

The Effect of Aerobic Exercises on Pain in Patients with Diabetic Peripheral Neuropathy

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ABSTRACT

Background: Evidence has suggested that exercises have always been part of diabetes controlling programs in past and recent years. But recently new improvements have been noticed regarding use of Aerobic exercises in controlling variation in symptoms of diabetes type 2 especially neuropathic pain. It has been proved that Aerobic exercises are much useful in controlling neuropathic symptoms than simple exercises.

Objective: This study was to determine the impacts of aerobic exercises on pain in diabetic neuropathic patients.

Methodology: A randomized controlled trial was done on 80 patients who fulfilled inclusion criteria of diabetic neuropathy having 40 to 70 years of age with no serious systemic illness and sensitivity. Coin toss method was used to randomize the patients in two groups in the Physical therapy department of District Head Quarter Hospital Layyah, Pakistan. Baseline measurements and demographic data were taken before starting exercise plans. Patients were divided into two groups (group A) treatment group and (group B) control group. Treatment plan consisted on 10 weeks program. Group A was given Aerobic exercises plan like cycling, treadmill walking and Group B was given Strengthening exercises like pulley exercises, dumbbell exercises for a period of 30-minute session thrice a week initially which was later on increased to Four days a week. Data was analyzed through SPSS version 20. Paired t test were used to analyze the data.

Results: The Physical Exam score within group showed before treatment $5.53 \pm .91$ and after treatment was $1.07 \pm .59$ ($<0.001^*$) and it showed significant improvement with the intervention of aerobic groups. Mean difference of pre-test post-test score in strengthening group was $2.19 \pm .40$ and in aerobic group was 4.76 ± 2.66 ($P=0.010$) showed there was significant difference between mean score of both groups. Mean score of pain in aerobic group in measurement was 79.1 ± 8.9 and after treatment was 39.2 ± 8.4 ($<0.001^*$) showed significant effect with intervention of this group

Conclusion: Aerobic exercises improve the intensity of pain in diabetic neuropathy patients while control group have no improvement of pain. While both experimental and control group showed some improvement regarding muscle tone and strength by exercises but intensity of pain only improved by Aerobic Exercises.

Keywords: Aerobic exercises, Diabetes, Pain management, Peripheral Neuropathy, Resistance exercises

INTRODUCTION

Diabetes is most common disease of elderly community in the world and 25% population of the USA is suffering from diabetes mellitus. There are many complications of diabetes mellitus but neuropathy is most common and probably bilaterally affecting the limbs. Neuropathy causes de-myelination of small and large nerve which leads to pain and sensation loss. This sensory loss caused by diabetic neuropathy leads to changes in balance and walking and patients are more prone to lower limbs injury and amputation.^{1,2,3}

It is proved that little modification in living pattern of life, healthy diet and little exercise can greatly reduce the chances of diabetes and its complications like neuropathies. Exercises have been always a first line of treatment for diabetes and are the most effective way of controlling it. The recent research showed that physical exercises have an impact on controlling diabetes type 2.⁴

Others studies like importance of physical activity and diet control also proved that the risk of complications by diabetes mellitus reduced by 58%. Another clinical trial proved that only dietary modification and exercise alone are no useful whereas combination of diet and exercise are effective at same level.^{5,6}

A systemic review was done on the effects of planned exercises on HbA1c level. It was a 2 months study plan during which it had been proven that at the end of study duration the levels of HbA1c and body mass index was greatly reduced. However, it did not alter the weights of participants.^{7,8,9}

It has been proven that aerobic exercises and Physical activities are very helpful in managing many diseases by only controlling blood sugar level and improving the blood circulation and decreases the death rate in community. The part of community whose lifestyle is sedentary have higher chances of diseases than normal members. However, there is no proven results that exercises can lower blood pressure or lipids level. While there have been some results that exercise can reduce the level of cholesterol and

increase the level of HDL which are very helpful.¹⁰

Objective: This study was to determine the impacts of aerobic exercises on pain in diabetic neuropathic patients.

