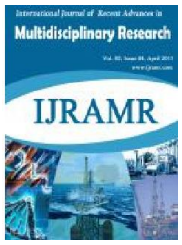

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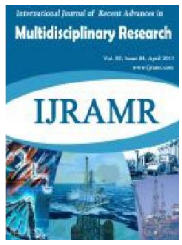

Research Article

PULSED LOW FREQUENCY MAGNETIC FIELD ON OBESE SUBJECTS

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ABSTRACT

Background: Obesity is a chronic disease characterized by excessive body fat that causes damage to the individual's health and is associated with comorbidities such as Diabetes mellitus, Hypertension and vascular dysfunction. Common traditional treatments utilized for obesity include medications, surgicalinterference, exercises and diet programs. Rare studies have investigated magnetic field treatments for obesity.
Purpose: Toinvestigate the effect ofpulsed low frequency magnetic field on obese subjects.
Material and Methods: Forty subjects from both genders having body mass index from 30 to 40, their ages ranged from 35 to 45 years oldwere selected.
Design of study: Group(A) The experimental group: This group consisted of 20 subjectswere received (Pulsed Magnetic Field withfrequency 15 Hz,intensity 60 gauss and duration 20 min) for 2 successive months. Group(B) The control group: This group consisted of 20subjects were received aerobic exercises using bicycle ergometer for 2 successive months.
Results: Within 2 groups: There was a significant decrease in body mass index and triglyceride. In group A, there was a significant increase in total cholesterol,low density lipoprotein and decrease in high density lipoprotein, In group B there was a significant decrease in T.CH,LDL and increased in HDL.
Conclusion: The application of LF-PMF on obese subjects has apositive effect on BMI and serum TGs, but it has anegative effect on HDL, serum T.CH and LDL.

INTRODUCTION

Obesity is a worldwide disease that is accompanied by several metabolic abnormalities such as hypertension, hyperglycemia and dyslipidemia. The accelerated adipose tissue growth and fat cell hypertrophy during the onset of obesity precedes adipocyte dysfunction. One of the features of adipocyte dysfunction is dysregulatedadipokine secretion, which leads to an imbalance of pro-inflammatory, pro-atherogenic versus anti-inflammatory, insulin-sensitizing adipokines. The production of renin-angiotensin system (RAS) components by adipocytes is exacerbated during obesity, contributing to the systemic RAS and its consequences. Increased adipose tissue RAS has been described in various models of diet-induced obesity (DIO) including fructose and high-fat feeding (Frigolet *et al*., 2013). The fact that electromagnetic fields (EMFs) have biological effects has been investigated not only for the health risks they invoke, but the potential for healing that has also been suggested. Much of the research originally will undertaken in those countries that had been unwilling or unable to afford the sort of expensive high-tech medical equipment used in many medical interventions in the West, though not everybody is convinced of its therapeutic effects (Hug and Röösli, 2011). EMFs have been found to produce a variety of biological effects. These effects of EMFs depend upon frequency, amplitude and length of exposure. They are also related to intrinsic susceptibility and responsiveness of different cell types. EMFs can influence cell proliferation, differentiation, cell cycle, apoptosis, DNA replication and protein expression. These effects are important considerations for the application ofEMFs for wound healing, tissue regeneration (Patruno *et al.,* 2010). The lipid profile is a group of tests that are often ordered together to determine risk of coronary heart disease (CHD) in obese population. The lipid profile typically includes total cholesterol (TC), High density lipoprotein-cholesterol; often called good cholesterol. Low density lipoprotein-cholesterol;

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often called bad cholesterol and Triglycerides (Labib, 2003). Cholesterol production is linearly related to body fat; approximately 20 milligram (mg) of additional cholesterol is synthesized for each kilogram (kg) extra body fat (Bray and Champagne, 2004).

MATERIALS AND METHODS

Subjects

Forty obese subjects with ages were ranged from 35 to 45 years and were suffered from obesity as their BMI from 30 to 40. They were selected from the faculty of Physical Therapy, Cairo University. subjectswere assignedintotwogroups;

Group (A)

Twenty obese subjects with ages were ranged from 35 to 45 years and were suffered from obesity as their BMI from 30 to 40 Were received pulsedmagnetic field (20 minutes session 3times per week for two successive months),

Group (B)

Twenty obese subjects with ages were ranged from 35 to 45 years and were suffered from obesity as their BMI from 30 to 40. They were received the aerobic exercises and cycling training on bicycle ergometer (30 minutes session 3 times per week for two successive months).

Inclusive criteria

- Subjects ages were ranged from 35-45years.
- Their BMI from 30 to 40
- All subjects aware of consciousness.

Exclusive criteria

Subjects were excluded when have one of the following criteria:

- Metastases, neither neurological nor orthopedic problems.
- Active kidney or hepatic disease.
- Diabetes mellitus or thyroid diseases.
- Previous surgeries, fibrosis or adherence in the abdomen.
- Pregnancy and/ or lactation.

Equipments

The study equipment divided into measuring equipment and therapeutic equipment.

Measuring Equipments

It involves the tools that were used to measure:

Weighing machine(Floor type) figure (1)

A self-indicating dial is equipped for easy reading, showing accurate weight both in Metric and in British systems by an indicator which is connected with the lever mechanism by means of gears and coiled spring. (Guyton and Hall, 2001).

