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INFLUENCE OF DIURNAL PATTERNS ON SELECTED BIOCHEMICAL VARIABLES AMONG VETERAN ATHLETES

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Abstract:

The main objective of this study was to investigate diurnal variation of selected biochemical variables among veteran athletes (sprinters, jumpers and throwers). Diurnal patterns and difference between the groups time of day effect was noticed among veteran athletes. It is well known that these athletes differ in their responses to the time of day. Since athletic training held at various times during the day and works in time of day effect athletes performances. Hence, the purpose of this study was to investigate diurnal variation of selected biochemical variables among veteran athletes (sprinters, jumpers and throwers). To accomplish the purpose of the study, 30 male veteran athletes were selected from the trainees training at various centers in Chennai, who were classified into three groups as sprinters (10), jumpers (10) and throwers (10). The investigator selected biochemical variables such as total protein and sodium the blood samples were analyzed in pathology laboratory, Chennai. The collection of blood specimens on chosen criterion variables were conducted on day 1 and physical fitness variables data was obtained on the day 2. To monitor 12 hours changes in selected biochemical parameters tests were conducted at 06:00, 09:00, 12:00, 15:00, and 18:00 hours. The data collected from the sprinters, jumpers and throwers at five different time of the day were statistically analyzed to examine the changes on selected biochemical variables. The experimental design used for the present investigation was 3 x 5 ANOVA with repeated measures on last factors. In which, the first factor denotes veteran athletes (sprinters, jumpers and throwers) and the second factor indicated different times (06:00, 09:00, 12:00, 15:00, and 18:00 hours) of a day whenever the interaction was significant, simple effect was used as a follow up test. Then, the Scheffe's test was applied as post hoc test to determine the significant paired mean differences. The level of confidence was fixed at 0.05 to test the significance. The data was analyzed in computer system by using statistical package for social science (SPSS) version 17.

Keywords: Diurnal Variation, Selected Biochemical Variables & Veteran Athletes.

Introduction:

Circadian Rhythm is derived from the Latin words circa dies meaning "approximately a day". It may be defined as the changes in human behavior and physiology that occur within a 24 hour period. The mammalian circadian system is regulated by endogenous clock genes **(Reppert and Weaver, 2001; Richter et al., 2004; Berger, 2004; Ueda et al., 2004; Walker and Hogenesch, 2005; Siepka et al., 2007; Belle et al., 2009)**. There is a master clock found in the brain in an anterior section of the hypothalamus known as the suprachiasmatic nucleus (SCN) **(Reppert and Weaver, 2002)**. The SCN synchronizes clock cells in peripheral tissues located in the eye, brain, heart, lung, gastrointestinal tract, liver, kidney and fibroblasts **(Roberts et al., 2000; Scher et al., 2002; Dubocovich et al., 2003; Richter et al., 2004; Takahashi et al., 2008)**. Clock genes found in lower species of mammals have recently been detected in humans **(Su et al., 2002; Ciarleglio et al., 2008)**. Without external stimuli, human circadian rhythm has an average period of 24.2 hours **(Czeisler et al., 1999)**. Although there may be some modification of the circadian cycle with food **(Mendoza et al., 2010; Mendoza, 2007)** and temperature **(Van Someren, 2000)**, the most powerful external stimulus for synchronizing (entraining) circadian rhythm to a 24 hour cyclic is exposure to the light of day and darkness at night.

Objective of the Study:

The main objective of this study was to investigate diurnal variation of selected biochemical variables among veteran athletes (sprinters, jumpers and throwers).

Material and Method:

30 male veteran athletes were selected from the trainees training at various centers in Chennai, who were classified into three groups as sprinters (10), jumpers (10) and throwers (10). The investigator selected biochemical variables such as total protein and sodium the blood samples were analyzed in pathology laboratory, Chennai. The collection of blood specimens on chosen criterion variables were conducted on day 1 and physical fitness variables data was obtained on the day 2. To monitor 12 hours changes in selected biochemical parameters tests were conducted at 06:00, 09:00, 12:00, 15:00, and 18:00 hours. The data collected from the sprinters, jumpers and throwers at five different time of the day were statistically analysed to examine the changes on selected biochemical variables. The experimental design used for the present investigation was 3 x 5 ANOVA with repeated measures on last factors. In which, the first factor denotes veteran athletes (sprinters, jumpers and throwers) and the second factor indicated different times (06:00, 09:00, 12:00, 15:00, and 18:00 hours) of a day whenever the interaction was significant, simple effect was used as a follow up test. Then, the Scheffe's test was applied as post hoc test to determine the significant paired mean differences. The level of

confidence was fixed at 0.05 to test the significance. The data was analysed in computer system by using statistical package for social science (SPSS) version 17.

