Effect of Pulsed Electro-Magnetic Field (PEMF) Therapy and Conventional Physiotherapy on Lipid Profile- A Randomised Control Trial

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Abstract:

Pulsed electromagnetic field therapy (PEMF) includes sending potent pulsed energy waves onto the patient's body's damaged or injured areas. In our study, we compared the impact of conventional physical therapy, combined with pulsed electro-magnetic field (PEMF) therapy, on patients' lipid profiles. Two participant groups were used in the research's experimental technique, and each group got a different intervention in order to determine how it affected the patients' lipid profiles. There were 40 participants in this experimental study (n = 40). The participants were divided evenly into Group A (PEMF combined with aerobic and resistance training programme) and Group B (aerobic and resistance training programme) by randomization in a 1:1 ratio. Here, the traditional physiotherapy programme includes an aerobic and resistance training component. Each patient received care for a period of three weeks in order to assess the effectiveness of the intervention. The study concluded that the Pulsed Electro-Magnetic Field (PEMF) Therapy along with the conventional physiotherapy was more effective in lowering the total cholesterol level, LDL and HDL levels when compared to only Conventional Physiotherapy on Lipid Profile of the patients.

Keywords : Pulse Electromagnetic field therapy, Physiotherapy Rehabilitation, Lipid profile.

Introduction :

Biochemical membranes, fuel, and signalling molecules all depend on lipids for their structure and function . Lipid signals have an impact on fat production, conservation, and the breakdown process, leading to complex metabolic networks that enable organisms to react to dietary supply and energy requirements or to adjust to other ambient changes. Earlier studies have connected bloodstream lipid-protein complexes (lipoprotein particles) and storage lipids (triglycerides) to aging-related illnesses, and obesity shortens life span [1].

Plasma cholesterol and triglycerides make up the bare minimum lipid profile. LDL and HDL cholesterol values are also part of a typical lipid profile. Triglycerides, HDL cholesterol, and total cholesterol can all be determined right away; however, if triglyceride concentrations are below 400 mg/dl (4.5 mmol/l), LDL cholesterol can either be determined right away or calculated using the Friedewald equation: total cholesterol HDL cholesterol triglycerides/2.2 (all in mmol/l; or triglycerides/5 with values in mg/dl). It has been suggested that the use of non-fasting lipid profiles is research-driven given the available information, but the persistent use of fasting lipid profiles is mostly belief-driven [2].

The term "aerobic exercise" describes a certain sort of regulated, continuous physical activity that forces the body's metabolic system to burn oxygen for energy [3]. The risk of cardiovascular disease is thought to be lessened in part by aerobic activity, which is thought to raise HDL-C levels in the blood [4]. Muscles are forced to operate against a load during strength training, commonly referred to as resistance exercise. Anaerobic exercise is referred to as resistance exercise [5]. PON1 levels significantly increased in aerobic groups and LDL levels significantly decreased, indicating that both training can be used as an effective factor to reduce the risks of cardiovascular disease in obese men. Endurance and resistance training also significantly decreased weight and body fat percentage[6]. In this way, different exercise regimens, such as aerobic and resistance training regimens, significantly affect the lipid profile.

Pulsed Electro-Magnetic Field (PEMF) Therapy is another procedure that has a substantial effect on lipid profiles. Using this specific technique, includes

sending potent pulsed energy waves onto the patient's body's damaged or injured areas [7]. Our study aimed at comparing the effect of Pulsed Electro-Magnetic Field (PEMF) Therapy along with the conventional physiotherapy and Conventional Physiotherapy on Lipid Profile of the patients.

Aims of the Study : The aim of the study is to compare the effect of Pulsed Electro-Magnetic Field (PEMF) Therapy along with the conventional physiotherapy and Conventional Physiotherapy on Lipid Profile of the patients.