Height measuring standard (figure 1)

Is composed of three round tubes of different calibers: the outer tube is rigidly fixed onto the column of the dial, while the middle and the inner tubes are closely inserted there in one after the other with both Metric and British units graduated thereon (Guyton and Hall, 2001).

Fig 1. The weighing machine (Floor type) and height measuring standard.

Body Mass Index(BMI) calculation

Body Mass Index (BMI) calculated according to the following equation:

BMI= Weight (Kg)/Height (m) ², where BMI from 18.5 to 24.9 means normal body weight, while BMI from 25 to29.9 means moderate overweight. But MBI from 30 to 39.9 indicate obesity that definitely required treatment, whereas BMI from 40 and above indicate extreme obesity (Kenneth and MacDonald, 2008).

Blood lipid analyzer (Roche Hitachi 912 Che) fig (2).

Fig 2. TheRoche Hitachi 912

Therapeutic Equipments

A- ASA magnetic field (Automatic PMT Quattro PRO). Fig. (3)

- ASA magnetic field as a device for magnetic therapy, its model is (automatic PMT Quattro PRO) and its serial number is (00001543). It consists of an appliance, motorized bed and solenoids. The appliance must be connected to electrical main supplying (230 V $\pm$ 10 %) at a frequency of 50 to 60 Hz with earth connection.
- - The appliance is capable for generating, on connected solenoids, pulsating magnetic field with pulse repetition frequency up to 100 Hz.
- The intensity and spatial layout of the generated magnetic field depend on the type of solenoid used. The intensity of magnetic field of solenoid installed on bed is 85 gauss while the intensity of magnetic field of solenoid on stand is 80 gauss.

Fig 3. ASA magnetic field (Automatic PMT Quattro PRO)

A The appliance B Motorized bed

C Solenoid D Accessory for transcranial application

B-Bicycle Ergometer figure (4)

Fig 4. Bicycle Ergometer

Stationary bicycle ergometer manufactured by Enraf – Nonious International, made in the Netherland.

Procedures of the study

The procedures of the study included the following:

A – **Measurement procedures:**

1- The measurements of the BMI was conducted before the first session (pre treatment record) and after 2 months of treatment (post treatment record). The measurement steps as follow:

BMI CALCULATION: after the measurement of weight and height according to the following equation:

BMI=Body weight in Kg / (Body height in meter)^2.As shown in figure (5)

Fig 5. Body weight and height measurement

Fig 6. Blood sample taken.

2-Serum lipid profile was conducted before the first session (Pre treatment record) and after 2 months of treatment (post treatment record) the subjects was fasted nine hours before taking the sample. As shown in fig (6).

B-Treatment procedures

The procedures of the treatment protocols were achieved under the following steps.

1-ASA magnetic field (Automatic PMT Quattro PRO). Fig. (9)

Fig 7. Magnetic program

Fig 8. Metabolism parameters

Fig 9. Subject on magnetic field (Automatic PMT Quattro P

Methods

Subjects received PEMF with a frequency of 15 Hz, intensity of 60 gauss and duration of 20 min(in the manual instrument of the apparatus –the metabolism diseases). While subjects in supine lying position wear light closes.

2-Bicycle ergometer treatment protocol (figure 10) (Group B)

Then the subjects cycle at 30 W for warming up, and then the intensity increased every 60 seconds by 15 W until exhaustion, then the subjects cycle at 30 W for cooling down and the duration of the treatment 30 minutes (15 minutes in the form of aerobic exercises in the gymnasium followed by 15 minutes cycling, total time of exercise divided into two to three intervals, and the frequency of this treatment protocol for each subjects was three sessions per week every other day for 2 months (Jian I2009).

Fig 10. Subject during achieving the Bicycle ergometer treatment protocol

Statistical analysis

Data Collection

Data were collected before and after the study for both groups.The data collection took the same sequence and procedure in both groups. These data included lipid profile and body mass index (BMI).

Data analysi

The data collected were fed to the computer, manipulatedand analyzed. The mean, and standard deviation were calculated for both groups. The comparison was made by paired t-Test to determine the probability levels for difference in mean value betweenthe results observed before and after the period of two months in each group (inter group). The comparison was made by unpaired T-test to test the significance of difference between before and after among both groups Statistical significance was established at the convention<0.05 level.

RESULTS

The purpose of this study was to investigate the effect of low frequency pulsedelectro magnetic field on obese subjects.

General Characteristics of the Subjects

In this study, forty subjects with age ranged from 35-40 years old and BMI ranged from 30 to 40 kg/m^2 were assigned randomly into two groups.

Group (A)

Twenty subjects were included in this group. The data in table (10) and (Fig. 8) represented their mean age (40.6±3.05) years, mean weight (96.55±11.16) kilograms (Kg), and mean height (166.65±9.38) centimeters (cm).

Group (B)

Twenty subjects were included in this group. The data in table (10) and (Fig.9) represented their mean age (40.35±3.06) years, mean weight (97.6±6.69) kilograms (Kg), and mean height (167.15±8.5) centimeters (cm). There was no significant difference between both groups in their ages, weights, heights, and BMI where their t and P-values were (0.25, 0.79), (0.36, 0.72), and (0.17, 0.86) respectively.

