EFFECT OF GENDER DIFFERENCE AND CIRCADIAN RHYTHM ON TOTAL MOOD DISTURBANCE OF VOLLEYBALL PLAYERS

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ABSTRACT

The purpose of the study was to find out the effect of gender difference and circadian rhythm on total mood disturbance (TMD) for volleyball players. To achieve the purpose, a total of thirty volleyball players [men (n = 15) and women (n = 15)] age between 19 years and 22 years from Einstein College of Engineering, Tamil Nadu, India were selected as subjects. The two independent variables of gender and circadian variations and dependent variable of total mood disturbance were selected for this study. The experimental design used was static group factorial design. The data were collected at 02:00, 06:00, 10:00, 14:00, 18:00 and 22:00 hours on total mood disturbance by using profile of mood state (POMS) questionnaire during the academic year of 2010 – 2011. Collected data were subjected to statistical analysis by using two-way factorial (2 x 6) Analysis of Variance (ANOVA) and Cosinor analysis. There was significant difference in total mood disturbance between genders, significant difference in total mood disturbance at different times of the day irrespective of gender status and significant difference in total mood disturbance for men and women volleyball players at different times of the day. Significant circadian rhythm exists on total mood disturbance for women. Insignificant circadian rhythm exists on total mood disturbance for men. It is recommended to the physical educators to adopt the findings of this study while planning to improve sports skills for the players and athletes.

Key words: Circadian Rhythm, Gender, Profile of Mood State, Total Mood Disturbance, Volleyball

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INTRODUCTION

Sports become stereotyped as gender-neutral, feminine, or masculine based on conceptions regarding gender, gender differences, and beliefs about the appropriateness of participation due to gender (Colley et al., 1987; Csizma, Wittig, & Schurr, 1988; Koivula, 1995; Matteo, 1986). Gender difference is now an unavoidable factor in the sports and games field. Gender differences in exercise and sport are considered as one of the major factor while preparing training and competition schedule. Even though men and women are having differences in physical and biological, the psychological difference especially mood state play a vital role for determining the sports performance. The mood state may differ for men and women at different times of the day.

Circadian rhythms are defined as an endogenous rhythm pattern that cycle on a daily (approximately 24 hour) basis under normal circumstances. The name circadian comes from the Latin circadia, meaning about a day. The circadian cycle regulates changes in performance, endocrine rhythms, behavior and sleep timing (Duffy, Rimmer, & Czeisler, 2001). More specifically these physiological and behavioral rhythms control the waking/sleep cycle, mood state, body temperature, blood pressure, reaction time, levels of alertness, patterns of hormone secretion, and digestive functions. Circadian rhythm is the vital factor that affects the mood state of an individual especially sports man.

Mood disturbances are characterized by opposite polar moods: depression, which involves extreme feelings of sadness and dejection, and mania, which involves unrealistic feelings of excitement and joy. There are a variety of unipolar mood disturbance, which involve mania or depression, and bipolar disorders, which are characterized by both mania and depression.

The alertness and positive mood states peak in the walking hours, usually the afternoon, conversely, mood disturbance is lowest in the afternoon and early evening. Mood and subjective alertness are important, since such states can alter an individual's motivation for strenuous physical exercise, circadian variations in mood states may also affect the team "cohesion" of a sports squad (Michelle Warren and Naama Constantini, 2000).

Gender difference and circadian rhythm in mood disturbance are becoming increasingly apparent, but have been less studied. This study attempt to gain an insight in this area that will be a benefit approaching to the sports fielders.

Purpose of the Study

The purpose of the study was to find out the effect of gender difference and circadian rhythm on total mood disturbance for volleyball players. Total mood disturbance have its own peak time and trough time based on circadian rhythm. This will also vary between men and women. But if the peak times of total mood disturbance would be predicted and if their peak times are closer together then that time would be the better time for peak performance of that particular individual or group. On the basis of this knowledge, an attempt has been made to study the gender difference and circadian rhythm on total mood disturbance for volleyball players. With this background in view, the following hypotheses were framed for this study.

1. There may be a significant difference on total mood disturbance between men and women volleyball players irrespective of different times of the day.

2. There may be a significant difference on total mood disturbance between different times of the day irrespective of gender status.

3. There may be a significant difference on total mood disturbance for

men and women volleyball players on different times of the day.

