



Evaluation of Diurnal Variations in Strength Endurance of Football Players

Basamsetti Ramagopal¹ & Dr. I. Devi Vara Prasad²

¹Ph.D., Research Scholar, University College of Physical Education & Sports Sciences, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India.

²Assistant Professor, Co-ordinator, Acharya Nagarjuna University, Ongole, Andhra Pradesh, India.

Received 21st December 2015, Accepted 15th January 2016

Abstract

The present study was proposed to evaluate diurnal variations on strength endurance of football players. To accomplish the purpose of the study, thirty-five male football players in the age group of eighteen (18) and twenty-two (22) years from the colleges affiliated to Acharya Nagarjuna University, Andhra Pradesh were considered as subjects. These subjects were classified into three groups based on their level participation in football tournaments as college level (12), inter-collegiate level (12) and inter-university level (11). The criterion variables selected in this study is strength endurance. To monitor the diurnal pattern tests were conducted at 06:00, 09:00, 12:00, 15:00, and 18:00 hours. The cosinor win software was used to examine the rhythm with regard to the criterion variable. 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 different levels of football players (college level, inter-collegiate level & inter-university level) 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 is significant, simple effect was used as a follow up test. The level of confidence was fixed at 0.05 to test the significance. Based on the findings of the study, it is inferred that a time of day effect do exist on strength endurance of football players, beside there is significant difference on the diurnal rhythm among groups.

Keywords: Diurnal patterns, muscular strength, Football players.

© Copy Right, IJRRAS, 2016. All Rights Reserved.

Introduction

Most individuals consider that their athletic prowess is best in the late afternoon and early evening, and this is the time period when best performances and even world records are most often likely to be set in competitions. External factors may be in part responsible, the world records set in track and field events in the evening reflecting the times at which grand prix events and major championships are held in front of large crowds and the media. However, recent reviews have considered the evidence that sports performance shows a diurnal rhythm that is, in part at least, due to the activities of a "body clock" (Reilly & Waterhouse, 2009). If body temperature was a determining factor, then peak performance should occur in the evening when the temperature of the body at rest is at its highest point. Most athletic world records are set at this time of day: indeed all middle-distance world records set by British runners (Seb Coe, Steve Cram, Steve Ovett & Dave Moorcroft) were set between 19:00 and 23:00 hours. The only exceptions in track and field events over the last half century have been the two set pre-noon in men's shot and women's javelin. Both of the events entail dynamic explosive rather than sustained effort: for

activities that depend more on central nervous system arousal than on the curve in body temperature, the period for high performance levels may be closer to mid-day. Indicators of arousal, such as circulating levels of catecholamines, reach a peak about 4 hours earlier in the day than does body temperature. Nevertheless, achievement of peak performances before noon is highly unusual.

The competitive data indicating high points for evening performances are supported by time trials for a variety of sports. A time of day effect is evident in the performance in all-out swimming over both 100 m and 400 m. A turning point in the performance curve is noted at about 20:00 hours. These trends in better performances in the evening than in the morning are evident also in throwers and rowers. The results for swimmers correspond to performance in power output on a swim-bench, peak power in this instance being produced at about 18:00 hours. An amplitude in performance of 14% has been reported for power output in the first 5 s of a 30 s test, and 11% for mean power production over the whole test. Hence, the investigator made an attempt to study the diurnal variation of strength endurance among football players.

Correspondence

Basamsetti Ramagopal

E-mail: pdvasavi68@gmail.com, Ph. +9194402 12488

Methodology

Subjects and Variables

Thirty five male football players in the age group

of eighteen (18) and twenty-two (22) years from the colleges affiliated to Acharya Nagarjuna University, Guntur, Andhra Pradesh, India during the academic year 2014-2015, were considered as subjects. These subjects were classified into three groups based on their level participation in football tournaments as college level (12), inter-collegiate level (12) and inter-university level (11). All the subjects were non smokers and also they were free from injuries for 2 months before the commencement of the study. The criterion variables selected in this study is muscular strength.

