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EFFECT OF CIRCADIAN OSCILLATION DURING FOOD DEPRIVATION ON STRENGTH ENDURANCE IN OBESE MEN

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Abstract:

The purpose of the study was to find out the effect of circadian oscillation during food deprivation on strength endurance 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. Strength endurance was assessed by 30 sec endurance jump test. 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 strength endurance. 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 strength endurance than the other experimental and control groups.

Key Words: Circadian Rhythm, Obese, Men & Strength Endurance

Introduction:

The earliest recorded account of a circadian process dates from the 4th century BC, when Androsthenes, a ship captain serving under Alexander the Great, described diurnal leaf movements of the tamarind tree. The observation of a circadian or diurnal process in humans is mentioned in Chinese medical texts dated to around the 13th century, that;

"*Noon and Midnight Manual* and the *Mnemonic Rhyme to Aid in the Selection of Acu-points According to the Diurnal Cycle, the Day of the Month and the Season of the Year"*.

The first recorded observation of an endogenous circadian oscillation was by the French scientist Jean-Jacques d'Ortous de Mairan in 1729. He noted that 24-hour patterns in the movement of the leaves of the plant Mimosa pudica continued even when the plants were kept in constant darkness, in the first experiment to attempt to distinguish an endogenous clock from responses to daily stimuli. In 1896, Patrick and Gilbert observed that during a prolonged period of sleep deprivation, sleepiness increases and decreases with a period of approximately 24 hours. In 1918, J.S. Szymanski showed that animals are capable of maintaining 24-hour activity patterns in the absence of external cues such as light and changes in temperature. In the early 20th century circadian rhythms were noticed in the rhythmic feeding times of bees. Extensive experiments were done by Auguste Forel, Ingeborg Beling, and Oskar Wahl to see if this rhythm was due to an endogenous clock. Ron Konopka and Seymour Benzer isolated the first clock mutant in Drosophila in the early 1970s and mapped the "period" gene, the first discovered genetic component of a circadian clock. Joseph Takahashi discovered the first mammalian 'clock gene' (CLOCK) using mice in 1994.

Methodology:

The purpose of the study was to find out the effect of circadian oscillation during food deprivation on strength endurance 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. Strength endurance was assessed by 30 sec endurance jump test. 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 strength endurance. 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 Strength Endurance at 6.00am

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	23.53	22.93	23.73	23.33	BG	5.25	3	1.75	1.38
					WG	70.93	56	1.26	
Post-Test Means	27.60	27.46	30.60	23.60	BG	370.45	3	123.48	23.16*
					WG	298.53	56	5.33	
Adjusted Post-Test Means	27.55	27.59	30.50	23.61	BG	355.42	3	118.47	22.25*
					WG	292.85	55	5.32	

BG- Between Group * - Significant

Results of Strength Endurance at 6.00 am:

Table – I reveals that the indicated that the obtained 'F'-ratio for the pre-test means among the groups on strength endurance were 23.53 for experimental group – I, 22.93 for experimental group - II, 23.73 for experimental group - III and 23.33 for control group. The obtained 'F'-ratio 1.38 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 27.60 for experimental group – I, 27.46 for experimental group – II, 30.60 for experimental group - III and 28.60 for control group. The obtained 'F'-ratio 23.16 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 27.55 for experimental group – I, 27.59 for experimental group – II, 30.50 for experimental group - III and 23.61 for control group. The obtained 'F'-ratio 22.25 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 Strength Endurance at 6.00am

Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
27.55	27.59	---	---	0.04	2.42
27.55	---	30.50	---	2.95*	
27.55	---	---	23.61	3.94*	
---	27.59	30.50	---	2.91*	
---	27.59	---	23.61	3.98*	
---	---	30.50	23.61	6.89*	

* 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 2.42. It was observed that the combined food deprivation and physical activity group significantly increased strength endurance better than the food deprivation, physical activity and control group. The physical activity group significantly increased strength endurance better than the control group. The food deprivation group significantly increased strength endurance better than the control group.

