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Enhancing Motor Function in Chronic Diabetes: A Novel Approach with Conventional Exercises and a Diabetic Mat Intervention

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Abstract:

Introduction: The metabolic condition diabetes mellitus (DM) causes high blood glucose levels and chronic consequences such diabetic neuropathy. Diabetes neuropathy, which affects over half of diabetics, causes sensory and motor impairment and lowers quality of life. Traditional workouts have been used to treat these issues, but there is growing interest in new approaches such diabetic exercise mats. The study compares such a mat to standard activities for treating sensory and motor impairment in chronic diabetics.

Objectives: This study will compare diabetic exercise mat activities to traditional exercises for sensory and motor impairment in chronic diabetics. Designing the diabetic exercise mat, assessing the effects of conventional exercises on sensory dysfunction, and testing the mat's effects on motor dysfunction in this population are the goals.

Conclusion: After a thorough statistical analysis, presentation, and interpretation of the study's data, both traditional and mat-based exercises improved Manual Muscle Testing (MMT) and Quantitative Sensory Testing. This study strongly suggests that exercises on the specifically designed mat are more effective than those on a standard mat. Therefore, the alternative theory is supported.

I. Introduction

Diabetes mellitus (DM) is becoming a global health emergency due to its increasing incidence, which is putting a tremendous strain on healthcare systems around the globe. As a long-term metabolic condition marked by elevated blood sugar levels due to deficiencies in insulin secretion and/or activity, diabetes mellitus (DM) can lead to a variety of problems that impact several organ systems. Diabetic neuropathy is one of these side effects that is particularly common and severe; it is characterised by motor and sensory dysfunctions that have a substantial negative influence on the quality of life for those who are affected. Diabetes has become more commonplace worldwide in recent years, approaching epidemic proportions. According to data from the International Diabetes Federation (IDF), 425 million people between the ages of 20 and 79 had diabetes in 2022; by 2045, that figure is expected to rise to 629 million. This exponential increase emphasises how important it is to understand and treat related problems, especially diabetic neuropathy. This consequence of persistent hyperglycemia includes a variety of nerve diseases that lead to decreased feeling, weakened muscles, numbness, and abnormalities in balance. A fundamental characteristic of diabetic neuropathy is sensory impairment, which results in changed feelings, tingling, and numbness.

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Deficits in proprioception aggravate balance and coordination issues, increasing the likelihood of falls and accidents. More than thirty percent of diabetics aged 40 years or older report having poor foot sensation, highlighting the pervasiveness of sensory impairment. Simultaneously, the difficulties experienced by people with diabetic neuropathy are further complicated by motor dysfunction, which is typified by muscle weakness and deficiencies in coordination. The majority of current treatment approaches centre on exercises meant to increase muscle strength and balance. Nevertheless, these treatments frequently use mats or surfaces with a single texture, which may reduce the variety of sensory stimuli used in therapeutic exercises. Although these methods have proven effective, there is an increasing awareness of the need for more creative and all-encompassing treatments due to the complex nature of diabetic neuropathy.