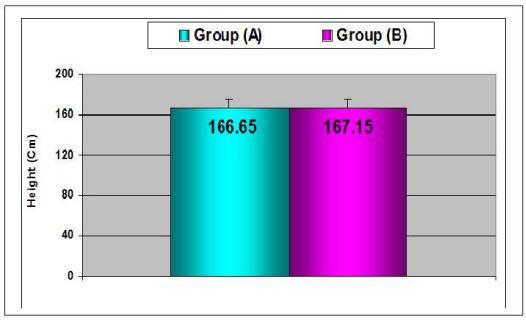

Fig 13. Mean and ±SD of the height for groups (A, B)

Body Mass Index

i) Within Subjects

Group (A)

Table (11) and figure (14) demonstrated the BMI pre and post treatment for group (A). There was a significant difference in the paired t-Test between pre and post treatment BMIas the mean value of pre treatment BMIwas (34.78± 3.2) and for post treatment BMIwas (32.01±3.21) where the t-value was (28.34) and P-value was (0.0001). The Percentage of improvement was 6.67 %.

Table 10. General characteristics of subjects in both groups (A and B)

General characteristics	Group A		Group B		Comparison		S
	Mean	±SD	Mean	±SD	t-value	P-value	
Age (yrs)	40.6	±3.05	40.35	±3.06	0.25	0.79	NS
Weight (Kg)	96.55	±11.16	97.6	±6.69	0.36	0.72	NS
Height (cm)	166.65	±9.38	167.15	±8.5	0.17	0.86	NS

*SD: standard deviation, P: probability, S: significance, NS: non-significant.

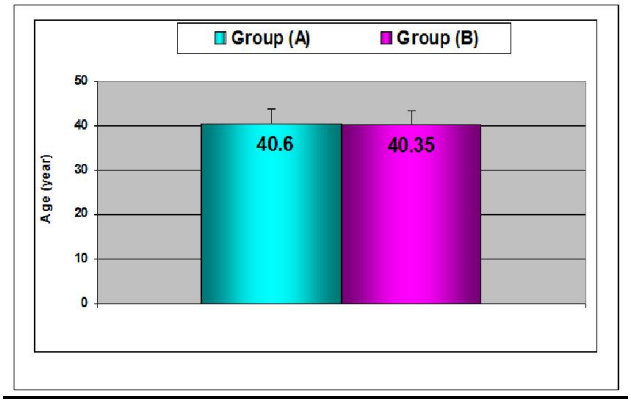

Fig 11. Mean and ±SD of the age for groups (A, B)

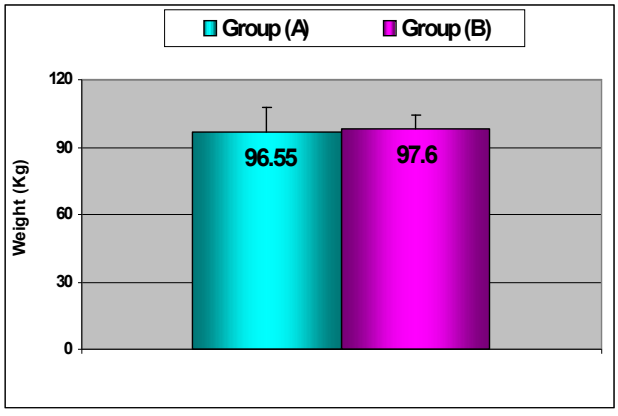

Fig 12. Mean and ±SD of the weight for groups (A, B)

Table 11. Mean and ±SD, t and P values of BMI pre and post treatment of group (A)

Group A	BMI	
	Pre treatment	Post treatment
Mean	34.78	32.01
±SD	±3.2	±3.21
Mean difference	2.77	
Percentage of difference	7.96%	
t-value	28.34	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant.

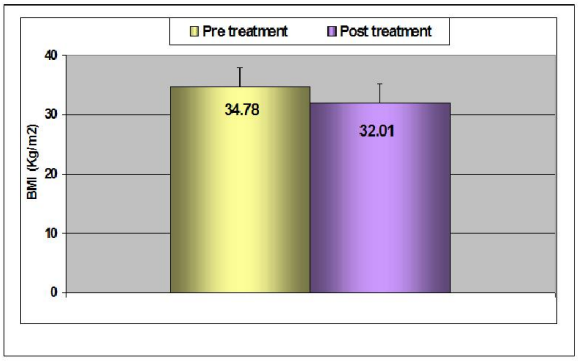

Fig 14. Mean and ±SD of BMI pre and post treatment of group (A)

Group (B)

Table (12) and figure (15) demonstrated the BMI pre and post treatment for group (B). There was a significant difference in the paired t-Test between pre and post treatment BMIas the mean value of pre treatment BMIwas (35.02± 2.59) and for post treatment BMIwas (34.19±2.43) where the t-value was (11.51) and P-value was (0.0001). The Percentage of improvement was 2.37 %.