Methodology :

The recruitment of the participants was done from the Physiotherapy OPD of Acharya Vinoba Bhave Rural Hospital Sawangi, Meghe, Wardha, Maharashtra. The research's experimental methodology involved two groups of participants, each of whom received a unique intervention to assess its impact on Lipid profile of the patients . This experimental investigation had a total of 40 individuals (n = 40) . The individuals were randomized in 1:1 ratio and were equally categorised into two groups i.e. Group A (PEMF along with aerobic and resistance training program) and Group B (aerobic and resistance training program) . Here, Aerobic and Resistance Training program are a part of the conventional physiotherapy program. To evaluate the outcome of the intervention, each patient received care for a duration of 3 weeks. After explaining the study's justification and methods to the participants, each one of them signed written consent forms . The study comprised participants with fluctuating levels of triglycerides, low density lipoprotein, and total cholesterol. The study's lead investigator carried out the distribution and allocation. The enrollment, screening, assessment, allocation, intervention, post-intervention assessment, and follow-up schedules for the research are depicted in Figure 1. Subjects with intermittent total cholesterol, low density lipoprotein, and triglyceride levels in the age range of 40 to 60 years of both sexes were required to meet the inclusion criteria. Subjects with a history of myocardial infarction, any recent abdominal surgery, pregnant women, lifelong smokers, subjects with pacemakers or a history of organ transplants, and people with high fever were all excluded from the study. The first day of the visit, the middle of the intervention (the first week), and the conclusion (the third week) will all involve assessment.

