



## EFFECT OF CIRCADIAN OSCILLATION DURING FOOD DEPRIVATION ON HEART RATE IN OBESE MEN

**Dr. K. V. Balamurugan**

Associate Professor, Department of Physical Education & Sports Science, Annamalai University, Chidambaram, Tamilnadu

**Cite This Article:** Dr. K. V. Balamurugan, "Effect of Circadian Oscillation during Food Deprivation on Heart Rate in Obese Men", International Journal of Computational Research and Development, Volume 2, Issue 2, Page Number 144-149, 2017.

### Abstract:

The purpose of the study was to find out the effect of circadian oscillation during food deprivation on heart rate among obese men. To achieve the purpose of the present study, sixty obese men from Islamiah College, Vaniyambadi, Tamilnadu, India were selected as subjects at random and their ages ranged from 18 to 25 years. The subjects were divided into four equal groups of fifteen subjects each. Group I acted as Experimental Group I (Food Deprivation Training), Group II acted as Experimental Group II (Physical training), Group III acted as Experimental Group III (Food Deprivation & Physical training) and Group IV acted as Control Group. The requirement of the experiment procedures, testing as well as training schedule was explained to the subjects so as to get full co-operation of the effort required on their part and prior to the administration of the study. Heart rate was assessed by using stethoscope. Experimental Group I was exposed to food deprivation training, Experimental Group II was exposed to physical training, Experimental Group III was exposed to food deprivation & physical training and Control Group was not exposed to any experimental training other than their regular daily activities. The duration of experimental period was 120 days. After the experimental treatment, all the sixty subjects were tested on heart rate. This final test scores formed as post test scores of the subjects. The pre test and post test scores were subjected to statistical analysis using Analysis of Covariance (ANCOVA) to find out the significance among the mean differences, whenever the 'F' ratio for adjusted test was found to be significant, Scheffe's post hoc test was used. In all cases 0.05 level of significance was fixed to test hypotheses. The findings of the study showed that the combined food deprivation and physical training group showed changes in heart rate than the other experimental and control groups.

**Key Words:** Circadian Rhythm, Obese, Men & Heart Rate

### Introduction:

The natural pattern of physiological and behavioral processes that are timed to a near 24-hour period. These processes include sleep-wake cycles, body temperature, blood pressure, and the release of hormones. This activity is controlled by the biological clock, which is located in the suprachiasmatic nuclei of the hypothalamus in human brains. It is highly influenced by natural dark-light cycles, but will persist under constant environmental conditions (Boudrea et al. 2008).

Revolution of the earth on its own axis gives rise to the spectacular and the most predictable geophysical phenomenon – the day and night. The rotation of the earth around the sun generates splendid and recurring seasonal cycles. The more complex movement of the moon in relation to the earth and the sun gives rise to the lunar month and to the tidal cycle (Saunders, 1977; Pati, 2001). The planet earth is rhythmic. All living organisms – microbes, plants, animals and human, on this planet have been evolved to maximize their chances of survival by integrating rhythms in various processes of biological organization at different levels, such as cells, tissues, organs, organ system and whole body. These rhythms are called biological rhythms.

### Methodology:

The purpose of the study was to find out the effect of circadian oscillation during food deprivation on heart rate among obese men. To achieve the purpose of the present study, sixty obese men from Islamiah College, Vaniyambadi, Tamilnadu, India were selected as subjects at random and their ages ranged from 18 to 25 years. The subjects were divided into four equal groups of fifteen subjects each. Group I acted as Experimental Group I (Food Deprivation Training), Group II acted as Experimental Group II (Physical training), Group III acted as Experimental Group III (Food Deprivation & Physical training) and Group IV acted as Control Group. The requirement of the experiment procedures, testing as well as training schedule was explained to the subjects so as to get full co-operation of the effort required on their part and prior to the administration of the study. Heart rate was assessed by using stethoscope. Experimental Group I was exposed to food deprivation training, Experimental Group II was exposed to physical training, Experimental Group III was exposed to food deprivation & physical training and Control Group was not exposed to any experimental training other than their regular daily activities. The duration of experimental period was 120 days. After the experimental treatment, all the sixty subjects were tested on heart rate. This final test scores formed as post test scores of the subjects. The pre test and post test scores were subjected to statistical analysis using Analysis of Covariance (ANCOVA) to find out the significance among the mean differences, whenever the 'F' ratio for adjusted test was found to be significant, Scheffe's post hoc test was used. In all cases 0.05 level of significance was fixed to test hypotheses.

