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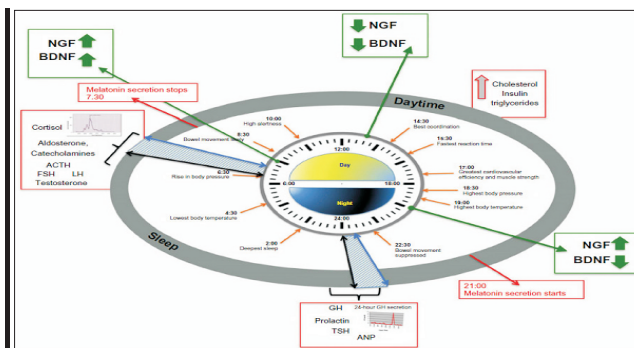
CIRCADIAN TIME STRUCTURE

Beyene Seleshi Mitiku

Head, Department of Sports Sciences, Hawassa University, Ethiopia.

ABSTRACT

The importance of the study of circadian rhythms in athletes and sports persons has been well documented. It is generally presumed that the temporal pattern in performance among sports persons is closely related to their rhythms in body temperature. Aim of the present study was to assess to circadian rhythm pattern in various physiological parameters such as heart rate, oral temperature, urine volume, urine temperature (Halberg et.al.1972) and stork stand test for balance of sports persons. Twenty on male subjects participated in the present study. Data were taken at four different times of the day in four hour intervals between 07:00 h to 19:00 h for seven consecutive days. COSINOR rhythmometry method is employed to analyze the time series data. Result of the



present study indicate that the most of the subjects showed statistically significant circadian rhythm in most of the variables.

KEYWORDS: Circadian rhythm, sports persons, Heart rate.

INTRODUCTION –

Life depends on sequences of physiological events that are reproducible (with greater or lesser precision) at regular intervals and that are evident even when environmental conditions are constants. The sequences represent biological rhythms, which are mainly a product of internal clocks, or oscillators that bestow

cyclical activity on physiological processes. The study rhythms and biological clocks is known as chronobiology.

Biological rhythms are characterized by their length: for example a rhythm that fits the solar day closely is known as circadian or about a day its period is 24 hours approximately. The other characteristics of rhythm are its amplitude or mean to peak variation, its mesor or mean value and its acrophase or time that the peak occurs. The idealized rhythm is represented by a sine wave and hence cosinor analysis is the main statistical method of identifying circadian

rhythm (Reilly, 1990).

METHOD

21 male subjects studying physical education were selected for the study. They were subjected to analysis of different physiological and physical variables i.e., heart rate, oral temperature, urine volume, urine temperature (Halberg et.al.1972) and stork stand test for balance (Johnson and Nelson 1982) at four different times of the Day i.e. at 07.00, 11.00, 15.00, 19.00 hours for 7 consecutive days. The subjects were instructed to self-measure oral temperature, heart rate, urine volume and urine temperature. Test for balance was performed with the help of partner.

STATISTICAL ANALYSIS

Self-measured variables were analyzed for documenting a circadian rhythm by cosinor methods (Nelson et. al.).

Various end points such as mesor (rhythm adjusted mean), amplitude (one half the difference between the highest and the lowest value) and acrophase (the timing of the highest value) were computed.

RESULTS

The result of the present study of different variables is given in table 1-5. (heart rate)