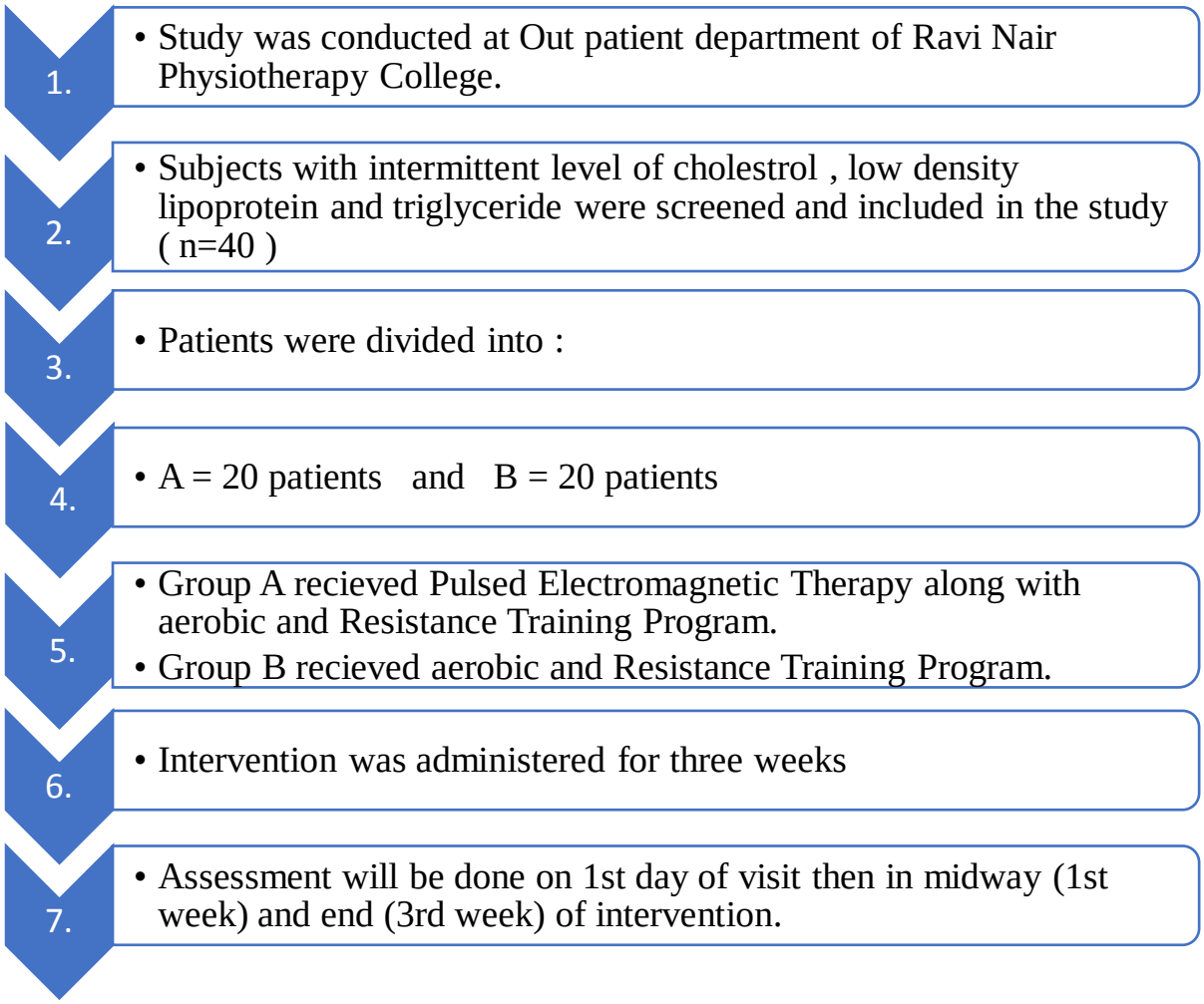


Figure 1 showing the procedure of the study.

Study Procedure:

The study will cover participants with moderate lipid profile levels who meet the inclusion criteria. The subjects will be split into Group 1 and Group 2 at random.

Group 1 was administered PEMT along with resistance and aerobic exercise for 30 minutes .

Group 2 underwent traditional physiotherapy interventions, such as resistance and aerobic exercise.

Group 1:- The pulsed electromagnetic field therapy will be addressed in detail. Patients were requested to take a comfortable seat. For 30 minutes, the subject wore a PEMF therapy device on their chest while the machine is turned on. While receiving treatment, the patient was monitored . After 30 minutes of

PEMF, the patient started aerobic exercise, progressing to aerobic exercise and resistance exercise the following week.

Group 2:- As a control group, subjects received resistance training and aerobic activity. The first week was dedicated to aerobic exercise, and the second and third weeks was dedicated to doing both aerobic exercise and resistance exercise.

Outcome Measures

Primary outcome measure

Blood Lipid Profile- A blood lipid profile was performed before and after the intervention to measure the levels of triglycerides, very low-density lipoprotein, and low-density lipoprotein.

Secondary outcome measure

SF-36 was utilised to assess quality of life both before and after the intervention.

Observation and Results:

The participants were of 41 to 60 age group .The table 1 shows age wise distribution of participants in Experimental and control group. There was homogeneous distribution.

Table 1: Age wise distribution of patients in two groups

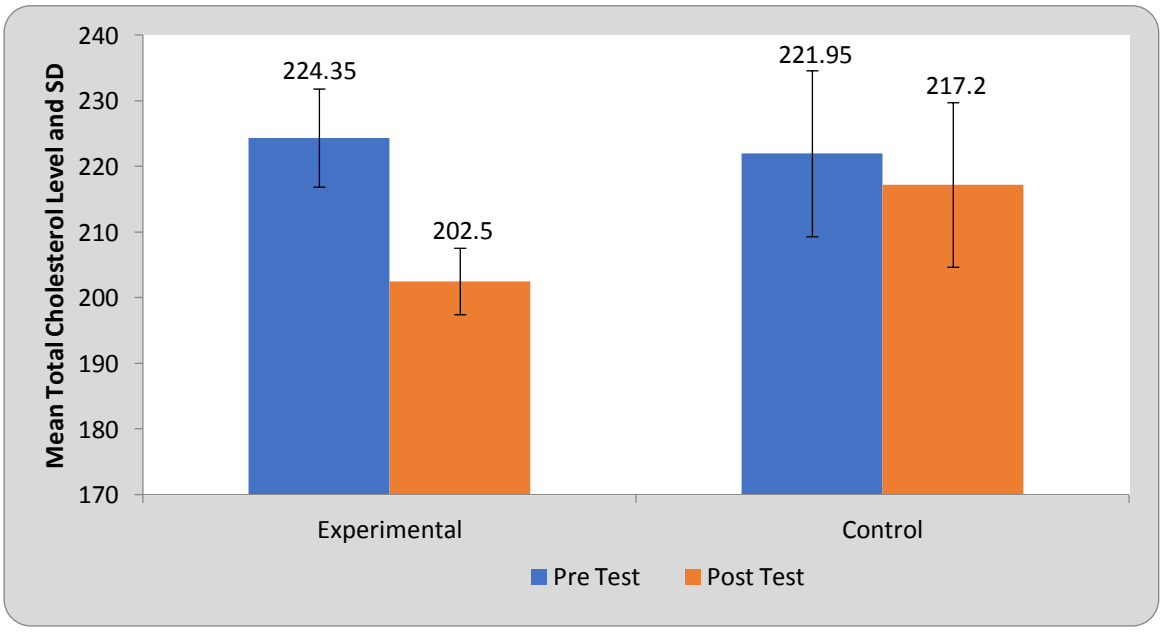
Age Group (yrs)	Experimental Group	Control Group	p-value
41-50 yrs	11(55%)	13(65%)	0.74,NS
51-60 yrs	9(45%)	7(35%)	
Total	20(100%)	20(100%)	
Mean±SD	49.85±5.32	47.90±4.35	
Range	41-60	43-58	