Table 12. Mean and ±SD, t and P values ofBMI pre and post treatment of group (B)

Group B	BMI	
	Pre treatment	Post treatment
Mean	35.02	34.19
±SD	±2.59	±2.43
Mean difference	0.83	
Percentage of difference	2.37 %	
t-value	11.51	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant

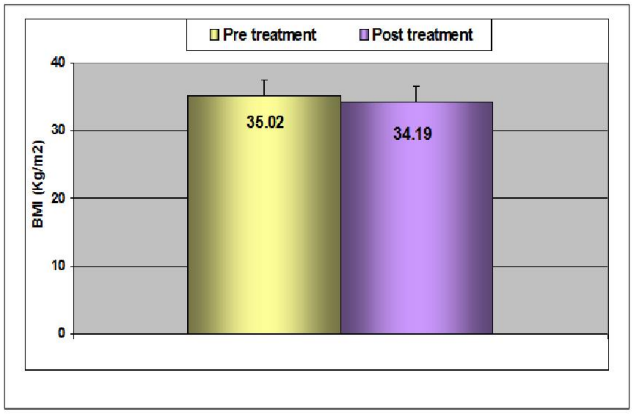

Fig 15. Mean and ±SD of BMI pre and post treatment of group (B)

ii) Between Groups

Table (13) and figure(16) revealed the independent t-Test results for the BMI pre and post treatment between groups A and B. There was no significant difference in pre treatment values where the t-value was (0.26) and p-value was (0.79). But there was a significant difference in the post treatment values (P<0.05) where the t-value was (2.42) and p-value was (0.02).

Table 13. Independent t-Test between groups A and B for BMI **pre and post treatment**

Independent t-Test	**BMI**			
	Pre treatment		**Post**	
	Group (A)	**Group (B)**	**Group (A)**	**Group (B)**
Mean	**34.78**	**35.02**	**32.01**	34.19
±SD	**±3.2**	**±2.59**	**±3.21**	±2.43
Mean difference	**0.23**		2.18	
t-value	**0.26**		2.42	
P-value	**0.79**		0.02	
S	**NS**		S	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, S: significant.

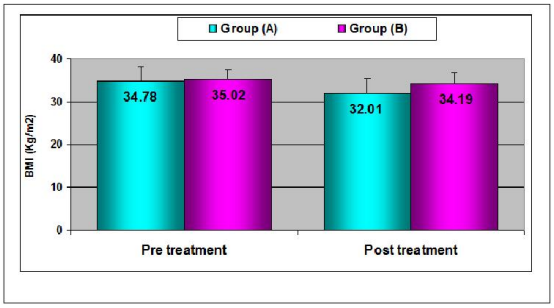

Fig 16. Mean and ±SD of BMI pre and post treatment of groups (A,B)

Total cholesterol

i) Within Subjects

Group (A)

Table (14) and figure(17) demonstrated the Total cholesterol pre and post treatment for group (A). There was a significant difference in the paired t-Test between pre and post treatment Total cholesterolas the mean value of pre treatment Total cholesterolwas (183.3± 25.45) and for post treatment Total cholesterolwas (203.9±23.4) where the t-value was (6.24) and P-value was (0.0001). The Percentage of change was 11.23 %.(negative effect).

Table 14. Mean and ±SD, t and P values ofTotal cholesterol pre and post treatment of group (A)

Group A	Total cholesterol	
	Pre treatment	Post treatment
Mean	183.3	203.9
±SD	±25.45	±23.4
Mean difference	20.6	
Percentage of difference	11.23 %	
t-value	6.24	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant

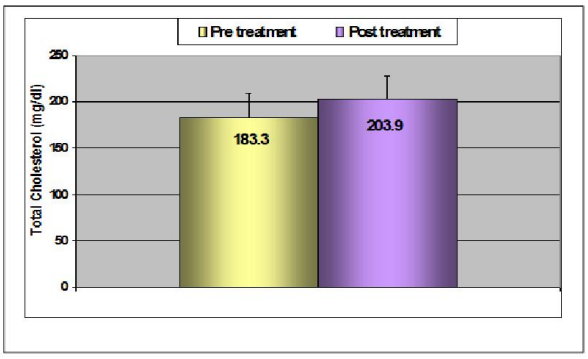

Fig 17. Mean and ±SD of Total cholesterol pre and post treatment of group (A)

Group (B)

Table (15) and figure (18) demonstrated the Total cholesterol pre and post treatment for group (B). There was a significant difference in the paired t-Test between pre and post treatment Total cholesterolas the mean value of pre treatment Total cholesterolwas (181.1±17.84) and for post treatment Total cholesterolwas (172.91±17.77) where the t-value was (10.35) and P-value was (0.0001). The Percentage of improvement was 4.51 %. (positive effect).

Table 15. Mean and ±SD, t and P values ofTotal cholesterol pre and post treatment of group (B)

Group B	Total cholesterol	
	Pre treatment	Post treatment
Mean	181.1	172.91
±SD	±17.84	±17.77
Mean difference	8.18	
Percentage of difference	4.51 %	
t-value	5.79	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant.

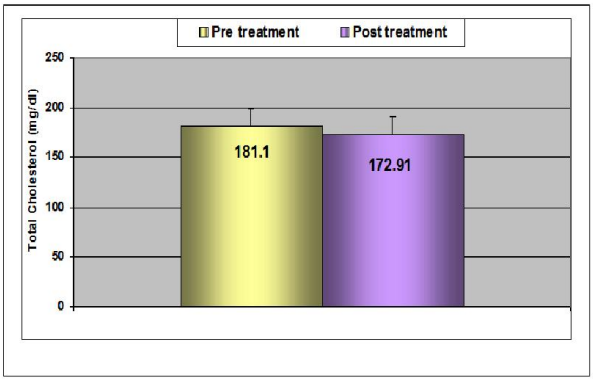

Fig 18. Mean and ±SD of Total cholesterol pre and post treatment of group (B).

ii) Between Groups

Table (16) and figure (19) revealed the independent t-Test results for the Total cholesterol pre and post treatment between groups A and B.

