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The Effect of Jacobson's Progressive Muscle Relaxation Technique along with Structured Exercise Program on HbA1c in Type II Diabetes Mellitus Patients

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ABSTRACT

Background- Diabetes mellitus on a comprehensive scale is an epidemic. It has become a snow-balling risk to the public health care system world-wide. It is predisposed with sever-diabetes related complications thus making it even more difficult to manage. Jacobson's Progressive muscle relaxation technique (PMR) is one of the least used techniques in diabetic management. PMR is an adjunctive therapy which is not only easy to teach but also cost- effective. Its benefits have been proved on various other conditions. Benefits of exercise on T2DM have been emphasized by many. The aim of this research is to see the effect of PMR technique along with structure exercise program on T2DM patients.

Materials and Methods- 30 subjects suffering with type-II diabetes mellitus were included and divided into experimental group (group-A) (n=15) and control group (group-B) (n=15). Their height, weight, BMI and HbA1c levels were evaluated. Group A participants participated in structured exercise program along with Jacobson's Progressive muscle relaxation technique for alternate days in a week for 12 weeks. While Group- B participants were advised to use their routine oral hypoglycemic drugs. Pre and Post values of HbA1c levels were assessed for both the group participants in the laboratory.

Results- Indicates no statistically noted difference exists in the Pre-value in group A experimental versus group-B control. There is a statistical difference in the Post- value in group A versus group-B. There is a reduction in the HbA1C levels in the experimental group (group-A)while there was no statistical difference in control group(group-B).

Conclusion- This study concluded that 12 weeks of Jacobson's Progressive muscle relaxation technique along with structured exercise program was effective in reducing HbA1c levels in T2DM patients. Hence PMR and exercises should be incorporated in diabetic patient's management.

Key Words- Diabetes, Jacobson's progressive muscle Relaxation technique, Structured Exercise, HbA1c.

INTRODUCTION

Diabetes is an austere and a persistent disease occurring as a result of reduced production of insulin (blood glucose regulating hormone), or when the insulin produced by our own body is not used efficiently. T2DM which was previously labelled as adult-onset diabetes is a disease in which the insulin activity is mostly resisted in the individuals suffering from it. [1] It is estimated that on the global scale people suffering with T2DM is 451

million populations and it may grow up-to 693 million by the year 2045.In which India is ranking second in the order of prevalence (73 million) according to the international diabetes federation (IDF) 2017. [2] Every 5th person suffering with diabetes in the globe is an Indian, thus India is also called as the capital of diabetes in the entire world. [3] Symptoms of it often remain undiagnosed or not noticeable in many individuals until complications have taken a rise thus making it even more challenging. Comorbidities of type II diabetes mellitus include- Psychological disorders, cardiovascular problems, nervous system related problems, retinopathies and nephropathies to name a few. [4,5]

While speaking about adjunctive therapies in managing type -II diabetes mellitus relaxation techniques are considered. As it is cost effective, extremely easy to administer and patients can perform themselves thus making it free of side effects. Amongst the different relaxation techniques PMR which Edmund Jacobson has proposed in the year 1976 is said to reduce the tension in the skeletal musculature there by producing a calming effect to the mind. [1] Deep state of relaxation can be achieved with the help of this technique. According to researcher Ghazavi et al PMR technique has reduced HbA1C level in diabetic patients by increasing the relaxed state of the person. [6] The self-awareness of relaxed sensation is one of the greatest things achieved with progressive muscle relaxation technique. [7]

All the movements which cause burning of energy are called as physical activity. The physical activity which is planned and structured according to the needs of the person is called as exercise. The most important element in increasing sensitivity of insulin is exercise. In type II diabetes mellitus patients exercise is said to enhance glucose control, lessen risk factors associated with cardiovascular system, help in maintaining a healthy weight. There by improving the overall health of the person. Although many forms of exercises are present aerobic and resistance training are the two forms of exercise which have been extensively employed for type-II diabetes mellitus patients. The exercise which is said to increase the maximal oxygen uptake which there by increases cardiovascular fitness is called as aerobic exercise. While the exercises which enhances the size and strength of the musculature of skeletal system is called resistance training. The efficacy of these training on type II diabetes mellitus patients have been scrutinized by many with regards to control of blood glucose levels. [8]