4. There may be a significant circadian rhythmicity in total mood disturbance of men and women volleyball players.

METHOD

Participants

The purpose of the present study was to find out the effect of gender difference and circadian rhythm on total mood disturbance of volleyball players. To achieve the purpose of the study, a total of thirty college level volleyball players [men (n = 15) and women (n = 15)] aged between 19 years and 22 years were selected as subjects during the academic year of 2010 - 2011. They were in good state of fitness and they regularly took part in physical activities and game practice both morning and evening in the college. The above said thirty volleyball players voluntarily took part in the present study as subjects.

Measures

In the present study men and women volleyball players were selected as one categorical variable. Circadian rhythms usually form sinusoid within a period about 24 hours. So six different times of the day 02:00 hours, 06:00 hours, 10:00 hours, 14:00 hours, 18:00 hours and 22:00 hours were selected as another categorical variable. Total mood disturbance (TMD) was selected as dependent variable for this study. The data on total mood disturbance were collected by using profile of mood state questionnaire (POMS) in six different times of the day (02:00 hours, 06:00 hours, 10:00 hours, 14:00 hours, 18:00 hours and 22:00 hours). The experimental design used was static group factorial design. The first factor consisted of gender status as men and women volleyball players, second factor consisted of circadian variation measured at six different times of the day (02:00, 06:00, 10:00, 14:00, 18:00, and 22:00 hours).

Statistical Procedure

Two factor analysis of variance with second factor repeated (2 x 6) measure was used to find out the influence of each of the factor independently and also their combined influence on dependent variable of total mood disturbance. Three “F” values were computed, one for rows to assess the gender status on dependent variable of total mood disturbance and the second F-value was calculated for columns to assess the circadian variations on the dependent variable of total mood disturbance. The third F-value was calculated for gender status and different times of the day. If the obtained F- values were significant, Scheffe’s post-hoc test was used for columns to find out the significant difference if any among the paired means. If interactions were significant, the simple effect follow up technique was used for testing the differences among cells. In all the cases .05 level of significance was fixed and considered to be appropriate in view of the fact that very highly sophisticated equipments were not used for more stringent level of significance. The mean value from each cell was subjected to cosinor analysis to find out parameters of circadian rhythm, the percentage Rhythm with Probability level, the mesor value, the amplitude and Acrophase for total mood disturbance in men and women volleyball players. Circadian rhythm was considered statistically significant when $P \leq .05$.

Testing Procedure

The subjects were requested to make sincere and careful attempts while answering all the sixty five questions in the profile of mood state questionnaire, as they filled in that particular testing time. The examiner and research assistants were readily available to tell the meaning of one or two words to occasional enquiries of the subjects. After making sure that the subjects had answered all the 65 questions the questionnaires were collected. The TMD was obtained by summing the score (with vigour weighted negatively) on the six primary mood factors (i.e.) the five scale scores of tension, depression, anxiety,

fatigue and confusion were added together and vigour was subtracted from these scores. The scoring was done by hand scoring through the use of POMS Testing Manual.

RESULTS

Analysis and Interpretations

The mean and standard deviation of TMD of men and women volleyball players at six different times of the day are presented in Table I

Table 1. Mean and Standard Deviation of Total Mood Disturbance of Men and Women Volleyball Players at Six Different Times of the Day

Status	Mean ± Standard Deviation						
	Times of the day						
	02:00	06:00	10:00	14:00	18:00	22:00	Mx
Men	113.26 ± 3.22	109.83 ± 3.23	108.22 ± 3.49	105.45 ± 3.57	101.37 ± 2.66	106.48 ± 2.43	107.44
Women	121.45 ± 1.87	116.40 ± 3.14	113.25 ± 3.45	109.47 ± 3.93	107.41 ± 2.88	113.85 ± 3.25	113.64
My	117.36	113.12	110.74	107.46	104.39	110.17	

Total Mood Disturbance is expressed in Numbers.

Mx - Combined mean of men and women volleyball players irrespective of different times of the day.

My - Combined mean of different times of the day irrespective of men and women volleyball players.

The mean values of male and female on TMD are graphically represented in figure I.