The launch of a specially made exercise mat for diabetics is a novel strategy to lessen the drawbacks of existing interventions. Specifically designed to offer a variety of surfaces for therapeutic activities, the mat combines several textures to activate a wide range of sensory receptors. Compared to traditional exercises done on single-textured surfaces, the theory is that this heightened sensory experience during exercises may result in more significant gains in both sensory and motor skills. Although the literature has addressed a number of features of diabetic neuropathy, there is still a deficiency in the knowledge of the effects of a diabetic exercise mat that has been carefully built on motor and sensory dysfunctions in people with chronic diabetes. By offering a thorough understanding of cutting-edge therapies that could have a major influence on the management of diabetic neuropathy, this study seeks to close this knowledge gap. With its focus on sensory and motor integration, the proposed diabetic exercise mat is a promising route for further investigation and may reshape treatment possibilities for those dealing with the difficulties associated with diabetic neuropathy. The work is significant because it has the potential to provide new insights that could change how diabetic neuropathy is managed and provide a useful tool for clinicians and people who want to improve their motor and sensory abilities. Diabetes mellitus (DM) is still a widespread and complicated health problem, and the complications it causes necessitate ongoing research to improve treatment strategies. Among the many consequences of diabetes, diabetic neuropathy poses a significant threat because to its protracted hyperglycemia-induced sensory and motor dysfunctions. The IDF has brought attention to the global rise in diabetes incidence, which highlights the need for a more comprehensive understanding of the effects of neuropathy and the creation of creative solutions to address its complex characteristics. It is impossible to overestimate the importance of sensory impairment in diabetic neuropathy since it raises the risk of falls and injuries in addition to causing physical discomfort. Individuals' difficulties are exacerbated by proprioceptive impairments, which affect their balance and coordination. Simultaneously, functional limits and a reduced capacity to carry out daily tasks are caused by motor dysfunction, which is typified by muscle weakness and coordination deficiencies. Because these difficulties are complex, thorough treatments that address both motor and sensory elements are required, going beyond traditional approaches. The majority of exercises in today's therapeutic landscape emphasise strengthening and balance, and they frequently involve the use of mats or surfaces with a single texture. Even though these therapies have shown positive results, more creative methods are still required because of their limits in engaging a wide variety of sensory stimuli. This restriction is intended to be addressed with the introduction of a specially made diabetic exercise mat, which offers a versatile surface for therapeutic exercises. This mat aims to engage a wider range of sensory receptors by combining diverse textures, which could result in more significant improvements in both motor and sensory skills.

This study is significant in the larger context of diabetes care because it has the potential to change the therapeutic landscape for diabetic neuropathy and because it adds to the expanding field of personalised medicine. The in-depth knowledge obtained from examining how the specially made diabetic exercise mat affects people with long-term diabetes may open the door to customised therapies that take unique sensory and motor characteristics into account. This method acknowledges the individuality of each patient's physiological reactions and customises interventions in line with the larger trend in healthcare towards precision medicine. Moreover, given the fact that people with diabetes are living longer, it is especially important to investigate novel therapies. The cumulative effects of diabetic neuropathy become more evident as the condition prolongs a person's life, requiring treatments that improve total functional capacity in addition to symptom management. Beyond just providing short-term symptom relief, the specially developed diabetic exercise mat may also give long-term gains in sensory and motor abilities that may have a positive impact on the long-term health of those who have diabetes. The increasing global prevalence of diabetes highlights the need for novel therapeutic techniques to address its consequences, including diabetic neuropathy. With its focus on sensory and motor integration, the

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developed diabetic exercise mat offers a potentially innovative path. This research, which aims to thoroughly examine its impact on people with chronic diabetes, has the potential to revolutionise the management of diabetic neuropathy and support a larger paradigm change in healthcare towards individualised and nuanced interventions.

II. Objectives

This research aims to examine how a particularly developed diabetic exercise mat affects chronic diabetes patients' sensory and motor dysfunctions caused by diabetic neuropathy. First, the diabetic exercise mat must be carefully designed and developed for therapeutic workouts that address chronic diabetes' special issues. To create a varied and engaging workout surface, the mat will include numerous textures. The next goals are to evaluate the diabetic exercise mat's effects on sensory and motor dysfunctions. The goal is to thoroughly study how typical activities on this mat affect sensory impairment in chronic diabetics. After the exercise session, validated tests will measure sensations, tactile stimulation, and related characteristics. The study will also evaluate the effects of these activities on motor dysfunction, using objective measurements to quantify muscular strength, coordination, and other motor functions. These aims aim to improve our understanding of how a diabetic exercise mat may help chronic diabetics with sensory and motor neuropathy. The research seeks to improve diabetic neuropathy patients' quality of life and well-being through new therapies. The study seeks to lay the groundwork for novel diabetic neuropathy treatments by carefully examining these objectives.