Collection of Data

To monitor the diurnal pattern on strength endurance of college level, inter-collegiate level and inter-university level football players tests were conducted at 06:00, 09:00, 12:00, 15:00, and 18:00 hours.

Statistical Techniques

The data collected from the football players

(college level, inter-collegiate level & inter-university level) at five different time of the day were statistically analyzed to examine the changes on strength endurance. The cosinor win software was used to examine the rhythm with regard to the criterion variable. 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 different levels of football players (college level, inter-collegiate level & inter-university level) 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 is significant, simple effect was used as a follow up test. The level of confidence was fixed at 0.05 to test the significance.

Result

The descriptive statistics on strength endurance of college level, inter-collegiate level and inter-university level football players at five different times of the day is shown in table-I.

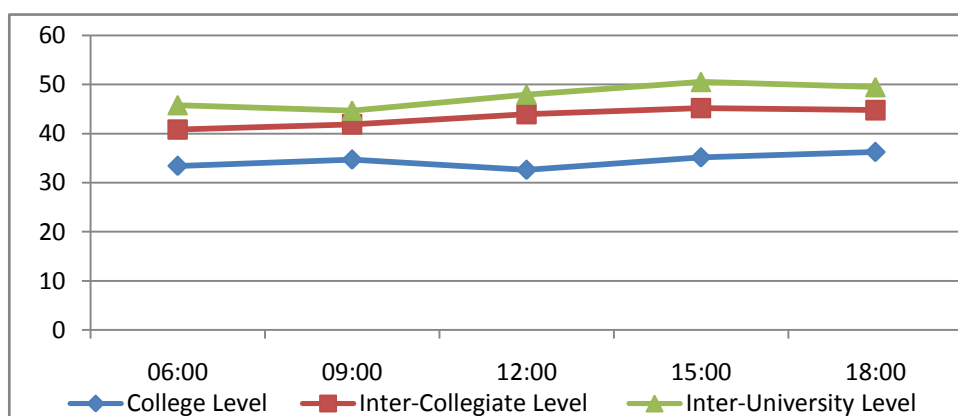
Table I. Descriptive Statistics on Strength Endurance of Football Players at Five Different Times of the Day

Time	Group Mean		
	College Level	Inter-Collegiate Level	Inter-University Level
06:00	33.45	40.86	45.83
09:00	34.73	41.93	44.71
12:00	32.64	44.00	47.97
15:00	35.18	45.21	50.54
18:00	36.27	44.79	49.49

Table-I displays the mean value on strength endurance at different times of the day is ranged between 32.64 and 36.27 for college level football players, 40.86 and 45.21 for inter-collegiate level football players, and 44.71 and 50.54 for inter-university level football

players. The data on strength endurance of college level, inter-collegiate level and inter-university level football players at different times of the day was graphically illustrated in figure-II.

Figure II. Graphical Representation of Data on Strength Endurance of Football Players at Five Different Times of the Day



The Diurnal rhythm on strength endurance of college level, inter-collegiate level and inter-university

level football players at five different times of the day is shown in table-II.

Table II. Diurnal Rhythm on Strength Endurance

Rhythm	Group Mean		
	College Level	Inter-Collegiate Level	Inter-University Level
Acrophase	21:26	16:08	17:46
Amplitude	1.7	2.5	2.7
MESOR	37.0	43.8	46.5
Trough	09:31	03:55	05:42
r value	-0.48	-0.82	-0.94

The acrophase of sit-ups performance was reached at 21:26, 16:08, and 17:46 hours respectively by college level, inter-collegiate level and inter-university level football players. Amplitude (*1/2 peak to trough difference*) is 1.7, 2.5, and 2.7. The MESOR of sit-ups performance of college level, inter-collegiate level and inter-university level football players are 37.0, 43.8, and

46.5 respectively. The correlation coefficient of -0.48, -0.82 and -0.94 were obtained for the respective group of football players. Additionally, the data on strength endurance was analyzed for significant difference among groups at different times of the day using repeated measures. The results thus obtained were given in table-III.

