

EFFECT OF GENDER DIFFERENCE AND CIRCADIAN RHYTHM ON DIASTOLIC BLOOD PRESSURE FOR 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 diastolic blood pressure for volleyball players. **METHODS:** 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 diastolic blood pressure 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 diastolic blood pressure by using Erkameter during the academic year of 2009 – 2010. Collected data were subjected to statistical analysis by using two-way factorial (2 x 6) Analysis of Variance (ANOVA) and Cosinor analysis. **RESULTS:** There was insignificant difference between genders, significant difference at different times of the day and insignificant circadian rhythmicity exists on diastolic blood pressure for women and significant for men. **CONCLUSION:** 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 – Gender; Circadian Rhythm; Volleyball; Erkameter and Diastolic blood pressure

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INTRODUCTION

All forms of life on earth, including human bodies, respond rhythmically to the regular cycles of the sun, moon, and seasons. For example, as night turns into day, vital body functions, including heart rate and blood pressure, speed up in anticipation of increased physical activity. These and other predictable fluctuations in body function, taking place during specific time cycles, are biologic rhythms or circadian rhythms. They are regulated by "biologic clock" mechanisms located in the brain.

Blood pressure or arterial pressure determines the force exerted on the arteries as blood is distributed throughout the body. Blood pressure does not stay constant throughout the day or throughout one's life and changes with accordance to an individual's daily activities, eating habits, medical health, and emotional condition. An average blood pressure reading is 120/80 mmHg and is read 120 over 80. The systolic pressure of 120 symbolizes the maximum pressure exerted on the arteries when the heart beats and the diastolic blood pressure of 80 symbolizes the pressure in the arteries when the heart is at rest.

Sports scientists have found that biologic rhythms can affect physical, physiological, psychological and bio chemical variables of players and athletes so that their performance may be varied. Gender difference also plays a vital role in sports and games field. Now the investigator is trying to discover how the gender difference and circadian rhythms of life affect the diastolic blood pressure of volleyball players.

Statement of the Problem

The purpose of the study was to analyze the effect of gender difference and circadian rhythm on diastolic blood pressure of men and women volleyball players.

Hypotheses

1. There may be a significant difference on diastolic blood pressure between men and women volleyball players irrespective of different times of the day.
2. There may be a significant difference on diastolic blood pressure between different times of the day irrespective of gender status.

3. There may be a significant difference on diastolic blood pressure for men and women volleyball players on different times of the day.

4. There may be a significant circadian rhythmicity in diastolic blood pressure of men and women volleyball players.

METHODOLOGY

The purpose of the present study was to find out the effect of gender difference and circadian rhythm on diastolic blood pressure of volleyball players. To achieve the purpose of the study, a total of thirty volleyball players [men (n = 15) and women (n = 15)] aged between 19 years and 22 years from Einstein College of Engineering, Tamil Nadu, India were selected as subjects during the academic year of 2009 - 2010. 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.

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. Diastolic blood pressure was selected as dependent variable for this study. The data on diastolic blood pressure were collected by using Erkameter 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). 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 diastolic blood pressure. Three "F" ratios were computed, one for rows to assess the gender status on dependent variable of diastolic blood pressure and the second F-ratio was calculated for columns to assess the circadian variations on the dependent variable of diastolic blood pressure.

The third F-ratio was calculated for gender status and different times of the day.

If the obtained F-ratios 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. Then, Scheffe's test was used as a test of significant

difference between each cell and .05 level of significance was fixed to test the hypotheses. 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 diastolic blood pressure in men and women volleyball players. Circadian rhythm was considered statistically significant when $P \leq .05$.

ANALYSIS AND INTERPRETATIONS

The mean and standard deviation of diastolic blood pressure of men and women

volleyball players at six different times of the day are presented in Table I.

Table I: Mean And Standard Deviation Of Diastolic Blood Pressure Of Men And Women Volleyball Players At Six Different Times Of The Day

Status	Mean \pm Standard Deviation						Mx
	Times of the day						
	02:00	06:00	10:00	14:00	18:00	22:00	
Men	78.53 \pm 1.83	78.87 \pm 1.81	79.00 \pm 0.93	80.00 \pm 1.69	80.60 \pm 2.11	80.00 \pm 1.51	79.50
Women	77.47 \pm 2.33	78.67 \pm 1.95	78.93 \pm 1.83	79.67 \pm 0.72	80.27 \pm 2.25	79.47 \pm 1.41	79.08
My	78.00	78.77	78.97	79.84	80.44	79.74	

Diastolic Pressure is expressed in mm.Hg

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 diastolic blood pressure are graphically represented in figure I.