Table 2: Comparison of Total Cholesterol level in two groups at pre and post treatment (Student's Paired t test)

Group	Pre Test	Post Test	Mean Difference	t-value
Experimental	224.35±7.47	202.50±5.06	21.85±5.53	17.4 P=0.0001,S
Control	221.95±12.64	217.20±12.53	4.75±2.73	7.77 P=0.0001,S

The table 2 represents pre and post intervention comparison of total cholesterol level in experimental and control group. The t value for the experimental group was 17.4 and control group was 7.77. Both the groups show significant difference with p value <0.0001.

Graph 1: Comparison of Total Cholesterol level in two groups at pre and post treatment (Student's Paired t test)



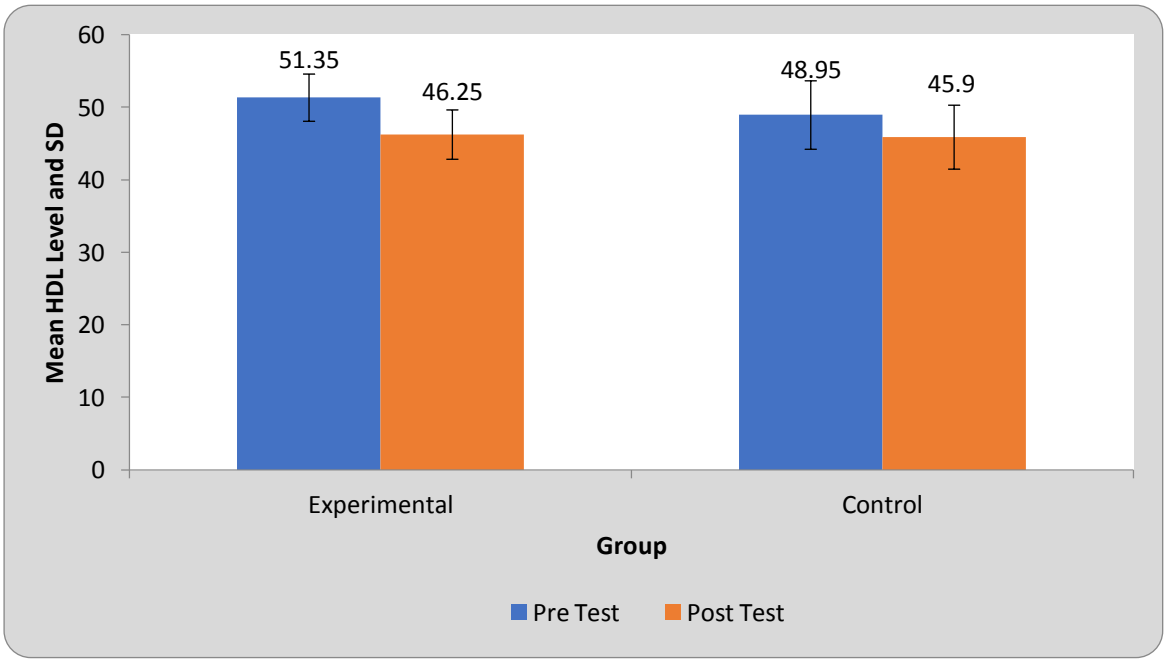
In graph 2 we can clearly appreciate that experimental group shown more reduction in total cholesterol level post intervention compared to the control group.