Table 16. Independent t-Test between groups A and B for Total cholesterol pre and post treatment

Independent t-Test	Total cholesterol			
	Pre treatment		Post	
	Group (A)	Group (B)	Group (A)	Group (B)
Mean	183.3	181.1	203.9	172.91
±SD	±25.45	±17.84	±23.4	±17.77
Mean difference	2.2		30.98	
t-value	0.31		4.71	
P-value	0.75		0.0001	
S	NS		S	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, S: significant.

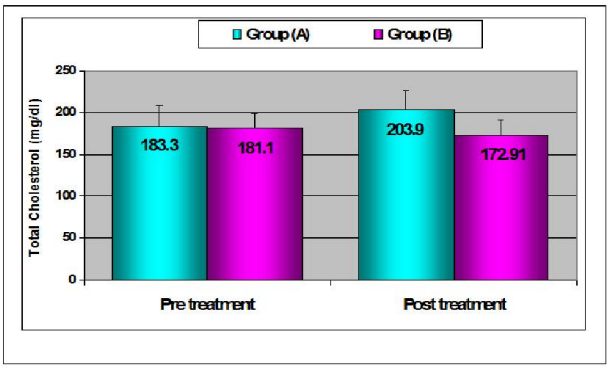

Fig 19. Mean and ±SD of Total cholesterol pre and post treatment of groups (A,B)

There was no significant difference in pre treatment values where the t-value was (0.31) and p-value was (0.75). But there was a significant difference in the post treatment values (P<0.05) where the t-value was (4.71) and p-value was (0.0001).

Triglycerides

i) Within Subjects

Group (A)

Table (17) and figure (20) demonstrated the Triglycerides pre and post treatment for group (A). There was a significant difference in the paired t-Test between pre and post treatment Triglyceridesas the mean value of pre treatment Triglycerideswas (116.95± 30.92) and for post treatment Triglycerideswas (103.32±28.33) where the t-value was (9.07) and P-value was (0.0001). The Percentage of improvement was 11.64 %.(positive effect).

Table 17. Mean and ±SD, t and P values ofTriglycerides pre and post treatment of group (A)

Group A	Triglycerides	
	Pre treatment	Post treatment
Mean	116.95	103.32
±SD	±30.92	±28.33
Mean difference	13.62	
Percentage of difference	11.64 %	
t-value	9.07	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant

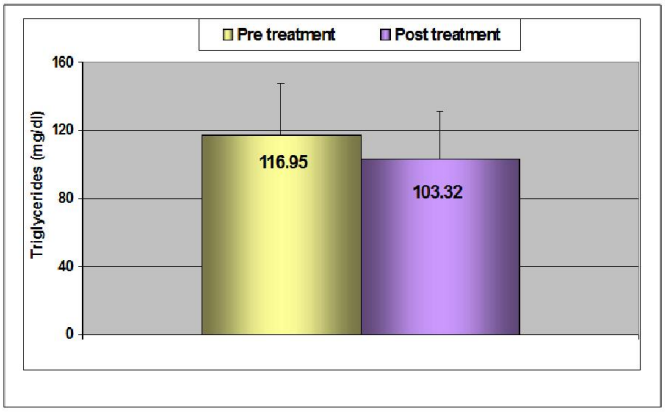

Fig 20. Mean and ±SD of Triglycerides pre and post treatment of group (A)

Group (B)

Table (18) and figure (21) demonstrated the Triglycerides pre and post treatment for group (B). There was a significant difference in the paired t-Test between pre and post treatment Triglyceridesas the mean value of pre treatment Triglycerideswas (**115.35±** 22.34) and for post treatment Triglycerideswas (99.97±18.27) where the t-value was (12.13) and P-value was (0.0001). The Percentage of improvement was 13.33 %.(positive effect).

Table 18. Mean and ±SD, t and P values ofTriglycerides pre and post treatment of group (B)

Group B	Triglycerides	
	Pre treatment	Post treatment
Mean	115.35	99.97
±SD	±22.34	±18.27
Mean difference	15.38	
Percentage of difference	13.33 %	
t-value	12.13	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant.

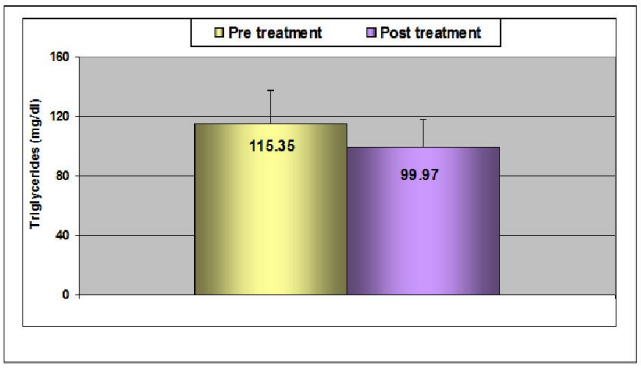

Fig 21. Mean and ±SD of Triglycerides pre and post treatment of group (B)

ii) Between Groups

Table (19) and figure (22) revealed the independent t-Test results for the Triglycerides pre and post treatment between groups A and B. There was no significant difference in pretreatment values where the t-value was (0.18) and p-value was (0.85), and also, there was no significant difference in the post treatment values where the t-value was (0.44) and p-value was (0.65).