METHODOLOGY

A randomized controlled trial was done on 80 patients who fulfilled inclusion criteria of diabetic neuropathy having 40 to 70 years of age with no serious systemic illness and sensitivity. Coin toss method was used to randomize the patients in two groups in the Physical therapy department of District Head Quarter Hospital Layyah, Pakistan. Baseline measurements and demographic data were taken before starting exercise plans. Patients were divided into two groups (group A) treatment group and (group B) control group. Treatment plan consisted on 10 weeks program. Group A was given Aerobic exercises plan like cycling, treadmill walking and Group B was given Strengthening exercises like pulley exercises, dumbbell exercises for a period of 30-minute session thrice a week initially which was later on increased to Four days a week. Data was analyzed via SPSS20 version. Inferential statistics and Paired sample t test were used for results.

RESULTS

Mean age of the participants was 45.73 ± 11.279 in group A whereas mean age was 4.00 ± 9.91 in group B.

Table-1.1 Within Group Comparison Physical Exam Score

Groups	Pre-treatment (Baseline)	After treatment (10 week)	P-Value
Strengthening Group	$6.20 \pm .56$	$3.07 \pm .79$	$<0.001^*$
Aerobic Group	$5.53 \pm .91$	$1.07 \pm .59$	$<0.001^*$
*p-value significant <0.005			

In the table 1.1, Comparison of pre-test and post-test observations for physical exam score, within groups is summarized. $6.20 \pm .56$ was mean score in strength group, and

after treatment was 3.07 ± 0.79 while P value ($<0.001^*$) showing significant effect with intervention. Pretest value was 5.53 ± 0.91 and in posttest reading was 1.07 ± 0.59 ($<0.001^*$) showing significant improvement with the intervention of aerobic groups.

Table-1.2 Between Group Comparison Mean Difference Pre-test post-test reading Physical Symptom Score

	Strengthening Group	Aerobic Group	P-value
Mean difference	2.19 ± 0.40	4.76 ± 2.66	0.010
*p-value significant <0.005			

Table 1.2 showed comparison of mean of pre-test and post-test observation between groups. Mean difference of pre-test post-test score in strengthening group was 2.19 ± 0.40 and in aerobic group was 4.76 ± 2.66 ($P=0.010$) showing there is significant difference between mean score of both groups.

Table -2.1 Within Group Comparison 100 mm VAS

Groups	Pre-treatment	After	P-value
Aerobic Group A	79.1 ± 8.9	39.2 ± 8.4	$<0.001^*$
Strengthening Group B	69.2 ± 9.2	38.1 ± 9.6	$<0.001^*$

Comparison of pre-test post-test observation of 100 mm VAS, within groups is summarized in table 2.1. Mean score of pain in aerobic group in measurement was 79.1 ± 8.9 and after treatment was 39.2 ± 8.4 ($<0.001^*$) showing significant effect with intervention of this group. Mean 100 mm VAS score pre-test readings were 69.2 ± 9.2 and in post-test reading was 38.1 ± 9.6 ($<0.001^*$).

Table -2.2 Between Group Comparison Mean Difference Pre-test Post-test reading 100mm VAS

	Aerobic group	Strengthening group	P-Value
Mean difference	41.0 ± 12.86	30.06 ± 13.6	0.032
*p-value significant <0.005			

Between groups comparison is summarized in table 2.2. First group pre-test post-test value was 41.00 ± 12.86 and in second group was 30.06 ± 13.62 ($P=0.032$).

DISCUSSION

The study aimed to find the effects of aerobic exercises on pain in diabetic neuropathy. After the end of 10 weeks treatment sessions the level and score of pain was significantly reduced in Aerobic exercise group as compared to strength training group. It is noted that sensory nerves responded more as compared to other nerve in case to adapt to activity.

Kludding et al performed a study in which they used Aerobics and Resistance exercises for 10 week which showed that diabetic condition and nerve fibers conductivity had improved. [11]

High levels of glucose are always harmful to body and have so many effects on body like cardiac issues and diabetes. The only way to control complications of these diseases is to control blood glucose level. [12] Hogikyan proved that nerves of patients having diabetes are sensitive to ischemic pressure and are easily damaged by such pressure so the high oxygen concentration by Aerobics can prevent these injuries easily. [Hogikyan, 1999]

In this study both aerobic and strengthening exercises were incorporated to see the effect on diabetic neuropathy patients and determine which one has better outcomes. Both exercises

improved blood flow in the body however the Aerobic exercises were much better than Strength training group in managing symptoms of pain and blood circulation.