The pre, post and adjusted means on strength endurance 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 Strength Endurance at 6.00am

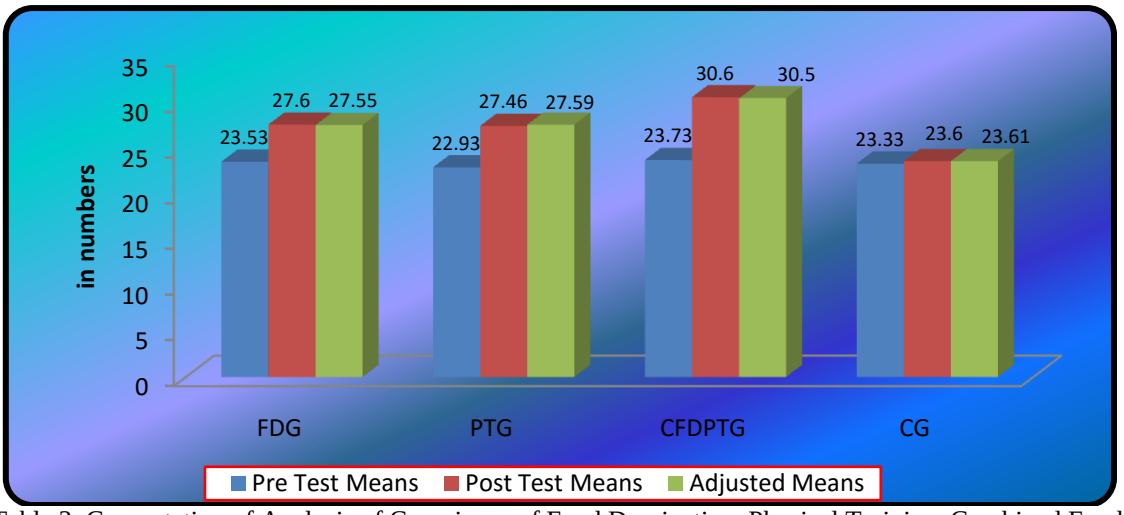


Table 3: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Strength Endurance at 8.00am

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	23.40	23.20	23.80	23.86	BG	4.60	3	1.53	1.53
					WG	56.13	56	1.00	
Post-Test Means	27.00	30.33	33.20	23.93	BG	727.51	3	242.50	59.91*
					WG	226.66	56	4.04	
Adjusted Post-Test Means	26.96	30.26	33.24	23.99	BG	722.25	3	240.75	58.93*
					WG	224.69	55	4.08	

Results of Strength Endurance 8.00 am:

Table – III reveals that the indicated that the obtained 'F'-ratio for the pre-test means among the groups on strength endurance were 23.40 for experimental group – I, 23.20 for experimental group - II, 23.80 for experimental group - III and 23.86 for control group. The obtained 'F'-ratio 1.53 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 27.00 for experimental group – I, 30.33 for experimental group – II, 33.24 for experimental group - III and 28.99 for control group. The obtained 'F'-ratio 59.91 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 26.96 for experimental group – I, 30.26 for experimental group – II, 33.24 for experimental group - III and 23.99 for control group. The obtained 'F'-ratio 58.93 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 Strength Endurance at 8.00am

Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
26.96	30.26	---	---	3.30*	2.12
26.96	---	33.24	---	6.28*	
26.96	---	---	23.99	2.97*	
---	30.26	33.24	---	2.98*	
---	30.26	---	23.99	6.27*	
---	---	33.24	23.99	9.25*	

* 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 2.12. It was observed that the combined food deprivation and physical activity group significantly increased strength endurance better than the food deprivation, physical activity and control group. The physical activity group significantly increased strength endurance better than the food deprivation group and control group. The food deprivation group significantly increased strength endurance better than the control group.

The pre, post and adjusted means on strength endurance 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 Strength Endurance at 8.00am