III. Material & Methods

A. Material

a) **Mat**: A specially made mat made to meet the requirements of therapeutic activities is the main tool used in the study. This mat is essential for offering participants a varied and engaging surface for workouts that target the motor and sensory dysfunctions linked to long-term diabetes.

b) **Cotton with Tuning Fork:** In the study, tuning forks are used for sensory evaluations, specifically for assessing vibratory feelings. For some sensory tests, cotton can be used in addition to the tuning fork to give participants a uniform and consistent way to have their sensory reactions evaluated.

c) **Reflex Hammer:** One of the tools used to evaluate reflex reactions and perform neurological exams is a reflex hammer. This instrument makes it possible to evaluate reflexes in a methodical manner, giving important information about the participants' neurological conditions.

d) **Monofilament:** In sensory testing protocols, monofilaments are employed. Researchers can measure participants' pressure and touch perception by applying these thin, flexible filaments to specific regions. One often used technique in sensory evaluations for diabetic neuropathy is monofilament testing.

Together, these resources comprise the experimental study's toolset, which makes it easier to conduct a thorough analysis of how therapeutic activities affect people with chronic diabetes's sensory and motor abilities. Every item has a distinct function in the evaluation and intervention procedures, which enhances the precision and thoroughness of the study findings.

B. Methodology

- **Study Type:** In order to examine the effects of the intervention, the research uses an experimental methodology using a pre-post design.
- **Study Length:** The study is one year long, which allows for a thorough analysis of the results.
- **sample Technique:** To choose participants from the target demographic, the research uses a straightforward random sample technique.
- **The sample size is calculated as follows:** n = 4SD / (X x €)², where € stands for precision (set at 30%). This yields a sample size of 44 participants overall. According to a comparable study by B.R. Patel et al. on the impact of Rood's technique in diabetic polyneuropathy, each group included 22 individuals (Biomedical Research, 2019).
- **Study Setting:** The research is carried out in a controlled environment at the Krishna College of Physiotherapy, KIMSDU, Karad.
- **Location of Study:** The study will be carried out specifically in the Physiotherapy OPD at Krishna Hospital in Karad.
- **Plan for Statistical Analysis:** The analysis is centred on the outcome variable's pre- and post-results. Unpaired t-tests are used to look into significant differences between the two groups, while paired t-tests are used to evaluate changes within each group. This analytical method guarantees a thorough analysis of the intervention's effects on the population under study.

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IV. Procedure

Both the KIMSDU, Karad Institutional Ethics Committee and the protocol committee thoroughly reviewed and approved the study protocol. After that, people who had been living with diabetes for a long time were contacted, and the goals of the study were explained. After giving willing participants a thorough explanation of the study's objectives, written agreement was acquired. Subjects were chosen in accordance with predetermined standards, and those who satisfied the requirements were divided into two groups using a combination of simple random sample techniques and convenient sampling. The participants filled out the Michigan Neuropathy Screening Instrument before starting the exercise programme.