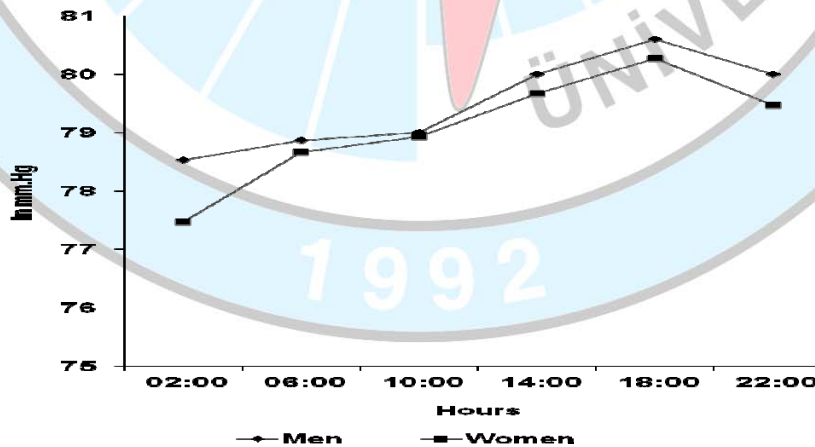


Figure I :Mean Scores Of Diastolic Blood Pressure Of Male And Female At Different Times Of The Day

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

Table II: Two Factor Anova With Repeated Measures On The Second Factor On Diastolic Blood Pressure Of Men And Women Volleyball Players At Different Times Of The Day

Source of Variance	Sum of Squares	df	Mean of squares	F-ratio
Men and Women (Gender)	14.45	1	14.45	3.56
Error I	113.58	28	4.06	
Different times of the day (Time)	101.76	5	20.35	7.05*
Interaction (Gender & Time)	20.12	5	4.02	1.39
Error II	404.29	140	2.89	

*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- ratio for factor – A (Gender Status - Men and Women volleyball players) is 3.56 and it is insignificant at .05 level of confidence as the required table value for significance is 4.20 (df 1 and 28). The 'F' ratio for Factor – B (different times of the day) is 7.05 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-ratio for Factor – A X B (Gender status x different times of the day) is 1.39 and it is insignificant at .05 level of confidence as the required table value for significance is 2.28 (df 5 and 140). Since the obtained F-ratio for men and women volleyball players is insignificant, it is concluded that there is

an insignificant difference in diastolic blood pressure between men and women volleyball players. The diastolic blood pressure of men volleyball players (79.50mm.Hg) is lower than that of the women volleyball players (79.08mm.Hg). Men volleyball players have 0.42mm.Hg (0.53 %) higher diastolic blood pressure than the women volleyball players. The F-ratio obtained for six different times of the day is significant. It is therefore concluded that there is a significant difference in diastolic blood pressure among six different times of the day. The difference between times of the day in diastolic blood pressure is presented in Table III.

Table III: Scheffe's Test For Difference Between The Paired Means Of Diastolic Blood Pressure 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	
78.00	78.77					0.77
78.00		78.97				0.97
78.00			79.84			1.84*
78.00				80.44		2.44*
78.00					79.74	1.74*
	78.77	78.97				0.20
	78.77		79.84			1.07
	78.77			80.44		1.67*
	78.77				79.74	0.97
		78.97	79.84			0.87
		78.97		80.44		1.47
		78.97			79.74	0.90
			79.84	80.44		0.60
			79.84		79.74	0.03
				80.44	79.74	0.57

*Significant at .05 level of confidence.

(Confidence interval value required for significance at .05 level is 1.48)

The results of the study clearly indicate that the diastolic blood pressure differs as the time of the day varies. And this difference in diastolic blood pressure is found to be significant in four paired means out of compared 15 paired means. However, insignificant increase in diastolic blood pressure is noted in 11 paired means between 02.00 hours and 06:00 hours, 02.00 hours and 10.00 hours, 06.00 hours and 10.00 hours, 06.00 hours and 14.00 hours, 06.00 hours and 22.00 hours, 10.00 hours and 14.00 hours, 10.00 hours and 18.00 hours, 10.00 hours and 22.00 hours, 14.00 hours and 18.00 hours, 14.00 hours and 22.00 hours and 18.00 hours and 22:00 hours of the day.

