads to rested and more alert. Sleep actually appears to be required for survival. Rats deprived of sleep will die within two to three weeks, a time frame similar to death due to starvation.

Systematic sleep research is recently gaining recognition. Very few scientific information is available regarding sleep. It is presumed that good night's sleep will helps perform better physically mentally. One hour less sleep per night than needed creates sleep debt. If the sleep debt becomes larger it leads to problem sleepiness. Although individual may not experience sleepiness, but this sleep debt deteriorate the daytime performance physically and mentally. The biological clock that times and controls a person's sleep/wake cycle will attempt to function according to a normal day/night schedule even when that person tries to change it.

Research is providing a scientific foundation for understanding sleep's physiology, rhythms, and implications for our health. Although much remains to be learned, this research is clarifying a number of important issues relating to sleep. Though these studies will mainly concern with the sleep pattern of sports persons, circadian rhythm of rest-activity pattern in all India inter university sports persons have not yet been studied adequately. Unfortunately, we do not have sufficient data on rest-physical activity rhythm of sports persons from the Indian sub-continent. Therefore, in the present study the impact of sports and physical activity will be investigated. The subjects will randomly been chosen from Degree College of Physical Education, located in the Shree Hanuman Vyayam Prasarak Mandal, Amravati, with all India Inter-University levels sports persons.

II. Methodology

Total 10 inter university male sports persons were selected as a subject in the present study. The sample for the present study were chosen randomly. Actual sleep hours, sleep quality, and post lunch deep were studied in the present study. Data was retrieved with help of Actiheart -2.

Assessment of Physical-activity Rhythm

Circadian rhythm in physical-activity was monitored with the help of Actiheart -02 (Mini Mitter Co. Inc., USA). The actiheart monitor is a larger, round, main sensor, and lead to the positive electrode lead worn on

the left side of the chest over the heart which was affixed to the ECG electrode's male snap. The Actiheart is a physical activity and heart rate monitor for long term monitoring of gross motor activity in human subjects. It is an electrometer (a piezo-electric element capable of converting voltage signal into binary signal by sampling into an 8-bit A/D converter). The device detect the vertical movement by selectively registering values only in the 1.0 to 7.0 Hz range, a programmable memory into which it stores the resulting values, and a user interface program that allows for its configuration. Data were collected at 1 minute epoch. Recordings were made with sampling epochs of one-minute over a period of 3 consecutive days in Sports Persons. After monitoring each subject, the data were transferred to the computer for further statistical analyses.

ECG electrode positioning:

Accurate lead positioning is important to get data. Each electrode was placed in specific location. In addition to acquired good ECG signal, the main sensor (lead I) electrode was placed left of the sternum at the fourth intercostals space (the space between the ribs). The ribs were counted from top to bottom. The left lead was placed at the fifth intercostals space in the mid-clavicular line.

Site preparation:

Both sites were shaved to remove the hair from site. It not only allows the electrodes to be affixed more securely, but removing the hair allowed better contact and less resistance. Both sites were cleaned with alcohol to remove excessive skin oils which allowed better contact of the electrodes. The protective layer of the ECG sensors were peeled away from the electrode pad and placed on the above said sites.

Assessment of Sleep Parameters: The following sleep parameters were also studied in each subject:
Time in Bed (TIB): The amount of time spent in bed. It is the difference between the get up time and bedtime.
Actual Sleep Time (AST): Represents the amount of time between Sleep Start and Sleep End. It is determined by the summation of the number of epochs that do not exceed the sensitivity threshold and multiplying that value by the epoch length in minutes. It is expressed in hours and minutes.
Sleep Efficiency (SE): An index of the amount of time in bed actually spent sleeping. It is determined by the division of the actual sleep time by time in bed and multiplying the result by 100.
Sleep Bout (SB): It represents the number of continuous blocks of sleep calculated between Sleep Start and Sleep End.
Wake Bout (WB): A measure of intervening waking periods between Sleep Start and Sleep End. It is indicative of fitful sleep if short sleep bouts alternate with short waking bouts.
Fragmentation Index (FI): It is an index of restlessness. FI indicates the extent to which sleep is disturbed in an individual.

After monitoring the activity, data were then transferred from the Actiheart to a personal computer with the help of Actiheart reader. Data on sleep and nap parameters from each patient were transferred to Microsoft Excel worksheet for further analyses.

Statistical Analysis:

Data from Actiheart was retrieved and analyzed by using specific Actiheart (version 2.0, Mini Mitter Co. Inc., USA) software. Actograms for visual inspection was obtained with the help of this software.