Table 19. Independent t-Test between groups A and B forTriglycerides pre and post treatment

Independent t-Test	Triglycerides			
	Pre treatment		Post	
	Group (A)	Group (B)	Group (A)	Group (B)
Mean	116.95	115.35	103.32	99.97
±SD	±30.92	±22.34	±28.33	±18.27
Mean difference	1.6		3.35	
t-value	0.18		0.44	
P-value	0.85		0.65	
S	NS		NS	

*SD: standard deviation, P: probability, S: significance, NS: non- significant.

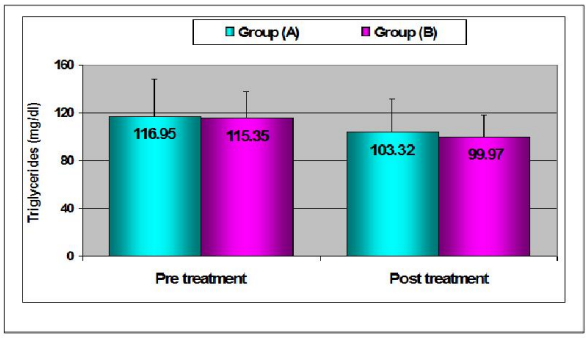

Fig 22. Mean and ±SD of Triglycerides pre and post treatment of groups (A, B)

High Density Lipoprotein

i) Within Subjects

Group (A)

Table (20) and figure (23) demonstrated the HDL pre and post treatment for group (A). There was a significant difference in the paired t-Test between pre and post treatment HDLas the mean value of pre treatment HDLwas (**45.63±** 5.9) and for post treatment HDLwas (40.75±4.32) where the t-value was (5.37) and P-value was (0.0001). The Percentage of change was 10.67 %. (negative effect).

Table 20. Mean and ±SD, t and P values ofHDL pre and post treatment of group (A)

Group A	HDL	
	Pre treatment	Post treatment
Mean	45.63	40.75
±SD	±5.9	±4.32
Mean difference	4.87	
Percentage of difference	10.67 %	
t-value	5.37	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant.

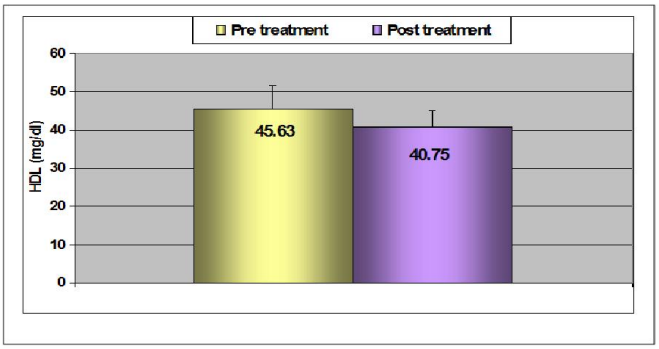

Fig 23. Mean and ±SD of HDL pre and post treatment of group (A)

Group (B)

Table (21) and figure (24) demonstrated the HDL pre and post treatment for group (B). There was a significant difference in the paired t-Test between pre and post treatment HDLas the mean value of pre treatment HDLwas (**46.21±** 4.76) and for post treatment HDLwas (50.71±5.63) where the t-value was (6.96) and P-value was (0.0001). The Percentage of improvement was 9.71 %.(positive effect).

Table 21. Mean and ±SD, t and P values ofHDL pre and post treatment of group (B)

Group B	HDL	
	Pre treatment	Post treatment
Mean	46.21	50.71
±SD	±4.76	±5.63
Mean difference	4,49	
Percentage of difference	9.71 %	
t-value	6.96	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant.

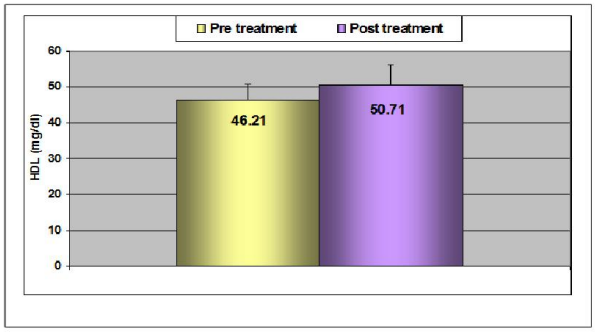

Fig 24. Mean and ±SD of HDL pre and post treatment of group (B)

ii) Between Groups

Table (22) and figure (25) revealed the independent t-Test results for the HDL pre and post treatment between groups A and B. There was no significant difference in pre treatment values where the t-value was (0.34) and p-value was (0.73). But there was a significant difference in the post treatment values (P<0.05) where the t-value was (6.27) and p-value was (0.0001).