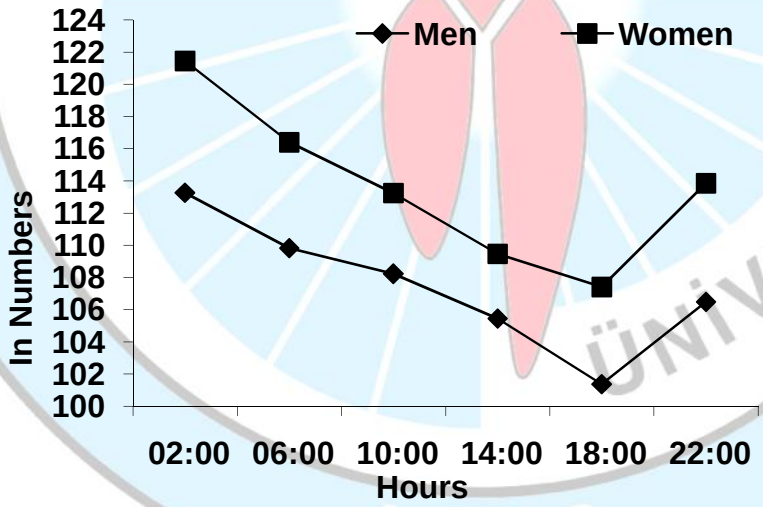

Figure 1: Mean Scores of TMD of Men and Women Volleyball Players at Different Times of the Day

The data of TMD have been analyzed by two factor ANOVA with repeated measure on the second factor and the results obtained are presented in Table II.

Table 2. Two Factor ANOVA With Repeated Measures on the Second Factor of TMD of Men and Women Volleyball Players at Different Times of the Day

Source of Variance	Sum of Squares	df	Mean of Squares	F - **value**
Men and Women (Gender)	1716.81	1	1716.81	46.82*****
Error I	1026.79	28	36.67	
Different times of the day (Time)	3015.05	5	603.01	122.19*****
Interaction (Gender & Time)	84.37	5	16.87	3.42*****
Error II	690.90	140	4.94	

*****Significant at .05 level of confidence.

(Table values required for significance at .05 level for df (1, 28) and (5, 140) are 4.20 and 2.28 respectively)

Table II shows that the F- value for factor – A (Gender Status - Men and Women volleyball players) is 46.82 and it is significant at .05 level of confidence as the required table value for significance is 4.20 (df 1 and 28). The 'F' value for Factor – B (different times of the day) is 122.19 and it is significant at .05 level of confidence as the required table value for significance is 2.28 (df 5 and 140). The interaction F- value for Factor – A X B (Gender status x different times of the day) is 3.42 and it is significant at .05 level of confidence as the required table value for significance is 2.28 (df 5 and 140). Since the obtained F- value for men and women volleyball players is significant, it is concluded that there is a significant difference in TMD between men and women volleyball players. The TMD of men volleyball players (107.44) is lower than that of the women volleyball players (113.64). Men volleyball players have 5.46 per cent lower TMD than the women volleyball players. The F- value obtained for six different times of the day is significant. It is therefore concluded that there is a significant difference in TMD among six different times of the day. The difference between times of the day in TMD is presented in Table III.

Table 3. Scheffe's Test for Difference between the Paired Means of TMD of Men and Women Volleyball Players at Six Different Times of the Day

Different Times of the Day						Mean Difference
02:00	06:00	10:00	14:00	18:00	22:00	
117.36	113.12					4.24*****
117.36		110.74				6.62*****
117.36			107.46			9.90*****
117.36				104.39		12.96*****
117.36					110.17	7.19*****
	113.12	110.74				2.38*****
	113.12		107.46			5.66*****
	113.12			104.39		8.73*****
	113.12				110.17	2.95*****
		110.74	107.46			3.28*****
		110.74		104.39		6.35*****
		110.74			110.17	0.57
			107.46	104.39		3.06*****
			107.46		110.17	2.71*****
				104.39	110.17	5.78*****

*****Significant at .05 level of confidence.

(Confidence interval value required for significance at .05 level is 1.94)

The results of the study clearly indicate that the TMD differs as the time of the day varies and this difference in TMD is found to be significant in 14 paired means out of compared 15 paired means. However, insignificant increase in TMD is noted only in one paired means between 10:00 hours and 22:00 hours of the day. The difference TMD between 10:00 hours and 22:00 hours is not significant at .05 level of confidence. Hence it is concluded that among men and women volleyball players, the TMD variation depends on the times of the day.

The significant difference obtained in the interaction indicates that the difference in TMD may vary for men and women volleyball players and also among different times of the day. Hence the simple effect test has been used for further analysis and results have been presented in Table IV.