**Results:**

Table 1: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Heart Rate at 6.00am

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	74.06	74.00	73.93	74.26	BG	0.93	3	0.31	0.06
					WG	286.80	56	5.12	
Post-Test Means	71.46	71.13	70.20	74.00	BG	118.73	3	39.57	3.33*
					WG	663.86	56	11.85	
Adjusted Post-Test Means	71.46	71.11	70.16	74.04	BG	123.37	3	41.12	3.49*
					WG	647.61	55	11.77	

**Results of Heart Rate at 6.00 am:**

Table – I reveals that the indicated that the obtained ‘F’-ratio for the pre-test means among the groups on heart rate were 74.06 for experimental group – I, 74.00 for experimental group - II, 73.93 for experimental group - III and 74.26 for control group. The obtained ‘F’-ratio 0.06 was lesser than the table ‘F’-ratio 2.76. Hence the pre-test mean ‘F’-ratio was insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post-test means were 71.46 for experimental group – I, 71.13 for experimental group – II, 70.20 for experimental group - III and 74.00 for control group. The obtained ‘F’-ratio 3.33 was higher than the table ‘F’-ratio 2.76. Hence the post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 56. The adjusted post-test means were 71.46 for experimental group – I, 71.11 for experimental group – II, 70.16 for experimental group - III and 74.04 for control group. The obtained ‘F’-ratio 3.49 was higher than the table ‘F’-ratio 2.77. Hence the adjusted post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 55.

The analysis of covariance of food deprivation, physical training combined food deprivation and physical training and control group was concluded that the pre test, post and adjusted post test was significantly varied on food deprivation group on speed at 6.00 am in obese men.

Table 2: The Scheffe’s Test for the Differences between the Adjusted Post Test Means on Heart Rate at 6.00am

Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
71.46	71.11	---	---	0.35	3.61
71.46	---	70.16	---	1.30*	
71.46	---	---	74.04	2.58*	
---	71.11	70.16	---	0.95*	
---	71.11	---	74.04	2.93*	
---	---	70.16	74.04	3.88*	
---	---	---	---	---	

\* Significant at 0.05 level of confidence

Table II shows the post hoc analysis obtained on adjusted post test means. The mean difference required for the confidential interval to be significant was 3.61. It was observed that the combined food deprivation and physical activity group significantly decreased heart rate better than the food deprivation, physical activity and control group. The physical activity group significantly decreased heart rate better than the control group. The food deprivation group significantly decreased heart rate better than the control group.

The pre, post and adjusted means on heart rate were presented through bar diagram for better understanding of the results of this study in Figure-I.

Figure 1: Pre Post and Adjusted Post Test Differences of the Experimental and Control Groups on Heart Rate at 6.00am