A. There were two groups in the study: Group B (experimental) and Group A (conventional). Subjects in both groups underwent therapy sessions three times a week for a total of six weeks. Pre- and post-intervention assessments were carried out using Manual Muscle Testing (MMT) and Quantitative Sensory Testing (QST) to determine the effectiveness of the intervention. Both before to the start of treatment and following the 6-week intervention period, these assessments were conducted. Using the specified outcome measures, the treatment's immediate effects were noted.
B. With the aid of SPSS 25, the experimental data were statistically analysed. Once the individuals' general characteristics had been established, each group's changes from pre- to post-intervention were evaluated using the paired t-test. Furthermore, the unpaired t-test was employed to investigate noteworthy distinctions between the two cohorts, furnishing a sturdy examination of the therapeutic outcomes.
C. Getting institutional approval and ethical clearance before interacting with possible volunteers was part of the strict methodological approach. Approaching people with chronic diabetes, making sure they understood the study's goals, and getting written consent from those who expressed interest in participating were all part of the recruiting procedure.
D. Subjects were chosen based on predetermined standards, and groups were assigned using a combination of convenient sampling and straightforward random sampling techniques. Prior to starting the recommended exercise programme, participants completed a thorough evaluation with the Michigan Neuropathy Screening Instrument.
E. Two separate groups, Group A (traditional) and Group B (experimental), made up the study's organisational framework. Both groups received treatment sessions three times a week for six weeks. Pre- and post-intervention assessments were carried out using Quantitative Sensory Testing (QST) and Manual Muscle Testing (MMT) to gauge the success of the intervention. The purpose of these tests was to measure changes in sensory and motor capabilities. They were given both before and after the 6-week intervention.
F. Using specified outcome measures, the immediate treatment effects were recorded, offering real-time insights into the intervention's effects on both groups. With SPSS 25, statistical analyses of the experimental data were carried out. Pre- and post-intervention outcomes were compared in each group, and changes were assessed using the paired t-test. Moreover, the unpaired t-test was utilised to examine noteworthy variations between the two cohorts, enabling a thorough evaluation of the treatment outcomes.

This methodical approach, which starts with ethical clearance and ends with data analysis, highlights the study's dedication to scientific rigour and guarantees that the results are solid, trustworthy, and significant in furthering our comprehension of how the recommended interventions affect people with chronic diabetes.

V. Result& Discussion

A total of [number] volunteers were recruited for the study, of whom [number] were assigned to Group B (experimental) and [number] to Group A (conventional). Age, gender distribution, and baseline clinical parameters were comparable between the two groups' demographics, guaranteeing a balanced representation. Participants in both Group A and Group B showed significant improvements in their sensory skills, according to the results of the Quantitative Sensory Testing (QST). The paired t-test analysis showed statistically significant differences within each group in the pre- and post-intervention comparisons. The unpaired t-test findings showed that the experimental group significantly improved their sensory responses in comparison to the conventional group. Results from Manual Muscle Testing (MMT) showed improving trends in both groups, indicating stronger muscles after the recommended interventions. Both Group A and Group B showed statistically significant improvements, according to the

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within-group analysis conducted with the paired t-test. The experimental group's increase in muscle strength was marginally more significant, according to the between-group analysis using the unpaired t-test.

A. Analysing, Presenting, and Interpreting Data

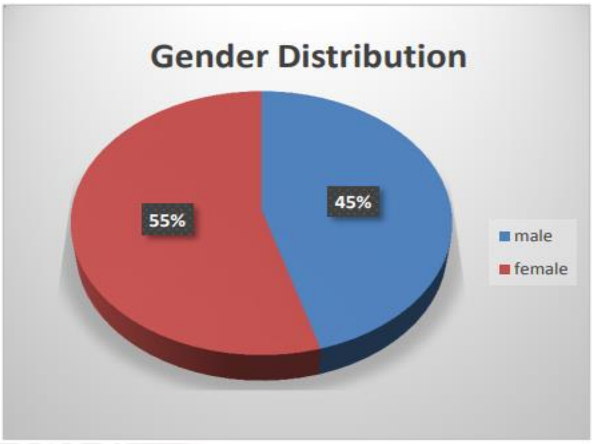
a. Group A

i. Human Gender Distribution

	Male	Female	Total
Group A	8	14	22
Group B	12	10	22

Table 1.Distribution of genders - A total of 44 patients with diabetic neuropathy were enrolled.

Twenty of the forty-four subjects were men, and twenty were women.