Table 4. Simple Effect for Mean TMD for Men and Women Volleyball Players at Six Different Times of the Day

Source of Variance	**Sum of Squares**	**df**	**Mean of Squares**	**F -** value
Men and Women Volleyball players				
at 02:00 Hours	503.48	1	503.48	102.02*****
at 06:00 Hours	324.07	1	324.07	65.67*****
at 10:00 Hours	190.01	1	190.00	38.50*****
at 14:00 Hours	121.20	1	121.20	24.56*****
at 18:00 Hours	273.61	1	273.61	55.44*****
at 22:00 Hours	388.80	1	388.80	78.78*****
Men volleyball players at different times of the day	1223.72	5	244.74	49.59*****
Women volleyball players at different times of the day	1875.69	5	375.14	76.02*****
Error	690.90	140	4.9350	

*****Significant at .05 level with df (5,140) is 2.28 and df (1, 140) is 3.84

Table IV shows that the F-values obtained for men and women at 02:00 hours, 6:00 hours, 10:00 hours, 14:00 hours, 18:00 hours, and 22:00 hours are significant at .05 level of confidence. Hence the men and women volleyball players have significant difference in TMD at all the selected different times of the day.

The F- value obtained for men volleyball players at different times of the day (F = 49.59) and women volleyball players at different times of the day (F = 76.02) are significant at .05 level of confidence. It means that irrespective of the gender status; various times of the day significantly affect their TMD. Hence Scheffe's test has been applied as the post hoc test of significance for men volleyball players at different times of the day and women volleyball players at different times of the day. The results of Scheffe's test for men volleyball players at different times of the day are presented in Table V.

Table 5. Scheffe's Test for Difference Between the Paired Means of TMD of Men Volleyball Players at Six Different Times of the Day

Different Times of the Day						Mean Difference
02:00	06:00	10:00	14:00	18:00	22:00	
113.26	109.83					3.43*****
113.26		108.22				5.04*****
113.26			105.45			7.81*****
113.26				101.37		11.89*****
113.26					106.48	6.78*****
	109.83	108.22				1.61
	109.83		105.45			4.38*****
	109.83			101.37		8.45*****
	109.83				106.48	3.35*****
		108.22	105.45			2.77*****
		108.22		101.37		6.85*****
		108.22			106.48	1.74
			105.45	101.37		4.07*****
			105.45		106.48	1.03
				101.37	106.48	5.11*****

*****Significant at .05 level of confidence. (Confidence interval value required for significance at .05 level is 2.74)

The results of the post hoc analysis clearly indicate that there is a significant difference in TMD of men volleyball players among different times of the day in 12 paired means out of compared 15 paired means. However, insignificant increase in TMD is noted only in three paired means between 06:00 hours and 10:00 hours, 10:00 hours and 22:00 hours and 14:00 hours and 22:00 hours of the day.

The difference in TMD between 06:00 hours and 10:00 hours, 10:00 hours and 22:00 hours and 14:00 hours and 22:00 hours is not significant at .05 level of confidence. Hence it is concluded that among men volleyball players, the TMD variation depends on the times of the day.

Table IV shows that 'F' value obtained for women volleyball players at different times of the day is 57.90 and it is significant at .05 level of confidence. Hence Scheffe's test has been applied as the post hoc test of significance and the results are presented in Table VI.

Table 6. Scheffe's Test for Difference Between the Paired Means of TMD of Women Volleyball Players at Six Different Times of the Day

Different Times of the Day						Mean Difference
02:00	06:00	10:00	14:00	18:00	22:00	
121.45	116.40					5.05*
121.45		113.25				8.20*
121.45			109.47			11.99*
121.45				107.41		14.04*
121.45					113.85	7.61*
	116.40	113.25				3.15*
	116.40		109.47			6.93*
	116.40			107.41		8.99*
	116.40				113.85	2.55
		113.25	109.47			3.79*
		113.25		107.41		5.84*
		113.25			113.85	0.59
			109.47	107.41		2.05
			109.47		113.85	4.38*
				107.41	113.85	6.43*

*****Significant at .05 level of confidence. (Confidence interval value required for significance at .05 level is 2.74)

The results of the post hoc analysis clearly indicate that there is a significant difference in TMD of women volleyball players among different times of the day in 12 paired means out of compared 15 paired means. However, insignificant increase in TMD is noted only in three paired means between 06:00 hours and 22:00 hours, 10:00 hours and 22:00 hours and 14:00 hours and 18:00 hours of the day.