HbA1c is a gold standard, clinical diagnostic tool for assessing the average blood sugar levels for over period of weeks to months. [9] Diabetic patients are quite vulnerable of experiencing stress in their daily life. Such mental anguish leads to raise in the stress hormones, which in-turn activates the sympathetic nervous system which could be an additional factor in raised glucose levels in the diabetic patients. Thus, improving their mental health along with their physical health is a quintessential component in holistic diabetic management. The aim of the following research is to see the effectiveness of Jacobson's progressive muscle relaxation technique along with structured exercise program on HbA1c levels. It may be hypothesized that there may be a significant program on HbA1c levels in type II diabetes mellitus patients.

MATERIALS AND METHODES

This experimental study has been carried out in the department of Physiotherapy, Durgabai Deshmukh college of Physiotherapy, Hyderabad. Ethical committee has approved this study. The study was conducted on 30 individuals suffering with T2DM.The participants were asked to answer the physical activity readiness questionnaire (PAR-Q) which was duly signed by their physician. They were randomly classified into experimental group (group-A) (n=15) and control group (group-B) (n=15). Height in centimeters and weight in kilograms were measured to calculate the

BMI with standard formula of weight in kilograms/ height in meter square. Their HbA1c levels were assessed in the laboratory of Durgabai Deshmukh hospital and research center.

Inclusion criteria

- Age- 40-50 years.
- Both males and females.
- BMI- normal range between – 18.5-22.9 kg/m^2
- HbA1c value- >6.5-10.0 %
- Is on oral hypoglycemic drugs.
- Has never undergone progressive muscle relaxation technique before.

Exclusion criteria

Overweight and obese individuals, HbA1c <6.5% or >10.0%, patients suffering with cardiovascular, neurological, musculoskeletal, psychological disorders, type I diabetes mellitus and patients having history of performing exercise past 3 months have been excluded from the study.

Methodology

All the eligible participants who meet the inclusion and exclusion criteria were provided with information about the procedure and need for the study was explained in the language they understood the best. And written consent was taken before starting the intervention from the participants.

GROUP –A (EXPERIMENTAL GROUP)- According to ACSM guidelines, [10] participants participated in structured exercise program on alternate days of a week for 12 weeks under supervision. Every session started with warm up for 5-10 minutes where participants were made to do stretching exercises and slow pace walking. Then the participants performed cycling on an ergometer bike for 10 minutes and on a cross trainer for 10 minutes with aPolar Electro OY Finland-H10 which is a heart rate monitor to monitor their heart rate while performing the exercise. This activity was performed at a maximum of 60-75% of their maximum heart rate using target heart rate. It was calculated using Karvonen method of maximal heart rate reserve.

Then the participants participated in resistance training. Intensity of which was calculated from one repetitive maximum (1RM) values. One repetitive maximum is the highest weight a person can lift accurately in a single repetition. Goal was to complete 2 sets, each set consisting of 10 repetitions for the following exercise at 60-75% of 1 RM and rested for 30 seconds between the sets and 1 minute of rest between the exercise for the following exercises-biceps curl, triceps curl, leg press, seated led curl and bench press.

The training protocol involved a slow uniform progression of repetitions and weight during the first months, so as the participants would get familiarized with the equipment, thereby reducing muscle soreness, and potential of getting injured. Resistance was increased when a participant was able to complete 10 repetitions on the second set for 2 consecutive sessions. Strength training was tested after every 4 weeks until 12 weeks of the program and training loads were modified to be compatible with 60-75% of 1 RM goal.