Table III. Two way ANOVA with Last Factor Repeated Measures on Strength Endurance

Source of Variation	SS	df	MS	F
Between Ss				
A (<i>college, inter-collegiate & inter-university level football players</i>)	4643.25	2	2321.63	18.61*
Ss w. groups (Error I)	3991.13	32	124.72	
Within Ss				
B (<i>Different times of Day</i>)	373.38	4	93.345	11.73*
AB (<i>Interaction</i>)	145.17	8	18.146	2.28*
B × Ss w. groups (Error II)	1019.03	128	7.96	

*Significant at 0.05 level

The table value required for significance at 0.05 level of confidence for the df of 2 and 32, 4 and 128, 8 and 128 are 3.29, 2.44 and 2.01 respectively.

Table-III reveals that there is a significant difference on strength endurance among athletes irrespective of different times of day as the obtained 'F' ratio of 18.61 is greater than the required table value of 3.29 for df 2 and 32 at 0.05 level of confidence. The finding also reveals a significant difference on strength endurance among different times of day, irrespective of groups as the obtained 'F' ratio of 11.73 is greater than the required table value of 2.44 at α 0.05 for df 4 and

128. The findings of the study disclose that there is a significant difference on strength endurance for the interaction of groups and different times of the day as the obtained F ratio of 2.28 is greater than the required table value of 2.01 for the df of 8 and 128 at 0.05 level of confidence. Since, interaction is significant the simple effect was applied and the results thereto were given in table-IV.

Table IV. Simple Effect Test on Strength Endurance of Football Players at Five Different Times of the Day

Variable	SS	df	MS	F
Football Players at 06:00	352.28	2	176.14	22.13*
Football Players at 09:00	206.14	2	103.07	12.95*
Football Players at 12:00	643.65	2	321.83	40.43*
Football Players at 15:00	615.36	2	307.68	38.65*
Football Players at 18:00	421.18	2	210.59	26.46*
College Level Football Players at Different Times of the Day	31.47	4	7.868	0.988
Inter-Collegiate Level Football Players at Different Times of the Day	69.12	4	17.28	2.17
Inter-University Level Football Players at Different Times of the Day	13.53	4	3.383	0.425
Error	1019.03	128	7.96	

*Significant at 0.05 level

The table value for significance at 0.05 level of confidence with df 2 and 128 is 3.07 and df of 4 and 128 is 2.44.

Table-IV demonstrated a significant difference of the diurnal rhythm on strength endurance among groups (college, inter-collegiate & inter-university level football players) at 06:00, 09:00, 12:00, 15:00 and 18:00 hours as the obtained F ratio of 22.13, 12.95, 40.43, 38.65, and 26.46 respectively are greater than the required table value of 3.07 for df 2 and 128 at 0.05 level

of confidence. Furthermore, it is found that significant diurnal variation didn't subsists on strength endurance at different times of the day of college, inter-collegiate & inter-university level football players as the obtained F ratio of 0.988, 2.17 and 0.425 respectively are lesser than the required table value of 2.44 for df 4 and 128 at 0.05 level of confidence .

Table V. Scheffe's Post Hoc Test for the Paired Mean Differences on Strength Endurance of Football Players at Five Different Times of the Day

	College Level	Inter-Collegiate Level	Inter-University Level	Mean Difference	Confidence Interval
Football Players at 06.00	33.45	40.86		7.41*	2.31
	33.45		45.83	12.35*	2.31
		40.86	45.83	4.94*	2.31
Football Players at 09.00	34.73	41.93		7.20*	2.31
	34.73		44.71	9.97*	2.31
		41.93	44.71	2.77*	2.31
Football Players at 12.00	32.64	44.00		11.36*	2.31
	32.64		47.97	15.56*	2.31
		44.00	47.97	3.90*	2.31
Football Players at 15.00	35.18	45.21		10.03*	2.31
	35.18		50.54	15.32*	2.31
		45.21	50.54	5.29*	2.31
Football Players at 18.00	36.27	44.79		8.51*	2.31
	36.27		49.49	13.13*	2.31
		44.79	49.49	4.61*	2.31

*Significant at 0.05 level

Table-V demonstrates that each of the paired mean differences have significant deviation among groups on strength endurance at different times of the day. It implies that inter-university level football players possess greater strength endurance at all the times of testing confined to this study.