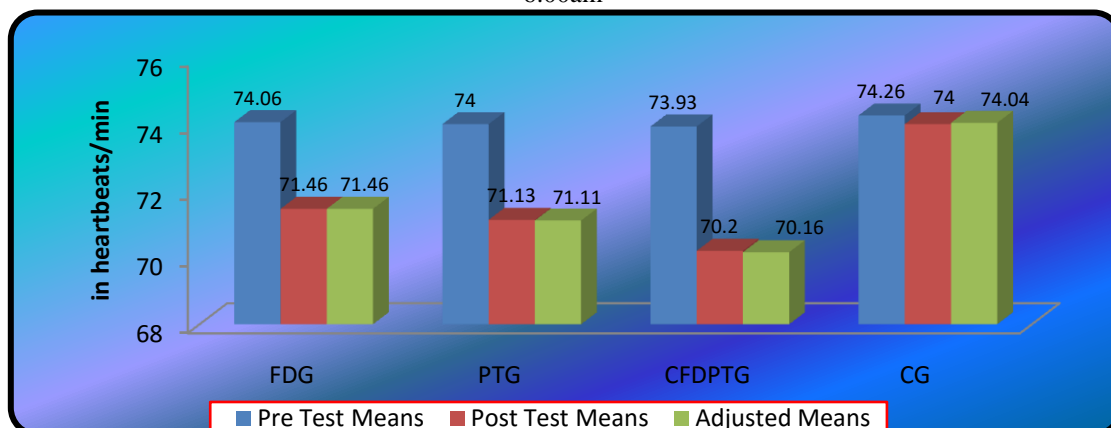


Table 3: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Heart Rate at 8.00am

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	78.13	78.06	77.33	77.66	BG	6.26	3	2.08	0.20
					WG	563.33	56	10.06	
Post-Test Means	74.13	74.20	74.33	75.00	BG	109.20	3	36.40	2.94*
					WG	692.80	56	12.37	
Adjusted Post-Test Means	74.12	74.19	74.34	77.33	BG	109.30	3	36.43	2.89*
					WG	692.69	55	12.59	

**Results of Heart Rate 8.00 am:**

Table – III reveals that the indicated that the obtained ‘F’-ratio for the pre-test means among the groups on heart rate were 78.13 for experimental group – I, 78.06 for experimental group - II, 77.33 for experimental group - III and 77.66 for control group. The obtained ‘F’-ratio 0.20 was lesser than the table ‘F’-ratio 2.76. Hence the pre-test mean ‘F’-ratio was insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post-test means were 74.13 for experimental group – I, 74.20 for experimental group – II, 74.33 for experimental group - III and 75.00 for control group. The obtained ‘F’-ratio 2.94 was greater than the table ‘F’-ratio 2.76. Hence the post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 56. The adjusted post-test means were 74.12 for experimental group – I, 74.16 for experimental group – II, 74.34 for experimental group - III and 77.33 for control group. The obtained ‘F’-ratio 2.89 was greater than the table ‘F’-ratio 2.77. Hence the adjusted post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 55.

The analysis of covariance of food deprivation, physical training combined food deprivation and physical training and control group was concluded that the pre test, post and adjusted post test was significantly varied on food deprivation group on speed at 8.00 am in obese men.

Table 4: The Scheffe’s Test for the Differences between the Adjusted Post Test Means on Heart Rate at 8.00am

Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
74.12	74.19	---	---	0.07	2.73
74.12	---	74.34	---	0.22	
74.12	---	---	77.33	3.21*	
---	74.19	74.34	---	0.15	
---	74.19	---	77.33	3.14*	
---	---	74.34	77.33	2.99*	
---	---	---	---	---	

\* Significant at 0.05 level of confidence

Table IV shows the post hoc analysis obtained on adjusted post test means. The mean difference required for the confidential interval to be significant was 2.73. It was observed that the combined food deprivation and physical activity group significantly decreased heart rate better than the control group. The physical activity group significantly decreased heart rate better than the control group. The food deprivation group significantly decreased heart rate better than the control group.

The pre, post and adjusted means on heart rate were presented through bar diagram for better understanding of the results of this study in Figure-II.

Figure 2: Pre Post and Adjusted Post Test Differences of the Experimental and Control Groups on Heart Rate at 8.00am