Lastly the participants were made to do 30 minutes of PMR in supine position on the bed. Patients were advised to tense the respected group of muscle and were advised to feel the tension holding it on up-to 5 seconds followed by relaxing it for 10 seconds. The sequence used was-left hand, left forearm, left upper arms then followed by right hand, right forearm, right upper arm. Followed by forehead, eyes, cheeks, mouth, jaw and neck. The next area was shoulders, shoulder blades/back, chest and stomach, buttocks, left upper leg, left lower leg, left foot followed by right foot. Followed by cool down (flexibility exercises) for 10 minutes Along with the above intervention, group-A experimental participants were asked to continue their routine oral hypoglycemic drugs.

GROUP-B (CONTROL GROUP) participants were advised to use their routine oral hypoglycemic drugs as before and continue their regular activity regimen.

After 12 weeks of period of training was completed both the group participants HbA1c levels were assessed in the laboratory and compared.

Statistical Analysis

The figures collected were analyzed using SPSS software 21IBM version. Pearson chi-square test was used to compare gender in both the groups. Differences in the age, BMI and HbA1c levels between both the experimental and control groups were assessed with the help of independent t test. Pre and post HbA1c levels within the groups were compared using paired t test.

RESULTS

Table -1 is depicting age and BMI levels in both the groups; it concludes that there is no statistically significant difference in both the groups. Table-2 results show no statistically notable difference in the gender in both the groups. Table-3 results shows a statistically significant difference in experimental group, pre and post intervention as the mean value in group-A pre-intervention is 8.288 while post-intervention it is 7.296 and its p value is 0.000 ($p<0.05$). While there is no statistical difference that exists between the pre and the post HbA1C value in control group as the mean value in group-B pre-intervention is 8.150, post-intervention it is 8.132 and its p value is 0.074 which is ($p>0.05$).

While comparing experimental group versus control group table-4 results is depicting that there is no statistically notable difference in both group-A and group-B, pre-intervention as the mean value pre-intervention in group-A is 8.288, in group - B is 8.150 and its p value is 0.698 ($p >0.05$). Post- intervention a statistically notable difference exists in both the groups as the mean value post-intervention in group-A is 7.296, in group B is 8.132 and its p-value is 0.019 ($p<0.05$).

Table-1- Age and BMI.

	Group	N	MEAN	Standard Deviation	t-value	P-value
Age(years)	Experimental – Group-A	15	50.47	5.330	0.573	0.571
	Control- group-B	15	49.40	4.852		
BMI (kg/m^2)	Experimental – Group-A	15	21.27	1.10	1.176	0.250
	Control- group-B	15	21.87	1.64		

There is no statistical difference in age and BMI in experimental and control groups.

Table-2-significance for gender in both group-A experimental and group-B control group.

	value	df	P-value
Pearson chi-square	0.133	1	0.715

There is no statistical difference in age in both the groups.

Table-3-comparison for HbA1c in pre and post of the intervention in group-A experimental and group-B control group.

	Pre		Post		Paired t-Value	Table value	df	P-Value
Experimental Group-A	Mean	SD	Mean	SD	19.797	2.145	14	0.00
	8.288	0.860	7.296	0.769				
Control Group-B	8.150	1.045	8.132	1.047	1.931	2.145	14	0.074

There is a statistical difference in the pre and post value in experimental group as the p-value is 0.00 and there is no statistical difference in the control group as the p-value is 0.074.

Table-4- comparison of HbA1c for group-A experimental verses group-B control group

	Experimental Group-A		Control Group-B		Independentt-Value	Table value	df	P-Value
Pre	Mean	SD	Mean	SD	0.393	2.048	28	0.698
	8.288	0.860	8.150	1.045				
Post	7.296	0.769	8.132	1.047	2.491	2.048	28	0.019

Thers is no statistical difference in the pre-value in experimental versus control group as the p-value is 0.698 and there is a statistical difference in the post-value in experimental versus control group as the p-value is 0.019.

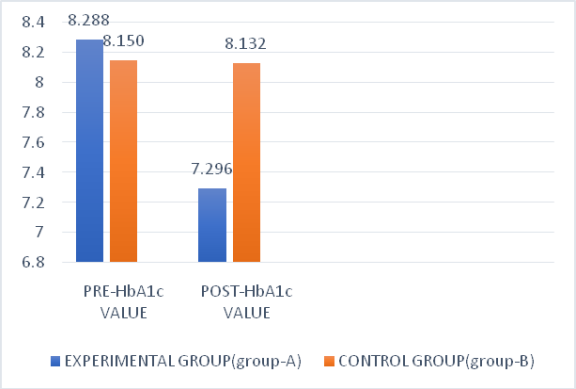

Figure 1- Pre and Post HbA1c (%) valuein experimental versus control group.