The difference in diastolic blood pressure between 02.00 hours and 06:00 hours, 02.00 hours and 10.00 hours, 06.00 hours and 10.00 hours, 06.00 hours and 14.00 hours, 06.00 hours and 22.00 hours, 10.00 hours and 14.00 hours,

Table IV: Cosinor Analysis Of Circadian Rhythmicity Of Diastolic Blood Pressure Of Men And Women Volleyball Players

Category	Percent Rhythm	Probability Level	Mesor± S.E	Acrophase± S.E	Amplitude±S.E	% Amplitude of Mesor
Men	87.08	0.046	79.50± 0.122	17:47 hours ± 10:59 min	0.78± 0.173	0.98
Women	85.15	0.057	79.08± 0.223	18:33 hours ± 55:25 min	1.31± 0.316	1.66

The results of the cosinor analysis confirm the existence of insignificant circadian rhythm in diastolic blood pressure for women volleyball players (85.15%) ($P > .05$) and significant circadian rhythm in diastolic blood pressure for men volleyball players (87.08%) ($P \leq .05$). The amplitude of the rhythm in women and men volleyball players is 1.31 and 0.78

RESULTS

From the analysis of the data, the following results are drawn.

1. Diastolic blood pressure showed no significant variation between men and women volleyball players.
2. There was a significant difference for volleyball players on different times of the day in diastolic blood pressure irrespective of gender status.
3. There was an insignificant difference for men and women volleyball players separately on

10.00 hours and 18.00 hours, 10.00 hours and 22.00 hours, 14.00 hours and 18.00 hours, 14.00 hours and 22.00 hours and 18.00 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 diastolic blood pressure variation depends on the times of the day.

The insignificant difference obtained in the interaction indicates that the difference in diastolic blood pressure may not vary for men and women volleyball players and also among different times of the day. Hence the simple effect test has not been used for further analysis.

Circadian rhythmicity of diastolic blood pressure 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 IV.

respectively. The time of peak performance (acrophase) in diastolic blood pressure for women and men volleyball players is calculated by means of cosinor analysis to be 18:33 hours and 17:47 hours respectively. The mesor value (mean) for women and men volleyball players is 79.02mm.Hg and 79.59mm.Hg respectively.

different times of the day in diastolic blood pressure.

4. There was a significant circadian rhythmicity in diastolic blood pressure for men volleyball players and no significant circadian rhythmicity in diastolic blood pressure for women volleyball players.
5. The peak time for diastolic blood pressure for both men and women volleyball players were same during the evening time.
6. It was found that men volleyball players show high value than women volleyball players in diastolic blood pressure.

7. It was found that the trough value among different times of the day of both men and women volleyball players in diastolic blood pressure are 02:00 hours.

DISCUSSION ON FINDINGS

The findings of the study show that there is an insignificant difference in diastolic blood pressure between men and women volleyball players. Women volleyball players have lower diastolic blood pressure (79.02 mmHg) than men volleyball players (79.59 mmHg) which makes the difference of 0.57 mmHg (0.72%).

This result supports the earlier findings of Jindrinc spinar, et al., (2009) who have found out that diastolic pressure is approximately 80 mmHg for both sexes. This result also supports the earlier findings of Patricia Landazuri, et al., (2008) who proved that although boys has a diastolic blood pressure (DBP) 1.3mmHg lower than girls, this difference is not significant. The result of women volleyball players has less diastolic blood pressure than men volleyball players supports the notion of William Ganong (2005) who noted that diastolic and diastolic blood pressures are lower in young women than in young men until age 55 – 65, after which they become comparable. It also supports the notion of Theresa Overfield (1995) that men have higher diastolic pressures than women from 18 through 64 years of age, but at about 65 years, diastolic pressures do not differ between the sexes. No guidance is found in the literature regarding the reasons for women having less diastolic blood pressure than men.

The study also reveals that there is a significant difference in mean diastolic blood pressure among different times of the day irrespective of gender status. The mean Diastolic blood pressure is significantly higher at 18:00 hours (80.40 mmHg) than 02:00 hours (78.07 mmHg) with the difference of 2.33 mmHg (2.98%).

The result supports the earlier findings of Rob de Vries, et al., (2006) who have proved that significant time of the day differences are found both at rest and during peak exercise for heart rate, diastolic blood pressure, and diastolic blood pressure. The result supports the earlier findings of Joel Belmin, et al., (2000) who have found out that peak value of diastolic blood pressure on different times of the day occurs at 5 – 6 pm. The trough and peak value of diastolic blood pressure on different times of the day are supported by the notion of Frank Chervenak and Asim Kurjak (1996) that generally, blood pressure rises in the

early morning, reaches the first peak in midmorning, and has a second peak in early evening and after that it falls progressively. The lowest blood pressure values occur between 0:00 hours and 04:00 hours. David Culver, Gabriel Khan and William White (2006) also reported that marked variability in blood pressure is normal. It varies from minute to minute and from day to day like the waves of the sea, fluctuating with force of the prevailing winds. Blood pressure is different at night, during sleep, and the early morning, fluctuating considerably during the day. Day time blood pressure is mainly determined by the degree of physical and mental activity and is under the control of baroreflexes that operate through adjustments in heart rate and peripheral vascular resistance. The usual fall in blood pressure at night is a result of sleep and inactivity rather than during the day. Blood pressure may fall 10–20 mmHg during sleep as the baroreflex sensitivity decreases sympathetic nervous activity.