The difference in TMD between 06:00 hours and 22:00 hours, 10:00 hours and 22:00 hours and 14:00 hours and 18:00 hours is not significant at .05 level of confidence. Hence it is concluded that among women volleyball players, the TMD variation depends on the times of the day.

Circadian rhythmicity of TMD and its parameters are explored using the best fitting curve procedure. The mean value from the data is subjected to cosinor analysis and the results are presented in Table VII.

Table 7. COSINOR Analysis of Circadian Rhythm for TMD of Volleyball Players

Category	Percent Rhythm	Probability Level	Mesor ± S.E	Acrophase ± S.E	Amplitude ± S.E	% Amplitude of Mesor
Men	82.54	0.07	107.44 ± 0.89	4:53 hours ± 1:01 hours	4.74 ± 1.26	4.41
Women	89.10	0.04	113.64 ± 0.87	3:53 hours ± 46:28 min	6.09 ± 1.12	5.36

The results of the cosinor analysis confirm the existence of insignificant circadian rhythm in TMD for men volleyball players (82.54%) ($P > .05$) and significant circadian rhythm in TMD for women volleyball players (89.10%) ($P \leq .05$). The amplitude of the rhythm in men and women volleyball players is 4.74 and 6.09 respectively. The time of peak performance (acrophase) in TMD for men and women volleyball players is calculated by means of cosinor analysis to be 4:53 hours and 3:53 hours respectively. The mesor value (mean) for men and women volleyball players is 107.44 and 113.64 respectively. The followings are the significant findings of the study.

1. There is a significant difference in TMD between men and women volleyball players and men volleyball players have less in TMD than women volleyball players.

2. The study also reveals that there is a significant difference in mean TMD among different times of the day irrespective of gender status. The mean TMD is significantly higher at 02:00 hours and lower at 18:00 hours.

3. The mean TMD of women volleyball players is significantly higher at 02:00 hours and lower at 18:00 hours.

4. The amount of variation between peak and trough values of TMD of men volleyball players is lower than women volleyball players.

5. There is an insignificant circadian rhythm for the samples of men volleyball players whereas statistically significant circadian rhythm is noted for women volleyball players.

DISCUSSION

The findings of the study show that there is a significant difference in TMD between men and women volleyball players. Men volleyball players have less in TMD (107.44) than women volleyball players (113.64) which makes the difference of 6.2 (5.46%).

The result of the study supports the earlier findings of Laurin, et al., (2007) who found out those psychiatric disorders are nearly two times higher in women than in

men. Women also have greater psychological distress, worse perceived control of symptoms, and greater functional impairment. It also replicates the earlier findings of Roberta Oka, et al., (2003) where despite the similarity in disease severity, women are reported to have greater mood disturbance than men. This lower level of TMD of men volleyball players might have been developed because of participation in vigorous physical training which includes stretching training also than that of women volleyball players. The reason for this result may be based on the notion of Daniel, Martin and Carter (1992) that acute mood changes occur with various forms of physical activity. Increased levels of endogenous opioids (endorphins) in response to exercise may mediate activity-induced shifts in mood state. Women have more TMD due to the reason quoted by Dawn Lemcke, et al., (2003) that cognitive and personality styles may affect mood. Family and culture bound traditions regarding female roles emphasize responsibility toward family over self, dependency, compliance, self sacrifice, and physical beauty, rather than assertiveness, self direction, physical expression in work and play, and independent creativity.

The study also reveals that there is a significant difference in mean TMD among different times of the day irrespective of gender status. The mean TMD is significantly higher at 02:00 hours (117.36) than 18:00 hours (104.39) with the difference of 12.97 cm (12.42%).

This result replicates the earlier findings of Taylor, et al., (2008) who have found out that during free living, men with low anxiety exhibit a diurnal cortisol pattern that peaks in the early morning, decreases precipitously during the midmorning, and continues to decrease throughout the day, reaching a nadir in the evening. The result may be due to the reason quoted by Claude Bouchard, Stevel Blair and William Haskell (2007) that the increase in body temperature that occurs with vigorous exercise can stimulate neurological changes that are associated with improved mood. It also may be based on the reason quoted by Anita Clark (2005) that although many external sources can influence mood and affect, for example, the weather and exercise, unlike emotions, moods are strongly influenced by endogenous circadian rhythms. These rhythms have been shown to have a much stronger relationship to positive mood than negative mood with positive moods varying closely with changes in body temperature and sleep wake cycle.