The table 3 represents HDL levels in experiment and control group. The t value for Experimental group was 14.08 and control group was 11.05 both were significant.

Table 3: Comparison of HDL level in two groups at pre and post treatment (Student's Paired t test)

Group	Pre Test	Post Test	Mean Difference	t-value
Experimental	51.35±3.26	46.25±3.40	5.10±1.61	14.08 P=0.0001,S
Control	48.95±4.72	45.90±4.41	3.05±1.23	11.05 P=0.0001,S

Graph 3: Comparison of HDL level in two groups at pre and post treatment (Student's Paired t test)



The Table 4 represents pre and post intervention differences in LDL level using Student's Paired t test. The T value for Experimental group was 8.29 and control group was 7.57. Both the groups show differences in pre and post intervention.

Table 4: Comparison of LDL level in two groups at pre and post treatment (Student's Paired t test)

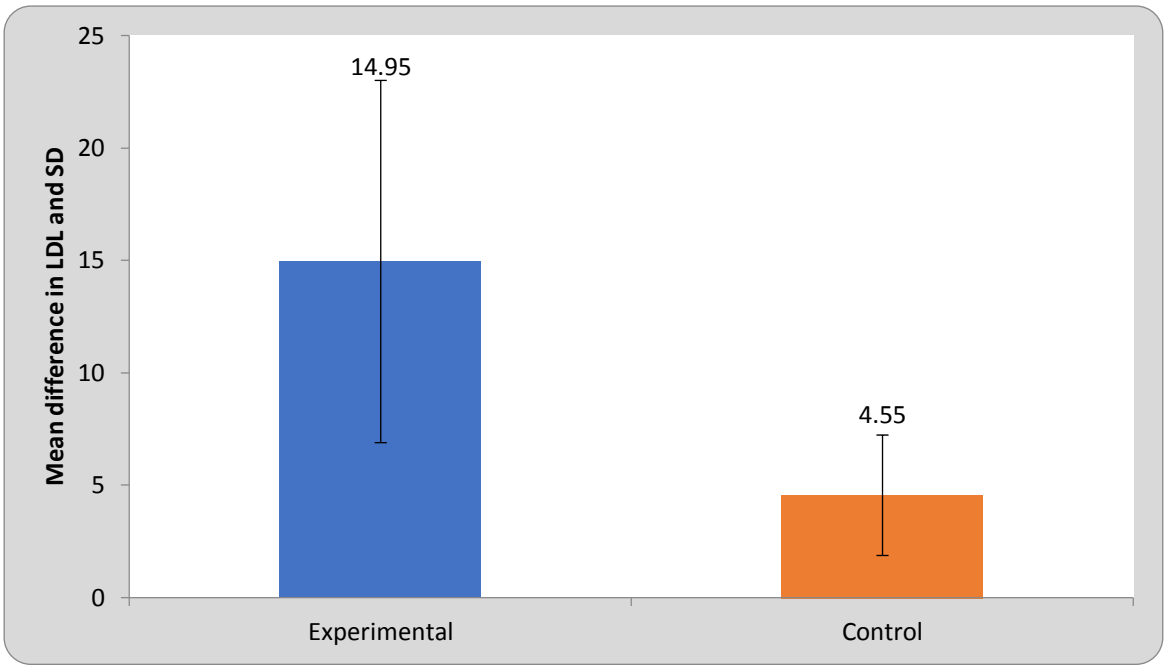
Group	Pre Test	Post Test	Mean Difference	t-value
Experimental	148.10±6.40	133.15±9.69	14.95±8.06	8.29 P=0.0001,S
Control	145.60±6.96	141.05±6.99	4.55±2.68	7.57 P=0.0001,S

Table 5: Comparison of mean difference in LDL level in two groups (Student's unpaired t test)

Group	Mean Difference	SD	t-value	p-value
Experimental	14.95	8.06	5.47	0.0001,S
Control	4.55	2.68		

In Graph 4 we can appreciate that experimental group showed more significant difference in pre and post intervention in experimental group compared to control group.