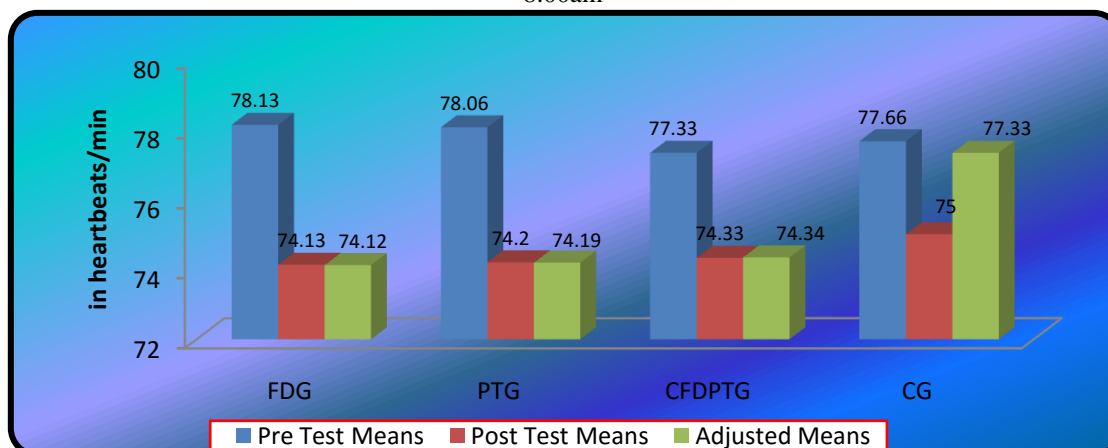


Table 5: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Heart Rate at 4.00pm

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	75.06	75.53	75.26	76.46	BG	17.25	3	5.75	0.96
					WG	335.33	56	5.98	
Post-Test Means	72.60	72.93	71.93	76.20	BG	162.71	3	54.23	7.09*
					WG	427.86	56	7.64	
Adjusted Post-Test Means	72.73	72.94	72.01	75.97	BG	131.62	3	43.87	5.95*
					WG	405.39	55	7.37	

**Results of Heart Rate 4.00 pm:**

Table – V reveals that the indicated that the obtained ‘F’-ratio for the pre-test means among the groups on heart rate were 75.06 for experimental group – I, 75.53 for experimental group - II, 75.26 for experimental group - III and 76.46 for control group. The obtained ‘F’-ratio 0.96 was lesser than the table ‘F’-ratio 2.76. Hence the pre-test mean ‘F’-ratio was insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post-test means were 72.60 for experimental group – I, 72.93 for experimental group – II, 71.93 for experimental group - III and 76.20 for control group. The obtained ‘F’-ratio 7.09 was higher than the table ‘F’-ratio 2.76. Hence the post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 56. The adjusted post-test means were 72.73 for experimental group – I, 72.94 for experimental group – II, 72.01 for experimental group - III and 75.97 for control group. The obtained ‘F’-ratio 5.95 was higher than the table ‘F’-ratio 2.77. Hence the adjusted post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 55.

The analysis of covariance of food deprivation, physical training combined food deprivation and physical training and control group was concluded that the pre test, post and adjusted post test was significantly varied on food deprivation group on speed at 4.00 pm in obese men.

Table 6: The Scheffe’s Test for the Differences between the Adjusted Post Test Means on Heart Rate at 4.00pm

Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
72.73	72.94	---	---	0.21	2.85
72.73	---	72.01	---	0.72	
72.73	---	---	75.97	3.24*	
---	72.94	72.01	---	0.93	
---	72.94	---	75.97	3.03*	
---	---	72.01	75.97	3.96*	
---	---	---	---	---	

\* Significant at 0.05 level of confidence

Table VI shows the post hoc analysis obtained on adjusted post test means. The mean difference required for the confidential interval to be significant was 2.85. It was observed that the combined food deprivation and physical activity group significantly decreased heart rate better than the control group. The physical activity group significantly decreased heart rate better than the control group. The food deprivation group significantly decreased heart rate better than the control group.

The pre, post and adjusted means on heart rate were presented through bar diagram for better understanding of the results of this study in Figure-III.