Results on Total Protein:

Descriptive statistics of total protein among sprinters, jumpers and throwers at different times of the day

Table No-I

Time	Groups	Mean	Standard Deviation
06:00	Sprinters	5.20	0.35
	Jumpers	5.22	0.38
	Throwers	5.44	0.39
09:00	Sprinters	5.26	0.33
	Jumpers	5.28	0.36
	Throwers	5.48	0.34
12:00	Sprinters	5.96	0.44
	Jumpers	5.96	0.44
	Throwers	6.11	0.38
15:00	Sprinters	5.99	0.42
	Jumpers	6.02	0.45
	Throwers	6.17	0.38
18:00	Sprinters	6.00	0.42
	Jumpers	6.03	0.45
	Throwers	6.20	0.37

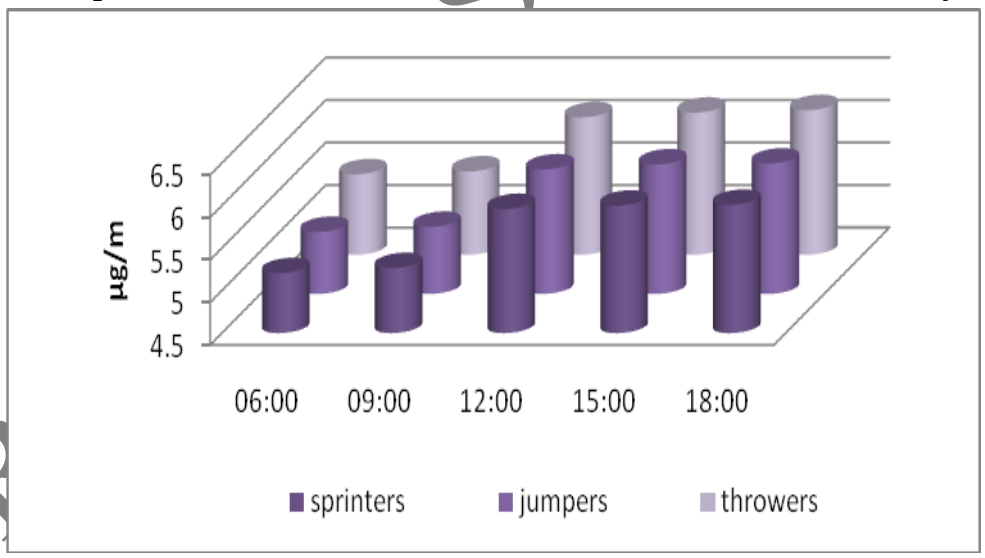
Table I reveals the descriptive statistics of total protein at five different times of the day among sprinters, jumpers and throwers. It is clear from this table that athletes showed peak performance in 18:00 hours.

Table No-II
Summary of ANOVA for 3 × 5 factorial experiments with Repeated measures on the last factor on total protein

Source of Variation	SS	df	MS	F
Between *Ss*				
A (Athletes: sprinters, jumpers and throwers)	1.158	2	.579	0.753
Ss w. groups (Error I)	20.775	27	.769	
Within Ss				
B (Different times of Day)	19.511	4	4.878	702.46*
AB (Interaction)	.028	8	0.004	0.571
B × Ss w. groups (Error II)	.750	108	0.007	

*Significant at 0.05 level of confidence with df of 2 to 27 is 3.35; df of 4 to 108 is 2.4557; df of 8 to 108 is 2.0252. Athlete's performance on total protein at different times of the day is presented in figure-I

Figure-I
Comparison of Athlete's Total Protein at Different Times of the Day



Results on Sodium:

Table No- III

Descriptive Statistics of Sodium among Sprinters, Jumpers and Throwers at Different Times of the Day

Time	Groups	Mean	Standard Deviation
06:00	Sprinters	130.50	9.93
	Jumpers	130.51	10.56
	Throwers	130.07	10.43
09:00	Sprinters	131.47	10.02
	Jumpers	131.61	10.63
	Throwers	131.08	10.46
12:00	Sprinters	132.49	10.10
	Jumpers	133.54	10.81
	Throwers	132.07	10.59
15:00	Sprinters	134.59	10.16
	Jumpers	134.49	10.87
	Throwers	134.08	10.76
18:00	Sprinters	136.33	10.01
	Jumpers	136.05	10.91
	Throwers	138.08	11.08

Table-III reveals the descriptive statistics of sodium at five different times of the day among sprinters, jumpers and throwers. It is clear from this table that athletes showed peak performance 18:00 hours.