Graph 4: Comparison of mean difference in LDL level in two groups (Student's unpaired t test)



Statistical analysis was done by using descriptive and inferential statistics using chi square test, student's paired and unpaired t test and software used in the analysis were SPSS 27.0 version and GraphPad Prism 7.0 version and $p<0.05$ is considered as level of significance.

Discussion:

13 meta-analyses that addressed the role of the lipid profile after exercise were classed by Pedersen and Saltin. People with dyslipidemia have been proven to benefit from exercise in terms of their pathophysiology and physical fitness. There aren't many studies that discuss how exercise impacts lipid profiles. This study aims to investigate the effects of pulsed electromagnetic field therapy on lipid profiles [8]. One of the causes could be an increase in lecithin-cholesterol acyltrans (LCAT), an enzyme that transfers ester to HDL cholesterol and has been shown to rise with exercise training.

Additional study into the application of PEMFs alone or in conjunction with osteogenic chemicals and/or biomaterial is motivated by recent advances in our understanding of how PEMFs alter signalling, opening up a multitude of potential for bone repair therapy and TE technique refinement [9].

PEMFs, which have been demonstrated to promote cellular proliferation and extracellular matrix deposition, have been discovered to facilitate the

colonisation of the planned construct and the in vitro formation of an engineered tissue with higher functional and mechanical properties [10].

Following surgical implantation of the construct, PEMF stimulation in vivo stimulates the anabolic functions of local cells and MSCs and has a strong anti-inflammatory effect, protecting the engineered construct from the damaging effects of inflammation. Overall, the research shows that tissue repair strategies for the musculoskeletal system should use PEMFs both in vitro and in vivo for the following reasons: to aid in the formation of an engineered construct with enhanced functional and mechanical properties; to encourage graft integration; to regulate the environment after implantation, shielding the engineered construct from the catabolic activity of inflammatory mediators; and to motivate the growth of new tissue [11].

In this study, the researchers looked at how participants' lipid profiles were impacted by PEMF therapy. According to one theory on the mechanism of action, PEMF may induce eddy currents in biological tissue, which may then mediate ensuing biological effects. Recent studies have shown that SCS and PEMF can affect the expression of genes relevant to pain, including those for endogenous opioids and eicosanoid enzyme pathways.

Limitations:

The study was carried out in small population, future studies study be carried out in larger population so that we can disseminate results. Hypertension was not taken into consideration which may affect the results of the study.

Conclusions:

The study concluded that the Pulsed Electro-Magnetic Field (PEMF) Therapy along with the conventional physiotherapy was more effective in lowering the total cholesterol level, LDL and HDL levels when compared to only Conventional Physiotherapy on Lipid Profile of the patients.

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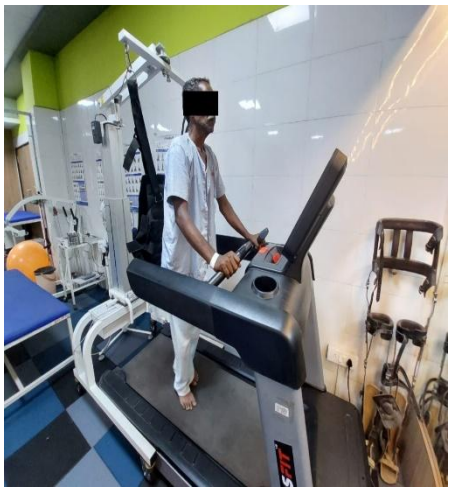

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