The circadian rhythm characteristics, such as average of the rhythmic function (Mesor, M: rhythm-adjusted mean), amplitude (A, one-half of the difference between the highest and the lowest value of the rhythmic function) and peak or acrophase (Ø, timings of the highest value of the rhythmic function) were estimated from the data at fixed windows, $\tau = 24$ h using Cosinor rhythmometry (Nelson *et al.,* 1979).

The circadian rhythm in rest-activity was also estimated by two non-parametric methods, such as autocorrelation coefficient at 24 h and dichotomy index.

Autocorrelation coefficient (*r*24): Autocorrelation is the measure of the regularity of the activity pattern over 24 h from one day to the next. It is depicted by a graphic display of correlation coefficients between time series staggered by given time lags, according to the following procedure. In the case of a 3-day time series (72 hours), if X_i is the measurement at time i, the correlation coefficient r_k between X_i and $X_i + _k$ is computed for lags k, with k = 1 to 4320 minutes (72 hours). When circadian variation is present, the correlation coefficient increases to its highest value with lags at or near 24 hours (1440 minutes). This coefficient can range from -1 to +1. In the case of a prominent circadian rhythm, *r*24 can reach the value of 1.

Dichotomy index (I<O): Differences in activity distribution between daily activity and rest spans. The dichotomy index I<O is the percentage of the 1-minute activity values measured while subject is in bed that are inferior to

the median value when the subject is out of bed. The value of I<O can vary between 0% and 100%. In the case of a marked circadian rhythm with complete rest at night and high activity during daytime, I < O reaches 100%.

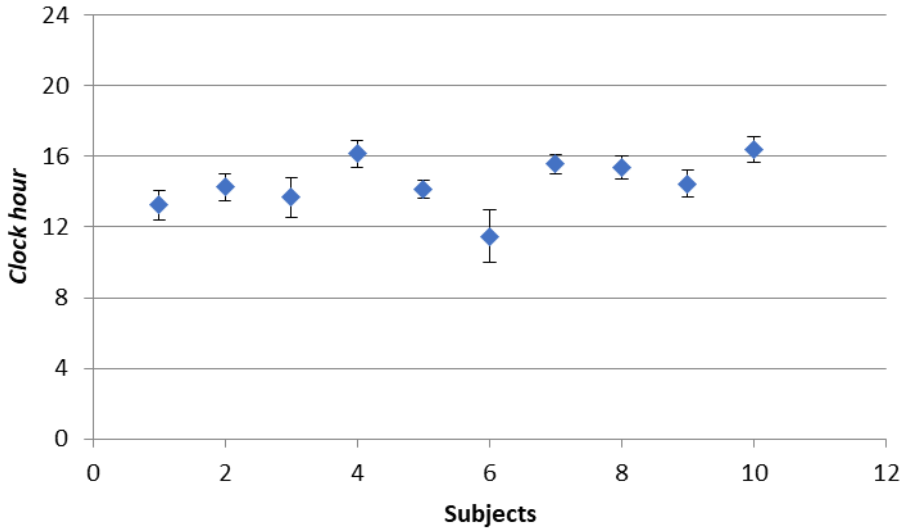
Other conventional statistical techniques, such as descriptive analysis, was also used. Data was analyzed with the help of software, namely SPSS, and Analysis Tool Pak (Microsoft Excel).

III. Results:

Table 1: Characteristics of circadian rhythm of physical activity in Sports persons

S. No	Sub. Code	Data points	Rhythm detection	Rhythm M ± SE adjusted mean,	Amplitude, A (95% CL)	Acrophase, Ø in h (95% CL)
1	SP1	4331	0.001	41.52±1.72	28.07±5.91	13.25±0.83
2	SP2	4533	0.001	61.81±2.19	38.53±7.55	14.26±0.76
3	SP3	4348	0.001	28.63±1.51	17.85±5.21	13.69±1.13
4	SP4	4082	0.001	50.75±2.03	34.4±7.02	16.14±0.79
5	SP5	4213	0.001	49.55±1.56	38.99±5.53	14.12±0.52
6	SP6	3550	0.001	72.14±3.02	27.26±10.44	11.47±1.48
7	SP7	4037	0.001	54.67±1.98	48.66±6.68	15.58±0.55
8	SP8	4007	0.001	32.67±1.19	24.99±4.01	15.4±0.65
9	SP9	3943	0.001	27.14±1.01	17.72±3.44	14.45±0.78
10	SP10	4101	0.001	26.99±0.99	17.92±3.35	16.37±0.74

Figure 2: Peak map illustrates location of acrophases of the circadian physical-activity rhythm in sport persons (SP)



Physical-activity rhythm

All subjects displayed a distinct and regular day-night pattern in physical activity, i.e., more activity was displayed during daytime than that of the night hours (Figures 4.1).In all subjects' regularity in the pattern of day-night physical activity was discerned.