Table-IV
Summary of ANOVA for 3 × 5 Factorial Experiments with Repeated Measures on the Last Factor on Sodium

Source of Variation	SS	Df	MS	F
Between Ss				
A (Athletes: sprinters, jumpers and throwers)	**.908**	**2**	**0.454**	**0.001**
Ss w. groups (Error I)	**14860.14**	**27**	**550.37**	
Within Ss				
B (Different times of Day)	**783.496**	**4**	**195.874**	**1052.8***
AB (Interaction)	**38.852**	**8**	**4.856**	**26.10***
B × Ss w. groups (Error II)	**20.093**	**108**	**0.186**	

*Significant at 0.05 level of confidence with df of 2 to 27 is 3.35; df of 4 to 108 is 2.4557; df of 8 to 108 is 2.0252.

It is clear from table that there is no significant difference on sodium among athletes irrespective of different times of day as the obtained 'F' ratio of 0.001 is lesser than the required table value of 3.35 at $\alpha = 0.05$ for df 2 and 27.

Figure-II
Comparison of Athlete's Sodium at Different Times of the Day

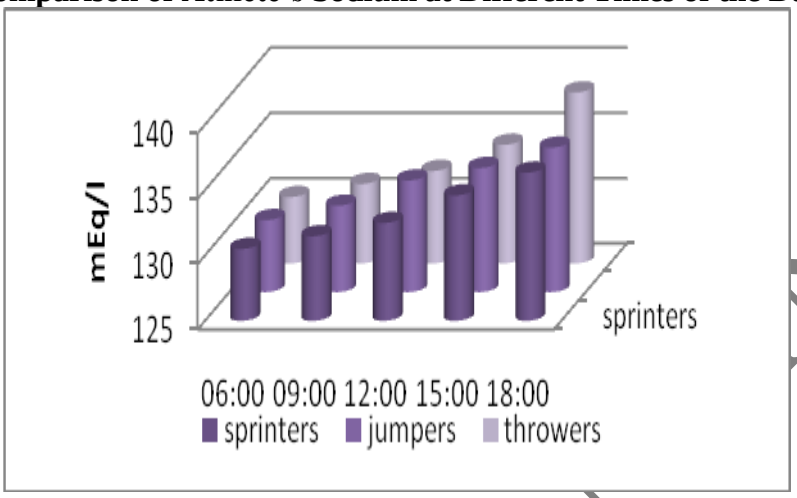


Table No-V
Simple Effect Test on Sodium

Variable	SS	Df	MS	F
Athletes at 06:00	0.61396	2	0.30698	1.65
Athletes at 09:00	0.746823	2	0.373412	2.00
Athletes at 12:00	5.728893	2	2.864447	15.40*
Athletes at 15:00	0.74991	2	0.374955	2.015
Athletes at 18:00	12.04008	2	6.020042	32.36*
Different Times of the Day with Sprinters	56.24863	4	14.06216	75.60*
Different Times of the Day with Jumpers	49.25816	4	12.31454	66.20*
Different Times of the Day	100.0801	4	25.02001	134.51*
Error	20.093	108	0.186	

*Significant at 0.05 level of confidence with df 2 and 108 is 3.0803 and df of 4 and 108 is 4557.

From Table-V, it is found that significant difference on sodium is elicited among athletes (sprinters, jumpers and throwers) at 12:00 and 18:00 hours as the obtained *F* ratio of 15.40 and 32.36 respectively are greater than the required table value of 3.0803 at $\alpha = 0.05$ for df 2 and 108. Scheffe's post hoc test on sodium was applied and presented in table VI to VII.

Table No-VI

Scheffe's Post Hoc Test on Sodium among Athletes at Specific Hours

Time	Sprinters	Jumpers	Throwers	MD	CI
12:00	132.493	133.547		1.05*	0.478
	132.493		132.079	0.41	0.478
		133.547	132.079	1.46*	0.478
18:00	136.338	136.058		0.28	0.478
	136.338		138.083	1.74*	0.478
		136.058	138.083	2.02*	0.478

* Significant at 0.05 level.

The above Table-VI reveals that significant difference was found in between sprinters and jumpers; jumpers and throwers at 12:00 hour, similarly at 18:00 hour sprinters and throwers; jumpers and throwers showed difference, whereas in other comparisons there was no significant difference, found in relation to sodium. It is inferred that jumpers had more sodium secretion at 12:00 and throwers at 18:00 hours.

Table No-VII

Scheffe's Test for Difference between Paired Means on Sodium of Sprinters

06:00	09:00	12:00	15:00	18:00	MD	CI
130.5	131.472				0.97	0.601
130.5		132.493			1.99*	0.601
130.5			134.596		4.09*	0.601
130.5				136.338	5.83*	0.601
	131.472	132.493			1.02*	0.601
	131.472		134.596		3.12*	0.601
	131.472			136.338	4.86*	0.601
		132.493	134.596		2.10*	0.601
		132.493		136.338	3.84*	0.601
			134.596	136.338	1.74*	0.601

* Significant at 0.05 level.