Discussion

In the present study strength endurance showed a significant difference among football players, but no fluctuation is elicited within the group at different times of the day. Core strength remained unaltered at different times of the day, however it peaked at 15:00 hours. It is proved from other studies that body temperature might contribute to the diurnal rhythm in athletic performance,

it is unlikely to be the sole determinant of performance. For example, large increases in body temperature via passive heating have been necessary to elicit modest improvements in strength and anaerobic performance (Bergh & Ekblom, 1979). This finding in accordance with muscle groups strength peak performance in early evening or afternoon (Wright et al., 1983; O'Connor et al., 1991; Coldwells et al., 1994; Callard et al., 2000; Gifford, 1987; Bambacichi et al., 2005; Wyse et al., 1994; Giacomoni et al., 2005). Thus it has been argued (Martin, Carpentier, Guissard, et al., 1999) that the diurnal rhythm in muscular strength is more likely to be attributable to intracellular processes involved in excitation-contraction coupling than the small diurnal variation in body temperature.

Conclusion

Based on the findings of the study, it is inferred that significant deviation among groups on strength endurance at different times of the day. It implies that inter-university level football players possess greater strength endurance at all the times of testing confined to this study. Furthermore, it is found that significant diurnal variation didn't subsists on strength endurance at different times of the day of college, inter-collegiate and inter-university level football players.

References

1. Bergh, U., Ekblom, B. (1979). Influence of muscle temperature on maximal muscle strength and power output in human skeletal muscles. *Acta Physiol Scand*, 107: 33–37.
2. Bambacichi, E., Reilly, T., Cable, N.T., Giacomoni, M. (2005). Influence of time of day and partial sleep loss on muscle strength in eumenorrhic females. *Ergonomics*, 48: 1499-1511.
3. Coldwells, A., Atkinson, G., Reilly, T. (1994). Sources of variation in back and leg dynamometry. *Ergonomics* 37(1):79–86.
4. Callard et al., (2000). Circadian fluctuations in the muscular efficiency of athletes: with sleep versus sleep deprivation. *J Soc Biol.*, 194: 165-169.
5. Giacomoni, M., Edwards, B., and Bambacichi, E. (2005). Gender differences in the circadian variations in muscle strength assessed with and without superimposed electrical twitches. *Ergonomics*, 48: 1473-1487.
6. Gifford, L. S. (1987). Circadian variation in human flexibility and grip strength. *Aust. J. Physiotherapy*, 33: 3–9.
7. Martin, A., Carpentier, A., Guissard, N., Van Hoeke, J., Duchateau, J. (1999). Effect of time of day on force variation in a human muscle. *Muscle Nerve*, 22(10):1380–1387.
8. O'Connor P, Morgan W, Koltyn K et al (1991) Air travel across four time zones in college swimmers. *J Appl Physiol.*, 70:756–763
9. Reilly, T. and Waterhouse, J. (2009). Sports performance: is there evidence that the body clock plays a role? *Eur. J. Appl. Physiol.*, 106: 321–332.
10. Wright et al., (1983). Effects of travel across time zones (jet-lag) on exercise capacity and performance. *Aviat Spac Environ Med.*, 54: 132-137.
11. Wyse, J. P., Mercer, T. H., Gleeson, N. P. (1994). Time-of-day dependence of isokinetic leg strength and associated interday variability. *Br. J. Sp. Med.* 28(3):167–170.