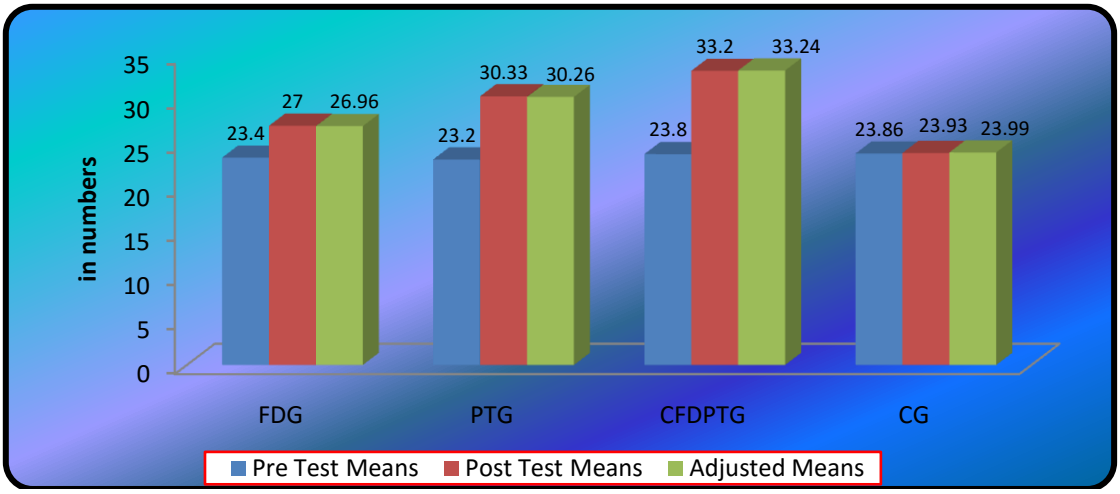


Table 5: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Strength Endurance at 4.00pm

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	23.33	23.13	23.46	23.26	BG	0.86	3	0.28	0.28
					WG	57.73	56	1.03	
Post-Test Means	28.53	28.66	33.26	23.33	BG	741.51	3	247.17	39.62*
					WG	349.33	56	6.23	
Adjusted Post-Test Means	28.52	28.71	33.22	23.34	BG	730.58	3	243.52	38.82*
					WG	345.00	55	6.27	

Results of Strength Endurance 4.00 pm:

Table – V reveals that the indicated that the obtained 'F'-ratio for the pre-test means among the groups on strength endurance were 23.33 for experimental group – I, 23.13 for experimental group - II, 23.46 for experimental group - III and 23.26 for control group. The obtained 'F'-ratio 0.28 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 28.53 for experimental group – I, 28.66 for experimental group – II, 33.26 for experimental group - III and 23.33 for control group. The obtained 'F'-ratio 39.62 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 28.52 for experimental group – I, 28.71 for experimental group – II, 33.22 for experimental group - III and 23.34 for control group. The obtained 'F'-ratio 38.82 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 Strength Endurance at 4.00pm

Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
28.52	28.71	---	---	0.19	2.63
28.52	---	33.22	---	4.70*	
28.52	---	---	23.34	5.18*	
---	28.71	33.22	---	4.51*	
---	28.71	---	23.34	5.37*	
---	---	33.22	23.34	9.88*	

* 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 2.63. It was observed that the combined food deprivation and physical activity group significantly increased strength endurance better than the food

deprivation group, physical activity group and control group. The physical activity group significantly increased strength endurance better than the control group. The food deprivation group significantly increased strength endurance better than the control group.

The pre, post and adjusted means on strength endurance 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 Strength Endurance at 4.00pm

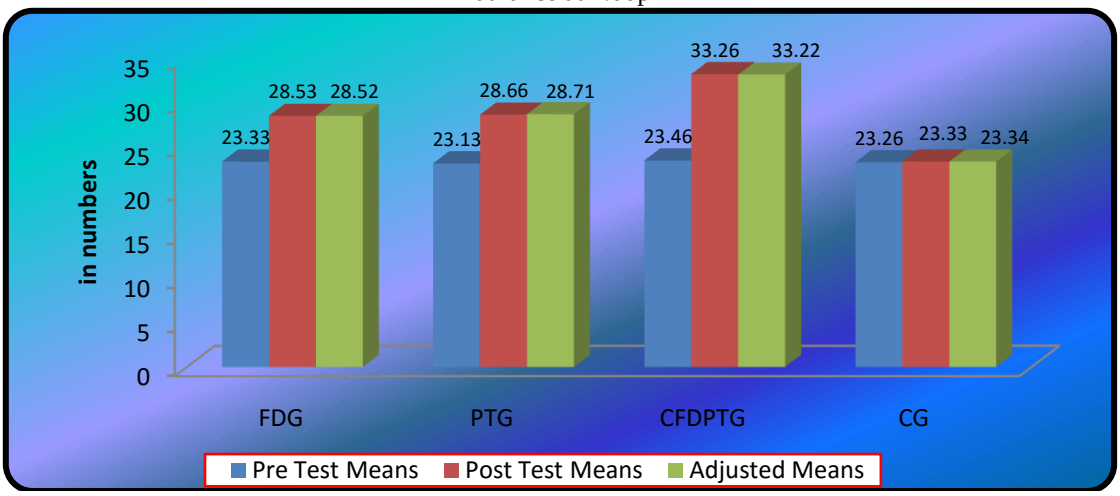


Table 7: Computation of Analysis of Covariance of Food Deprivation, Physical Training, Combined Food Deprivation and Physical Training and Control Groups on Strength Endurance at 6.00pm