DISCUSSION

The aim of this research was to know the effectiveness of PMR along with structured exercise program on HbA1c level in type -II diabetes mellitus patients. This study indicates that there is a statistically significant lowering of HbA1c levels in the experimental group (group-A) following 12 weeks of intervention. While no statistically significant difference exists in the HbA1c level in control group (group-B) post-intervention.

Due to increased agony associated with the diseases, diabetic patients are often prone experiencing stress. When someone experiences stress it leads to the secretion of stress hormones in the body. Stress hormones like epinephrine, glucagon and cortisol levels are raised in their body. Stress reaction is a feedback pathway occurring betwixt the brain and the muscle. [11] Stress leads to increased muscle tension in the body. Which in-turn conveys stimulus to the higher centers to put up a feedback pathway. Stress even leads to the activation of sympathetic nervous system. This system leads to raised arterial blood pressure, increased heart rate and also aids in raised glucose levels in the blood. There by increasing the HbA1c levels in the body. [12]

When PMR is performed inhibition of activation occurs in the brain by the change of nerve impulses in the afferent pathway. [13] This change of pathway promotes relaxation both mentally and physically. There by reducing the arterial blood pressure, heart rate and blood glucose levels thus progressive muscle relaxation technique inhibits the pathway and manipulates the hypothalamus as a result the stress carrying impulses to the hypothalamus reduces. [14]

Along with above mentioned mechanism progressive muscle relaxation technique will cause a shift in the ANS from sympathetic to para sympathetic nervous system. Once parasympathetic nervous system is activated body shows positive reinforcement attitude in the brain and reduces arterial blood pressure, heart rate and blood glucose levels. There by HbA1c levels in the body will also reduce. [15] This study results are in accordance with Dunning et al; who said that Jacobson's progressive muscle relaxation technique can benefit patients with diabetes mellitus and can ameliorate reception conditions at the same time by lowering stress levels, reducing anxiety, decreasing depression and also helps in growth of sustainable strategies to prevent stress. PMR also improves in reducing blood sugar levels. [16] Insulin activity in liver and muscle can be altered by exercise and by performing physical activity regularly. Structured exercise helps in improving muscle capillary density, lipid metabolism, oxidative capacity, and insulin signalling proteins. [17]

While coming to the effect of structured exercise on blood glucose levels. Regular exercise modifies insulin activity in the liver and muscle. Insulin independent mechanism gets activated in the body after performing aerobic exercise. Which causes increases in the uptake up-to 5 times. After exercise, raised glucose uptake is seen up-to 2 hours in type -II diabetes mellitus patients. [18] Exercise causes repletion of muscle glycogen in the body thus increasing the glucose uptake in the muscle. Short duration

exercise (20 minutes) may enhance the insulin action up-to 24 hours. Both resistance and aerobic training is said to aid in – lipid metabolism, oxidative capacity, insulin signaling protein, muscle capillary density, adaptations in skeletal musculature, adipose tissue and enhanced insulin action in the liver. This study results are in accordance with a study were in a meta-analysis was done on type 2 diabetes patients and they have reported that there was a greater reduction in A1C following combined exercise training and said -for better glycemic control in the body combined training is the best. Thus, T2DM patients should perform both resistance and aerobic exercise training along with Jacobson's progressive muscle relaxation technique for excellent glycemic control and better health outcomes. [19]

CONCLUSION

This study concluded that 12 weeks of Jacobson's progressive muscle relaxation technique along with structured exercise program was effective in reducing HbA1c levels in T2DM patients. Hence such holistic approach of using Jacobson's progressive muscle relaxation along with structured exercise program should be encouraged in T2DM patients for better diabetic management.

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