The Simple Effect test followed by the Scheffe's post hoc test clearly indicates that the differences in TMD of men volleyball players between selected different times of the day are significant except between 10:00 hours and 22:00 hours and 14:00 hours and 22:00 hours of the day. The mean TMD of men volleyball players is significantly higher at 02:00 hours (113.26) than at 18:00 hours (101.37) with the difference of 11.89 (11.73%).

The differences in TMD of women volleyball players between selected different times of the day are significant except between means between 06:00 hours and 22:00 hours, 10:00 hours and 22:00 hours and 14:00 hours and 18:00 hours of the day. The mean TMD of women volleyball players is significantly higher at 02:00 hours (121.45) than at 18:00 hours (107.41) with the difference of 14.04 (13.07%).

The amount of variation between peak and trough values of TMD of men volleyball players is (11.73%) lower than that of women volleyball players (13.07%).

Cosinor analysis shows that TMD does confirm an insignificant circadian rhythm for the samples of men volleyball players whereas statistically significant circadian rhythm is noted for women volleyball players. Men volleyball players have lower percentage rhythm in TMD (82.54) than women volleyball players (89.10). The rhythm amplitude of the men volleyball players is higher (4.74) than that of women volleyball players (6.09). This result supports the earlier findings of Jim Reeves

Silent Night (2003) who found out that there is an insignificant circadian rhythm in profile of mood state for the samples of trained males whereas statistically significant circadian rhythm in profile of mood state is noted for untrained males. Trained male have lower percentage rhythm in profile of mood state than untrained male. The rhythm amplitude of trained male is lower than untrained male.

Men and women volleyball players have their peak in TMD at 4:53 hours and 3:53 hours respectively which are a little bit later phases than body temperature phases. The result may be due to the variation of body temperature. This result supports the earlier findings of Von Zerssen, et al., (1987) who have noted that the mood scales reach their circadian maxima in the middle of the night around the time when sleep is interrupted to take measurements. This result supports the earlier findings of Thomas Reilly, et al., (2007) who have stated that the results indicate football players perform at an optimum between 16:00 and 20:00 h when not only football-specific skills but also measures of physical performance are at their peak. Body temperature peaks at a similar time, but positive mood states seem to peak slightly earlier. The result supports the notion of Michelle Warren, et al., (2000) that the alertness and positive mood states peak in the walking hours, usually in the afternoon, conversely, mood disturbance is the lowest in the afternoon and early evening. Anita Clark (2005) have reported that these rhythms have been shown to have a much stronger relationship to positive moods than to negative moods with positive moods varying closely with changes in body temperature and sleep wake cycle. Ruth Craven and Constance Hirnle (2006) have reported that body temperature normally fluctuates throughout the day. Temperature is usually the lowest around 03:00 hours.

The hypotheses were tested based on the result of the study and discussed in the following way.

1. The first hypothesis was that there may be a significant difference on total mood disturbance between men and women volleyball players irrespective of different times of the day.

The present study shows significant difference between men and women volleyball players in total mood disturbance irrespective of different times of the day. Hence, the first hypothesis of the researcher is accepted.

2. The second hypothesis was that there may be a significant difference on total mood disturbance between different times of the day irrespective of gender status.

The present study reveals that significant difference between different times of the day exists in total mood disturbance irrespective of gender status. Hence, the second hypothesis of the researcher is accepted.

3. The third hypothesis was that there may be a significant difference on total mood disturbance for men and women volleyball players on different times of the day.

The present study shows significant difference among men and women volleyball players on different times of the day in total mood disturbance. Hence, the third hypothesis of the researcher is accepted.

4. The fourth hypothesis was that there may be a significant circadian rhythmicity in total mood disturbance of men and women volleyball players.

The present study reveals that insignificant circadian rhythmicity exists in total mood disturbance for men volleyball players and significant circadian rhythmicity exists in total mood disturbance for women volleyball players. Hence, the fourth hypothesis of the researcher is partially accepted.

CONCLUSION

In the present study, it is concluded on total mood disturbance that there was significant difference between genders, significant difference at different times of the day irrespective of gender status, significant difference for men and women volleyball players at different times of the

day. Significant circadian rhythmicity exists for women volleyball players and insignificant circadian rhythmicity exists for men volleyball players. Hence, it is recommended to the coaches, trainers and physical educators to adopt the findings of this study while planning to improve sports skills for the players and athletes.

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