CONCLUSION

Aerobic exercises improve the intensity of pain in diabetic neuropathy patients while control group have no improvement of pain. While both experimental and control group showed some improvement by exercises but intensity of pain only improved by Aerobic Exercises.

REFERENCES

1. CHEN, Y.-W., HSIEH, P.-L., CHEN, Y.-C., HUNG, C.-H. & CHENG, J.-T. 2013. Physical exercise induces excess hsp72 expression and delays the development of hyperalgesia and allodynia in painful diabetic neuropathy rats. *Anesthesia & Analgesia*, 116, 482-490.
2. COLBERG, S. R., SIGAL, R. J., FERNHALL, B., REGENSTEINER, J. G., BLISSMER, B. J., RUBIN, R. R., CHASAN-TABER, L., ALBRIGHT, A. L. & BRAUN, B. 2010. Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes care*, 33, e147-e167.
3. DIXIT, S., MAIYA, A. G. & SHASTRY, B. 2014. Effect of aerobic exercise on peripheral nerve functions of population with diabetic peripheral neuropathy in type 2 diabetes: a single blind, parallel group randomized controlled trial. *Journal of Diabetes and its Complications*, 28, 332-339.
4. VOULGARI, C., PAGONI, S., VINIK, A. & POIRIER, P. 2013. Exercise improves cardiac autonomic function in obesity and diabetes. *Metabolism*, 62, 609-621.
5. SONG, C. H., PETROFSKY, J. S., LEE, S. W., LEE, K. J. & YIM, J. E. 2011. Effects of an exercise program on balance and trunk proprioception in older adults with diabetic neuropathies. *Diabetes technology & therapeutics*, 13, 803-811.
6. STRECKMANN, F., ZOPF, E. M., LEHMANN, H. C., MAY, K., RIZZA, J., ZIMMER, P., GOLLHOFER, A., BLOCH, W. & BAUMANN, F. T. 2014. Exercise intervention studies in patients with peripheral neuropathy: a systematic review. *Sports medicine*, 44, 1289-1304.
7. SIGAL, R. J., KENNY, G. P., WASSERMAN, D. H. & CASTANEDA-SCEPPA, C. 2004. Physical activity/exercise and type 2 diabetes. *Diabetes care*, 27, 2518-2539.
8. SINGLETON, J. R., MARCUS, R. L., JACKSON, J. E., K. LESSARD, M., GRAHAM, T. E. & SMITH, A. G. 2014. Exercise increases cutaneous nerve density in diabetic patients without neuropathy. *Annals of clinical and translational neurology*, 1, 844-849.
9. SINGLETON, J. R., SMITH, A. G. & MARCUS, R. L. 2015. Exercise as therapy for diabetic and prediabetic neuropathy. *Current diabetes reports*, 15, 120.
10. BROWN, D., CLAFFEY, A. & HARDING, R. 2016. Evaluation of a physiotherapy-led group rehabilitation intervention for adults living with HIV: referrals, adherence and outcomes. *AIDS care*, 28, 1495-1505.
11. KLUDING, P. M., PASNOOR, M., SINGH, R., JERNIGAN, S., FARMER, K., RUCKER, J., SHARMA, N. K. & WRIGHT, D. E. 2012. The effect of exercise on neuropathic symptoms, nerve function, and cutaneous innervation in people with diabetic peripheral neuropathy. *Journal of Diabetes and its Complications*, 26, 424-429.
12. KUNITOMI, M., TAKAHASHI, K., WADA, J., SUZUKI, H., MIYATAKE, N., OGAWA, S., OHTA, S., SUGIMOTO, H., SHIKATA, K. & MAKINO, H. 2000. Re-evaluation of exercise prescription for Japanese type 2 diabetic patients by ventilatory threshold. *Diabetes research and clinical practice*, 50, 109-115.