The study also reveals that there is an insignificant difference in mean diastolic blood pressure between different times of the day and gender status.

Cosinor analysis shows that diastolic blood pressure does confirm a circadian rhythm for both the samples of men and women volleyball players but women are statistically insignificant and men are statistically significant. Even if there is either statistically insignificant or significant circadian rhythm in diastolic blood pressure, there is a quantity of circadian rhythm. This result partially supports the earlier findings of Kanabrocki, et al., (2008) who proved that significant circadian variations in diastolic blood pressure and diastolic blood pressure of male are evident with peak levels, on average, occurring in the evening hours. This result also partially replicates the earlier works of Driziene, et al., (2008) who noted that the gender-specific circadian blood pressure rhythm pattern demonstrates in both gender groups. This result also partially replicates the earlier works of Ramon Hermida, et al., (2001) who have stated that the circadian double (heart rate and blood pressure) amplitude of the rhythm is statistically significantly greater in men than that of women.

Men volleyball players have higher percentage rhythm in diastolic blood pressure (87.08) than women volleyball players (85.15). The rhythm amplitude of women volleyball players is higher (1.31) than that of men volleyball players (0.78). Men and women volleyball players have their peak diastolic blood pressure at 17:47 hours and 18:33

hours respectively which are a little bit earlier phases than body temperature phases.

This result supports the earlier findings of Kanabrocki, et al., (2008) who have found out that peak value of circadian variations in diastolic blood pressure occurs in the evening hours. The result also supports the earlier findings of Joel Belmin, et al., (2000) who have proved that peak value of diastolic blood pressure on different times of the day occurs at 5–6 pm. This result supports the notion of Frank Chervenak, et al., (1996) that generally, blood pressure rises in the early morning (06:00 hours), reaches the first peak in midmorning (10:00 hours), and has a second peak in early evening (18:00 hours) and after that it falls progressively. The lowest blood pressure values occur between 0:00 hours and 04:00 hours. This result may be due to the circadian rhythm of body temperature and resting heart rate which are showed peak at evening (18:00 hours). The result may be based on the notion of David Culver, et al., (2006) that marked variability in normal blood pressure. It varies from minute to minute and from day to day like the waves of the sea, fluctuating with force of the prevailing winds. Blood pressure is different at night, during sleep, and the early morning, fluctuating considerably during the day. Day - time blood pressure is mainly determined by the degree of physical and mental activity and is under the control of baroreflexes that operate through adjustments in heart rate and peripheral vascular resistance. The usual fall in blood pressure at night is a result of sleep and inactivity rather than at the time of the day. Blood pressure may fall 10 – 20 mmHg during sleep as the baroreflex sensitivity decreases sympathetic nervous activity.

DISCUSSION ON HYPOTHESES

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

The present study shows insignificant difference between men and women volleyball players in diastolic blood pressure irrespective of different

times of the day. Hence, the first hypothesis of the researcher is rejected.

2. The second hypothesis was that there may be a significant difference on diastolic blood pressure 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 diastolic blood pressure 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 diastolic blood pressure for men and women volleyball players on different times of the day.

The present study shows insignificant difference among men and women volleyball players on different times of the day in diastolic blood pressure. Hence, the third hypothesis of the researcher is rejected.

4. The fourth hypothesis was that there may be a significant circadian rhythmicity in diastolic blood pressure of men and women volleyball players.

The present study reveals that significant circadian rhythmicity exists in diastolic blood pressure for men volleyball players and insignificant circadian rhythmicity exists in diastolic blood pressure for women volleyball players. Hence, the fourth hypothesis of the researcher is accepted except for women volleyball players.

CONCLUSION AND RECOMMENDATIONS

In the present study, it is concluded that there is an insignificant difference between genders on diastolic blood pressure, significant difference at different times of the day irrespective of gender status and significant circadian rhythmicity exists on diastolic blood pressure for men volleyball players and insignificant circadian rhythmicity exists on diastolic blood pressure for women 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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