Figure 3: Pre Post and Adjusted Post Test Differences of the Experimental and Control Groups on Heart Rate at 4.00pm

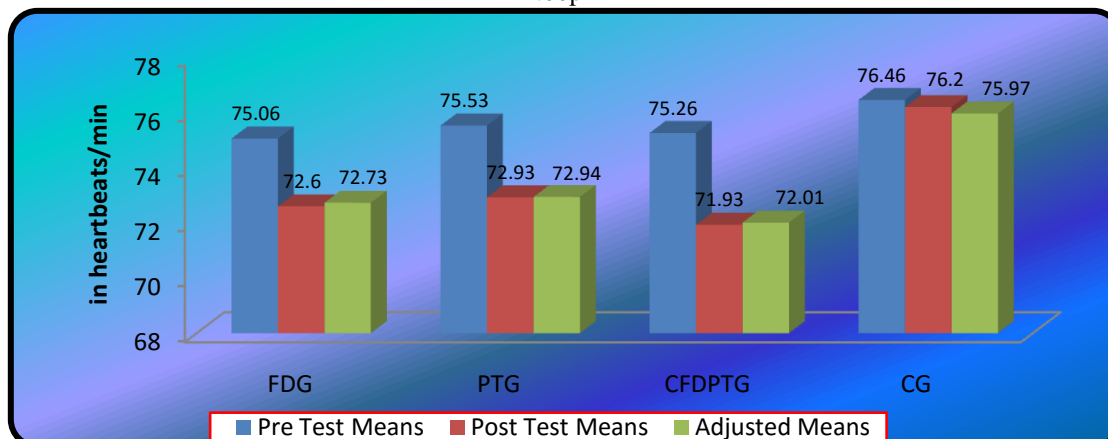


Table 7: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Heart Rate at 6.00pm

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	74.20	74.13	75.26	75.80	BG	30.18	3	10.06	1.15
					WG	487.46	56	8.70	
Post-Test Means	71.60	71.86	72.46	75.53	BG	148.13	3	49.37	7.11*
					WG	388.80	56	6.94	
Adjusted Post-Test Means	71.59	71.86	72.46	75.53	BG	142.13	3	47.37	6.70*
					WG	388.78	55	7.06	

**Results of Heart Rate 6.00 pm:**

Table – VII reveals that the indicated that the obtained ‘F’-ratio for the pre-test means among the groups on heart rate were 74.20 for experimental group – I, 74.13 for experimental group - II, 75.26 for experimental group - III and 75.80 for control group. The obtained ‘F’-ratio 1.15 was lesser than the table ‘F’-ratio 2.76. Hence the pre-test mean ‘F’-ratio was insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post-test means were 71.60 for experimental group – I, 71.86 for experimental group – II, 72.46 for experimental group - III and 75.53 for control group. The obtained ‘F’-ratio 7.11 was higher than the table ‘F’-ratio 2.76. Hence the post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 56. The adjusted post-test means were 71.59 for experimental group – I, 71.86 for experimental group – II, 72.46 for experimental group - III and 75.53 for control group. The obtained ‘F’-ratio 6.70 was higher than the table ‘F’-ratio 2.77. Hence the adjusted post-test mean ‘F’-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 55.

The analysis of covariance of food deprivation, physical training combined food deprivation and physical training and control group was concluded that the pre test, post and adjusted post test was significantly varied on food deprivation group on speed at 6.00 pm in obese men.

Table 8: The Scheffe’s Test for the Differences between the Adjusted Post Test Means on Heart Rate at 6.00pm

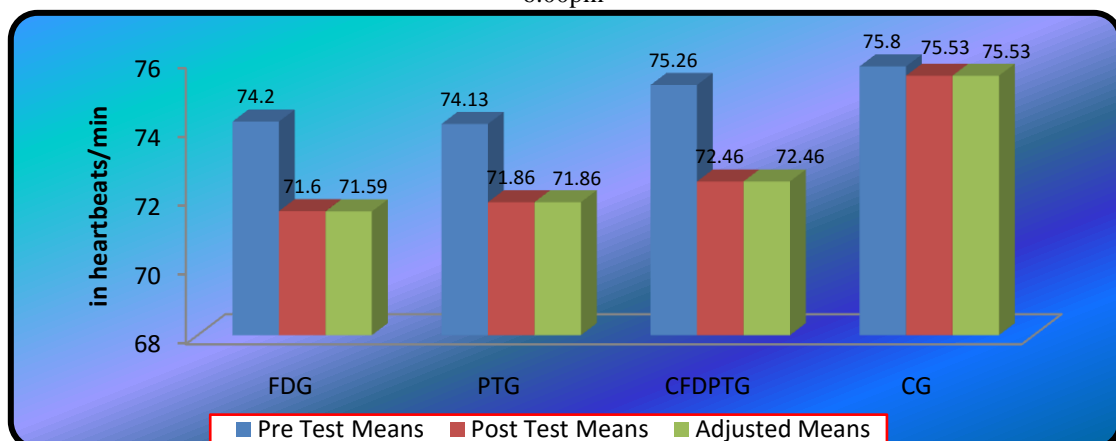
Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
71.59	71.86	---	---	0.27	2.79
71.59	---	72.46	---	0.87	
71.59	---	---	75.53	3.94*	
---	71.86	72.46	---	0.60	
---	71.86	---	75.53	3.67*	
---	---	72.46	75.53	3.07*	
---	---	---	---	---	