Rhythm detection*:* Results of Cosinor rhythmometry of the time series on rest-physical-activity rhythm in sports persons are summarized in Tables 4.1. Results indicated a statistically (p<0.001) significant circadian rhythm (τ = 24 h) in rest-physical-activity in the sports persons.

Circadian 24-h average (Mesor): Tables 1 depict summary of Cosinor rhythmometry based on variability in rest-physical activity in each subject belonging to sports persons. The analyses of data were performed at fixed windows with τ = 24 h. The averages of all three rhythm parameters, such as Mesor, amplitude and acrophase, were computed for both groups (Table 1).The results of Cosinor rhythmometry indicated inter-individual differences in the level of 24-h average activity among individuals of groups. The lowest circadian Mesor (27.14 ± 1.01) was observed in SP#9 and the highest (61.81 ± 2.19) in SP#2 among individuals of SP group (Tables 1).

Circadian amplitude: Inter-individual variation (Tables 1) in circadian amplitudes of physical-activity was observed. The lowest circadian amplitude in physical activity (17.85) was noticed in SP#3 and the highest (48.66) was in SP#7 among the individuals of the SP group (Table 1).

Circadian peak (Acrophase): The inter-individual variations in acrophases for physical activity at individual (Tables 1). The acrophase spread for physical-activity circadian rhythm was between 11.47 h to 16.37 h in SP group (Table 1). The acrophase occurred at the earliest (11.47 h) in SP#6, and at the latest (16.37) in SP#10.

Peak map: The peaks of physical-activity rhythm in 10 subjects are plotted in Figures 2. The maps reveal inter-individual variability in peaks of physical-activity rhythm in within the studied groups.

Table 2:	Dichotomy index (*I<O*) of physical -activity in Sports persons
Code	Dichotomy Index
SP1	93.91
SP2	94.92
SP3	95.49
SP4	95.41
SP5	98.12
SP6	95.77
SP7	96.23
SP8	94.67
SP9	93.43
SP10	97.10

Dichotomy index (I<O): Tables 2 show dichotomy index (*I<O*) of physical-activity rhythm for the sports persons. All the sports persons experienced sound sleep in the present study.

Table 3	**Autocorrelation coefficient (*r*24) of rest-activity in Sports persons**	
Code	PA	*P-value*
SP1	0.143	0.001
SP2	0.147	0.001
SP3	0.189	0.001
SP4	0.165	0.001
SP5	0.139	0.001
SP6	0.105	0.001
SP7	0.212	0.001
SP8	0.145	0.001
SP9	0.048	0.001
SP10	0.135	0.001

Autocorrelation coefficient (*r*24): The autocorrelation coefficient at $\tau = 24$ h was computed for each subject (Tables 3). In each subject, the value of *r*24 of physical-activity rhythm in SP groups was statistically ($p < 0.001$) significant.

Table 4: Showing parameters of sports persons

Variable (unit)	*Males* (*N* = 10)
TIB (*h*)	7.60 ± 0.38
AST (*h*)	6.52 ± 0.36
SE (%)	84.73 ± 1.20
SB (*count*)	48.05 ± 3.43
WB (*count*)	47.29 ± 3.39
FI (%)	27.69 ± 3.01

Sleep parameters: Tables 4 depict means and standard errors of sleep parameters, namely time in bed (TIB), actual sleep time (AST), sleep efficiency (SE), sleep bout (SB), wake bout (WB) and fragmentation index (FI) of sports persons at group level. Results indicate that all the subjects had longer time in bed durations.

IV. Conclusions:

On the basis of the above results the following conclusions can be drawn:

1. All the sports persons exhibited higher Mesor and amplitude in Physical activity rhythm indicating greater stability of their circadian rhythm. They can cope with rhythm disturbances.
2. All the subjects experienced sound sleep
3. The autocorrelation of rest – physical activity patterns are significant, it indicate regularity and consistency
4. All the subjects has longer sleep hours

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