From table-VII the Scheffe's post hoc test showed a significant difference in sprinters across different times of day at 0.05 level of confidence. Thus, it is concluded that sprinters showed a significant fluctuations in sodium across different times of day.

Table No-VIII

Scheffe's test for Difference between Paired Means on Sodium of Jumpers

06:00	09:00	12:00	15:00	18:00	MD	CI
130.514	131.61				1.09*	0.601
130.514		133.547			3.03*	0.601
130.514			134.497		3.98*	0.601
130.514				136.058	5.54*	0.601
	131.61	133.547			1.93*	0.601
	131.61		134.497		2.88*	0.601
	131.61			136.058	4.44*	0.601
		133.547	134.497		0.9*	0.601
		133.547		136.058	2.51*	0.601
			134.497	136.058	1.56*	0.601

* Significant at 0.05 level.

From Table-VIII the Scheffe's post hoc test showed a significant difference in jumpers across different times of day at 0.05 level of confidence. Thus, it is concluded that jumpers showed a significant fluctuations in sodium across different times of day.

Table No-IX

Scheffe's Test for Difference between Paired Means on Sodium of Throwers

06:00	09:00	12:00	15:00	18:00	MD	CI
130.078	131.083				1.00*	0.601
130.078		132.079			2.00*	0.601
130.078			134.08		4.00*	0.601
130.078				138.083	8.00*	0.601
	131.083	132.079			0.99*	0.601
	131.083		134.08		2.99*	0.601
	131.083			138.083	7*	0.601
		132.079	134.08		2.00*	0.601
		132.079		138.083	6.00*	0.601
			134.08	138.083	4.00*	0.601

* Significant at 0.05 level.

From Table-IX, the Scheffe's post hoc test showed a significant difference in throwers across different times of day at 0.05 level of confidence. Thus, it is concluded that throwers showed a significant fluctuations in sodium across different times of day.

Discussion on Findings:

Total Protein:

Touitou *et al.*, (1989) found out the relationship between protein intake and physical performance. He reported that dependent to a great extent on muscular strength, protein intake could possibly play a role in aiding performance. Total protein rhythmicity is mainly attributed to the positive and negative balance between synthesis and degradation of total protein. In the present study athletes showed peak at 18:00 hours. In present study similarly monosodium glutamate (involved in the transmission of the high information of the clock) was also found to be at least the characteristics of glucose, cholesterol and total protein rhythms **(Manivasagam & Subramanian, 2004b)**.

Circadian rhythms in total plasma protein were reported in humans and mice **(Touitou *et al.*, 1986; Berezkin *et al.*, 1992)**. Circadian rhythms in protein synthesis have been documented in a set of species of monocellular eukaryotes **(Donner *et al* 1985)** and the circadian rhythm of the synthesis of protein by the rat liver has been described **(Van Mayersbasch, 1978)**. The positive or negative balance between synthesis and degradation of proteins might be responsible for the rhythmic phenomenon.

Sodium:

The physiological requirement for increased blood pressure during the activity phase, circadian rhythm of the blood pressure parallels oscillations of sodium excretion, showing maximal values during biological day and a 10-20% dip during the sleep phase **(Burnier *et al.*, 2007)**. In present study sprinters with normal nocturnal sleep recorded peak at 20:7 h. Since sprinter with disturbed nocturnal sleep recorded peak at 22:06. This is significant phase delayed 1:59 h which resulted because of disturbed nocturnal sleep in sprinters.

Physiologic renal excretion shows a rhythm with greater urine volumes and a higher excretion of sodium, chloride, potassium, microalbumin and aldoscence during the day **(Werson, 1964; Koopman *et al.*, 1989; Manchester, 1993; Van Acker *et al.*, 1993; Bartter *et al.*, 1962).** However, **Chuncey, Feller and Shannon, (1963)** have recorded higher flow rates in the afternoon. The acetylcholine diffuses across the synapse and binds to and activates nicotinic acetylcholine receptors on the neuromuscular junction. Activation of the nicotinic receptor opens its intrinsic sodium/potassium channel, causing sodium to rush in and potassium to trickle out. Because the channel is more permeable to sodium, the muscle fiber membrane becomes more

positively charged, triggering an action potential. **Henkin, Gill and Barlter (1963)** have reported an increased for sodium in normal subjects tested in the afternoon.

Discussion on Hypothesis:

For the purpose of the study the formulated hypothesis stated that there would be a significant change on total protein and sodium among sprinters, jumpers and throwers at different times in a day. The results of the study indicated that sodium showed that there was a significant difference among the groups. The hypothesis was accepted at 0.05 level. However the total protein, have no significant changes. Hence the hypothesis was rejected.

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