\* Significant at 0.05 level of confidence

Table LI shows the post hoc analysis obtained on adjusted post test means. The mean difference required for the confidential interval to be significant was 2.79. It was observed that the combined food deprivation and physical activity group significantly decreased heart rate better than the control group. The physical activity group significantly decreased heart rate better than the control group. The food deprivation group significantly decreased heart rate better than the control group.

The pre, post and adjusted means on heart rate were presented through bar diagram for better understanding of the results of this study in Figure-IV.

Figure 4: Pre Post and Adjusted Post Test Differences of the Experimental and Control Groups on Heart Rate at 6.00pm



**Conclusions:**

From the analysis of the data, the following conclusions were drawn:

- ✓ The findings of the study showed that there were significant changes in heart rate due to influence of food deprivation at 6.00 am, 8.00 am, 4.00 pm and 8.00 pm respectively.
- ✓ The findings of the study showed that there were significant changes in heart rate due to influence of physical training at 6.00 am, 8.00 am, 4.00 pm and 8.00 pm respectively.
- ✓ The findings of the study showed that there were significant changes in heart rate due to influence of combined food deprivation and physical training at 6.00 am, 8.00 am, 4.00 pm and 8.00 pm respectively.
- ✓ The findings of the study showed that the combined food deprivation and physical training group showed changes in heart rate than the other experimental and control groups.

**References:**

1. Boudreau, Shechter, Dittmar, Gehin, Delhomme, Nocua, Dumont and Boivin, "Cerebral temperature varies across circadian phases in humans", Conf Proc IEEE Eng Med Biol Soc., 2008; 2008: 4856-8.
2. Buijs R, Salgado R, Sabath E, Escobar C. (2013). Peripheral circadian oscillators: time and food. Prog Mol Biol Transl Sci. 2013; 119:83-103.
3. Challet E. (2013). Circadian clocks, food intake, and metabolism. Prog Mol Biol Transl Sci. 119:105-35.
4. Leonie van de Luit, Jan Van Der Meulen, Ton J. M. Cleophas and Aeilko H. Zwinderman, "Amplified amplitudes of circadian rhythms and nighttime hypotension in patients with chronic fatigue syndrome", Journal of Angiology, 1998; 49(11): 903-908.
5. Marcoen, N., Vandekerckhove, M., Neu, D., Pattyn, N. & Mairesse, O. (2015). Individual differences in subjective circadian flexibility. Chronobiol Int. 32(9):1246-53.
6. Smith RS, Efron B, Mah CD, Malhotra A. (2013). The impact of circadian misalignment on athletic performance in professional football players. Sleep. 2013 Dec 1; 36(12):1999-2001.
7. Theresa Over field, Biologic variation in health and illness: race, age, and sex differences. New York: CRC Press Publisher, 1995.
8. Thomas Reilly, Greg Atkinson, Ben Edwards, Jim Waterhouse, Kelly Farrelly and Emma Fairhurst, "Diurnal Variation in Temperature, Mental and Physical Performance, and Tasks Specifically Related to Football (Soccer)", Chronobiology International, 2007 May; 24 (3): 507 – 519.