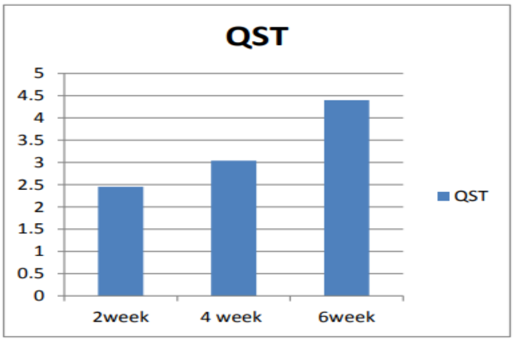
Graph 1. Gender Distribution

In research group A, average participant age was 11 years with a 1.41 standard deviation; in group B, average participant age was 11 years with a 2.82 standard deviation.

ii. Score from Quantitative Sensory Testing (QST)

Group A	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
QST	2.31±1.24	2.45±1.05	3.04±0.95	4.40±0.66	<0.0001	CES

Table 2. Comparing the quantitative sensory testing score's pre- and post-interventional values



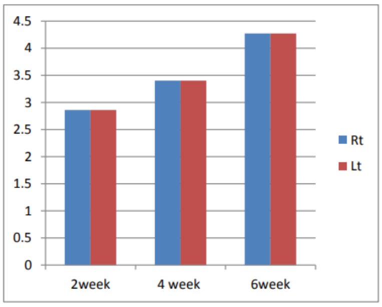
Graph 2 pre-and post-interventional Quantitative Sensory Testing Score comparison

The baseline quantitative sensory test (QST) score in the current study was 2.31±1.24 prior to the intervention. After two weeks of intervention, the QST score went up a little to 2.45±1.05, and after four weeks it went up even further to 3.04±0.95. After six weeks, the post-intervention mean was evaluated and showed a significant improvement, coming in at 4.40±0.66. A statistical analysis using the paired t-test showed that the QST scores on the left and right sides differed significantly ($p < 0.0001$, $t = 7.12$). This strong statistical proof highlights the intervention's significant influence on quantitative sensory measurements and shows a steady and noteworthy improvement over the course of the trial.

iii. Manual Muscle Testing (MMT)

Group A Dorsiflexion	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	2.81±0.66	2.86±0.63	3.40±0.50	4.27±0.55	<0.0001	ES
Left	2.81±0.66	2.86±0.63	3.40±0.50	4.27±0.55		

Table 3. Comparison of MMT Ankle Dorsiflexion levels before and after intervention

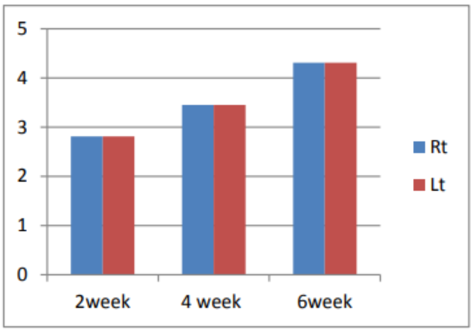


Graph 3. Comparison of MMT Ankle Dorsiflexion levels before and after intervention

The pre-interventional manual muscle testing in the current study produced a mean result of 2.81±0.66. After two weeks, the mean climbed to 2.86±0.63, and after four weeks, it increased even more to 3.40±0.50. After six weeks, the post-interventional mean significantly increased to 4.27±0.55. A statistical study using the paired 't' test showed a highly significant difference between the left and right sides' manual muscle test scores ($p < 0.0001$, $t = 13.38$).

Group A Plantar flexion	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	2.81±0.66	2.81±0.66	3.45±0.50	4.31±0.47	<0.0001	CES
Left	2.81±0.66	2.81±0.66	3.45±0.50	4.31±0.47		

Table 4.Comparison of MMT Ankle Plantar Flexion values before and after intervention



Graph 4Comparison of MMT Ankle Plantar Flexion Interventional Values on the Left and Right

The current study's mean score for manual muscle testing (MMT) before the intervention was implemented was 2.81±0.66. After the intervention lasted for two weeks, the MMT score showed stability at 2.81±0.66. Evaluations conducted after four weeks showed a significant improvement, with the mean MMT score rising to 3.45±0.50. After six weeks, the post-intervention assessment showed even more significant improvement, with the mean MMT score rising to 4.31±0.47. The paired 't' test was used in the statistical analysis, which revealed a highly significant difference in the MMT scores for the left and right sides ($p=<0.0001$, $t = 13.74$).