	FDG	PTG	CFDPTG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	23.86	23.40	23.46	23.33	BG	2.58	3	0.86	0.92
					WG	52.40	56	0.93	
Post-Test Means	28.33	32.00	33.13	23.40	BG	865.51	3	288.50	75.26*
					WG	214.66	56	3.83	
Adjusted Post-Test Means	28.28	32.01	33.14	23.42	BG	864.34	3	288.11	74.21*
					WG	213.52	55	3.88	

Results of Strength Endurance 6.00 pm:

Table – VII reveals that the indicated that the obtained 'F'-ratio for the pre-test means among the groups on strength endurance were 23.86 for experimental group – I, 23.40 for experimental group - II, 23.46 for experimental group - III and 23.33 for control group. The obtained 'F'-ratio 0.92 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 28.33 for experimental group – I, 32.00 for experimental group – II, 33.13 for experimental group - III and 23.40 for control group. The obtained 'F'-ratio 75.26 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 28.28 for experimental group – I, 32.01 for experimental group – II, 33.14 for experimental group - III and 28.42 for control group. The obtained 'F'-ratio 74.21 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 Strength Endurance at 6.00 Pm

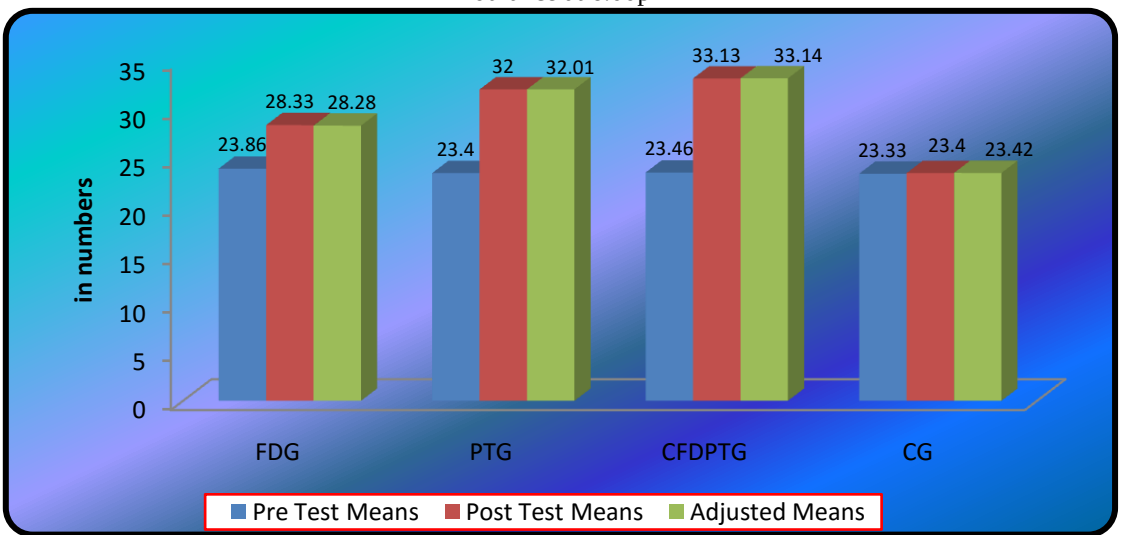
Adjusted Post-Test Means				Mean Difference	Confidence Interval
FDG	PTG	CFDPTG	CG		
28.28	32.01	---	---	3.73*	2.07
28.28	---	33.14	---	4.86*	
28.28	---	---	23.42	4.86*	
---	32.01	33.14	---	1.13*	
---	32.01	---	23.42	8.59*	
---	---	33.14	23.42	9.72*	

* Significant at 0.05 level of confidence

Table VIIII shows the post hoc analysis obtained on adjusted post test means. The mean difference required for the confidential interval to be significant was 2.07. It was observed that the combined food deprivation and physical activity group significantly increased strength endurance better than the food deprivation group, physical activity group and control group. The physical activity group significantly increased strength endurance better than the food deprivation group and control group. The food deprivation group significantly increased strength endurance better than the control group.

The pre, post and adjusted means on strength endurance 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 Strength Endurance 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 strength endurance 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 strength endurance 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 strength endurance 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 strength endurance than the other experimental and control groups.

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