Subject Code	No. of observation	p ¹	M ² ± SE ³	A ⁴ (95%CL) ⁵	φ(95%CL) ⁵
S01	28	<0.05	73.96±1.34	03.89	15.75
S02	28	<0.06	71.21 ± 1.53	05.74	14.38
S03	28	<0.01	65.21 ± 2.45	07.71(02.39,11.95)	12.96(11.45,14.47)
S04	28	<0.04	73.65 ± 1.85	07.80(-0.71,16.31)	14.05(06.15,21.95)
S05	28	<0.27	74.13 ± 1.61	04.76	12.85
S06	28	<0.01	66.25 ± 1.23	05.13(-0.35,10.58)	14.97(08.84,21.10)
S07	28	<0.96	72.60 ± 1.16	00.29	18.24
S08	28	<0.01	65.38 ± 1.03	04.99(0.62,09.36)	15.47(10.88,20.06)
S09	28	<0.09	67.17 ± 1.46	05.36	14.04
S10	28	<0.01	80.00 ± 1.35	11.32(50.10,17.540)	13.92(12.36,15.48)
S11	28	<0.01	66.26 ± 1.10	05.39(0.74,10.04)	15.55(11.02,20.08)
S12	28	<0.63	62.92 ± 0.87	01.30	11.74
S13	28	<0.97	72.59 ± 1.54	00.55	09.28
S14	28	<0.01	71.38 ± 1.23	06.00(0.95,11.05)	15.87(11.45,20.29)
S15	20	<0.32	72.97 ± 1.34	03.56	13.35
S16	16	<0.32	73.04 ± 1.97	02.69	19.67
S17	16	<0.15	62.17 ± 2.24	07.84	12.27
S18	20	<0.01	70.57 ± 1.92	12.26(3.56,20.96)	14.82(11.72,17.92)
S19	28	<0.22	62.46 ± 0.61	07.84	12.27
S20	24	<0.05	66.54 ± 0.41	01.77	13.81
S21	16	<0.58	64.64 ± 0.74	02.54	15.16
GRP	532	<0.01	69.42 ± 0.43	04.50(2.66,6.34)	14.34(13.17,15.51)

PERCENTAGE OF RHYTHM DETECTION

Percentage of rhythm detection was 38.10%, 23.08%, 19.05%, 23.81% and 40.76% in case of heart rate, oral temperature, urine volume, urine temperature and stork stand test for balance respectively.

CIRCADIAN RHYTHM

Pooled data of heart rate, oral temperature and urine volume exhibited circadian rhythm.

CIRCADIAN ACROPHASE

Acrophase of pooled data in case of different variables occurred in between 13.48 to 14.34 hours.

CIRCADIAN MESOR

Circadian mesor for pooled data for heart rate was recorded 69.42± 0.43 beats/hour. In case of oral temperature group mesor noted was 36.43± 0.04°C. similarly group circadian mesor for urine volume was 253± 5.94 ml, for urine temperature it was 34.47± 0.15 and 60.91± 8.33 for stork stand test.

CIRCADIAN AMPLITUDE

Group circadian amplitude for heart rate was 04.50 (2.60,6.30), for oral temperature 0.23 (0.07, 0.39),

for urine volume 16.550 urine temperature 0.49 and for balance it was noted 03.69.

DISCUSSION

The result of the study showed similar trend of acrophase in most of the variable i.e. different physiological and physical variables showed peak values at the time of the peak in oral temperature.

The majority of the world records are set in the late afternoon close to the time when body temperature attains the peak. All the world record set by British runners at distance of 800-5000meters in the 10years between 1978-1988 were achieved between 19.00 and 23.00 hour(Reilly, 1987). Rutenfranz and Colquhoun (1979) on the basis of their observation, suggested that exercise be best performed at the crest time core temperature. Reilly and Hales (1988) recorded significant in oral temperature and resting pulse rate ($p < 0.05$). The circadian curve in oral temperature peaked at 19.00hours, while that in pulse rate at 16.00hours. Reilly and Brooks (1990) further recorded significant circadian rhythm at rest for heart rate, VO_2 and VE :the acrophase for heart rate was at 13:50 hours. All these observations indicate the insignificance of circadian rhythm body temperature and in other variables of physiological significance. Selection of time schedule for games therefore becomes very critical in view of result of the present study and those performed by earlier (Gowswami 1988, Mukherjee 1989, Reilly et al., 1993).

The results of the present study may help in scheduling training program so that the athlete gives his best performance at the time of the competition.

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