Table 22. Independent t-Test between groups A and B for HDL **pre and post treatment**

Independent t-Test	HDL			
	Pre treatment		Post	
	Group (A)	Group (B)	Group (A)	Group (B)
Mean	45.63	46.21	40.75	50.71
±SD	±5.9	±4.76	±4.32	±5.63
Mean difference	0.58		9.95	
t-value	0.34		6.27	
P-value	0.73		0.0001	
S	NS		S	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, S: significant.

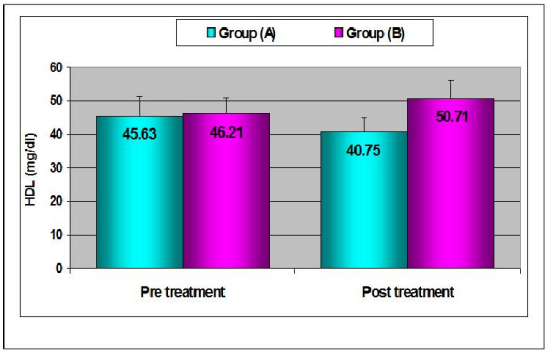

Fig 25. Mean and ±SD of HDL pre and post treatment of groups (A,B)

Low Density Lipoprotein

i) Within Subjects

Group (A)

Table (23) and figure (26) demonstrated the LDL pre and post treatment for group (A). There was a significant difference in the paired t-Test between pre and post treatment LDLas the mean value of pre treatment LDLwas (98.14± 11.07) and for post treatment LDLwas (107.55±12.49) where the t-value was (4.67) and P-value was (0.0001). The Percentage of change was 9.57 %. (negative effect).

Table 23. Mean and ±SD, t and P values ofLDL pre and post treatment of group (A)

Group A	LDL	
	Pre treatment	Post treatment
Mean	98.14	107.55
±SD	±11.07	±12.49
Mean difference	9.4	
Percentage of difference	9.57 %	
t-value	4.67	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant.

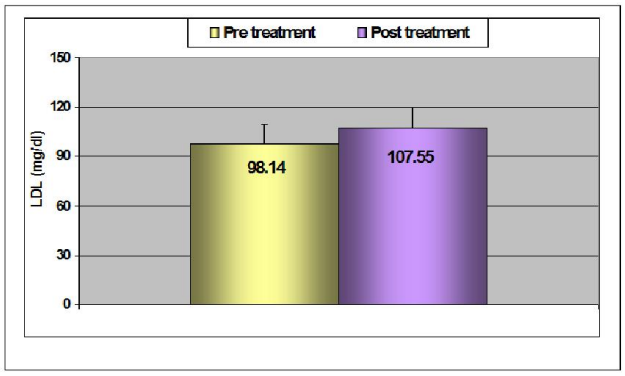

Fig 26. Mean and ±SD of LDL pre and post treatment of group (A)

Group (B)

Table (24) and table (27) demonstrated the LDL pre and post treatment for group (B). There was a significant difference in the paired t-Test between pre and post treatment LDLas the mean value of pre treatment LDLwas (**96.72**± 9.15) and for post treatment LDLwas (90.47±8.72) where the t-value was (12.99) and P-value was (0.0001). The Percentage of improvement was 6.46 %.(positive effect)

Table 24. Mean and ±SD, t and P values ofLDL pre and post treatment of group (B)

Group B	LDL	
	Pre treatment	Post treatment
Mean	96.72	90.47
±SD	±9.15	±8.72
Mean difference	6.25	
Percentage of difference	6.46 %	
t-value	12.99	
P-value	0.0001	
S	S	

*SD: standard deviation, P: probability, S: significance, S: significant

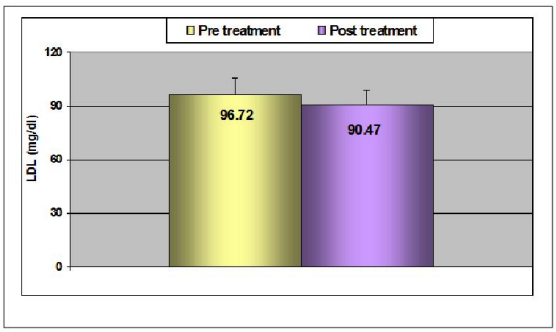

Fig 27. Mean and ±SD of LDL pre and post treatment of group (B)

ii) Between Groups

Table (25) and figure(28) revealed the independent t-Test results for the LDL pre and post treatment between groups A and B. There was no significant difference in pre treatment values where the t-value was (0.44) and p-value was (0.66). But there was a significant difference in the post treatment values (P<0.05) where the t-value was (5.01) and p-value was (0.0001).

Table 25. Independent t-Test between groups A and B for LDL **pre and post treatment**

Independent t-Test	LDL			
	Pre treatment		Post	
	Group (A)	Group (B)	Group (A)	Group (B)
Mean	98.14	96.72	107.55	90.47
±SD	±11.07	±9.15	±12.49	±8.72
Mean difference	1.41		17.07	
t-value	0.44		5.01	
P-value	0.66		0.0001	
S	NS		S	

*SD: standard deviation, P: probability, S: significance, NS: non-significant, S: significant.

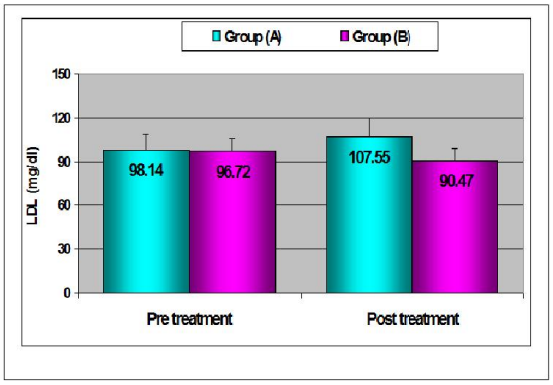

Fig 28. Mean and ±SD of LDL pre and post treatment of groups (A,B)

DISCUSSION

To the best of our knowledge, this is the first study evaluating the effect of pulsed low frequency magnetic field on obese subjects, there were few studies investigated the influence of magnetic field on serum lipids in the rats. The main purpose of this study was to investigate the effect of Low frequency pulsedelectro magnetic field on obese subjects by measuring the body mass index and serum lipid profile. The subjects in both groups were assessed for BMI calculation and to serum lipid profile pre and post treatment. Within the limitations of this study, the results showed that post treatment; there was significant decrease in BMI in both groups but the decreased in BMI in group(A) was statistically more than group(B). There was significant improvement in serum lipids profile in group(B) .But in group (A) there was significant increase in T.ch andLDL, and significant decrease in TG and HDL(negative effect). From statistical analysis of pre and post values of BMI and serum lipids in the study group (A) and study group (B), there was a decrease in BMI at the end of treatment in relation to pre treatment values and this difference was significant. While the improvement in serum lipids was statistically significant in the study group (B) compared to the study group (A). The results of the current study are contradicted with the findings of Takuya Horietal., 2012 as both plasma total cholesterol ($P < 0.01$) and phospholipid ($P < 0.05$) in the group exposed to MF were lower than those in the control, but there was no difference in triacylglycerol or free fatty acid levels. Accorrding to (Patricia *et al.,* 2007)) results he concloded that low-frequency rotary constant magnetic field has beneficial effect on fat metabolism, leading to reduced lipid peroxidation. The results of the current study are coincided with the findings of (Torres-Duran *et al.,* 2007). Blood lipids showed, at 48 h stimulated animals, a significant increase of cholesterol associated to high density lipoproteins (HDL-C) than those observed at any other studied time.Free fatty acid serum presented at 24 h significant increases in comparison with control group. The other serum lipids, triacylglycerols and total cholesterol did not show differences between groups,at any time evaluated. No statistical differences were shown on total lipids of the liver but total cholesterol was elevated at 24 h with a significant decrease at 96 h ($p = 0.026$). The ELF-EMF stimulation increased the liver content of lipoperoxides at 24 h. Most previous reports suggest that ELF-MF exposure might increase lipid metabolism, (SoroushSeifirad *et al.,* 2014) observed that one time exposure to ELF-MF significantly decreased total cholesterol levels and increased lipid peroxide content in the liver. Serum free fatty acids level were increased in their exposed rats compared to their control sham exposed rats. ELF-MF exposure affects antioxidant system by production of free reactive oxygen species Atherosclerosis is a chronic process, and chronic lipid peroxidation by ELF-MF exposure theoretically might increase the risk of atherosclerosis (Lee *et al*., 2004). Furthermore exposure to extremely low frequency electromagnetic fields increased the serum values of HDL-cholesterol (in the 48 h group), the liver content of lipoperoxides (in the 24 h group) and decreased total cholesterol of the liver (significant in the 96 h group). The mechanisms for the effects of extremely low frequency electromagnetic fields on lipid metabolism are not well understood yet (Jelenkovic *et al.,* 2006).

Conclusions and recommendations

The data concerning the BMI and serum lipids profile by using descriptive statistics (mean and standard deviation). t-Test was used to compare the pre-test and post-test values for BMI and serum lipids profile. The level of significance for all tests was set as ($P = 0.0001$).

FINDINGS

With in 2 groups

The analysis of data revealed the following findings:

- There was a significant decrease in BMI .
- There was a significant decrease in TGs.

Between 2 groups

- There was significant difference between 2 groups in the value of improvement of lipids profile,with superiority for group (B).
- There was significant difference between groups in the value of BMI and serum lipids.
- the improvement of BMI in group(A) is more than in group(B).
- But the improvement of serum lipids in group (B).(there is significant decrease in T.CH and LDL and increase HDL).
- There is increase in T.CH and LDL and decrease HDL in group (A).

Conclusions

In conclusion, our findings showed that PLF-MF exposure had apositive effect on BMI and TGs but it had anegative effect on TC, LDL and HDL. To our knowledge, this study is the first to

describe the effects of MF exposure on obese subjects, which will help in further understanding of the researchers. The mechanisms for the effects of MF on lipid metabolism are not well understand yet, but could be associated to lipid metabolism. To define the relationship of MF, and regulation of lipid metabolism further experiments are needed.

Recommendations

According to the results of the present study, the following further researches are highly recommended.

1. Replicate this study and make follow up to the two groups for three months, and measure the serum lipid profile after the 3 monthes.
2. Further studies including hormonal responses to pulsed electro magnetic field should be conducted.
3. Studying the effects of pulsed electro magneticfeild on insulin sensivity is required.

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