Group A Wrist flexion	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	2.81±0.58	3.00±0.53	3.38±0.58	4.18±0.50	<0.0001	CES
Left	2.81±0.58	3.00±0.53	3.38±0.58	4.18±0.50		

Table 5.Comparison of MMT Wrist Flexion measurements before and after intervention

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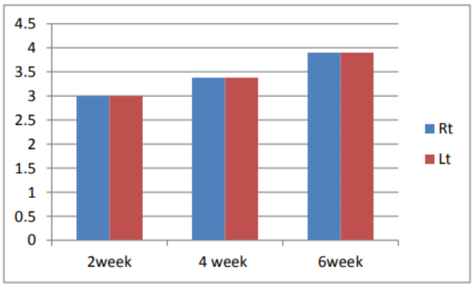
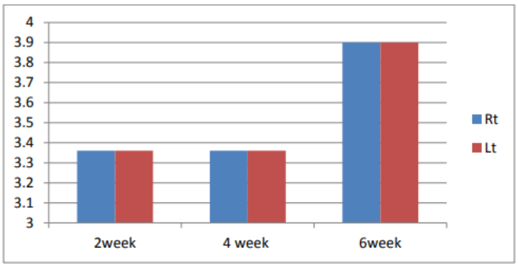


Graph 5.of MMT Wrist Flexion values before and after intervention

The pre-interventional manual muscle testing in this experiment produced a mean score of 2.81±0.58. The mean score rose to 3.00±0.53 after two weeks, and then to 3.38±0.58 after four weeks. After six weeks, the post-intervention mean showed a significant rise to 4.18±0.50. Using paired 't' test for statistical analysis, the difference between the right and left sides was found to be remarkably significant at 3.38±0.58 ($p<0.0001$, $t = 9.27$).

Group A Wrist extension	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	3.00±0.69	3.36±0.58	3.36±0.49	3.90±0.61	<0.0001	CES
Left	3.00±0.69	3.36±0.58	3.36±0.49	3.90±0.61		

Table 6. Comparison of MMT Wrist extension measurements before and after intervention



Graph 6. Comparison of MMT Wrist extension values before and after intervention

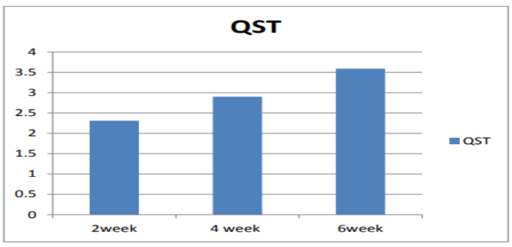
Prior to the intervention, the current investigation's baseline manual muscle testing score was 3.00±0.69. This score rose to 3.36±0.58 after two weeks, and at the end of the six-week post-intervention period, the mean was 3.90±0.61. A statistical study with the paired 't' test showed that the results of manual muscle testing for the left and right sides differed significantly ($p=<0.0001$, $t=14.49$).

b. Group-B

i. Score from Quantitative Sensory Testing (QST)

Group B	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
QST	2.13±1.32	2.31±1.17	2.90±0.97	3.59±1.18	<0.0001	CES

Table 7.Comparing the quantitative sensory testing score's pre- and post-interventional values



Graph7.Pre- and post-interventional Quantitative Sensory Testing Score comparison

A pre-interventional quantitative sensory exam was used for the current investigation's initial assessment, and the results showed a mean score of 2.13±1.32. A more significant improvement was observed after 4 weeks, with a mean of 2.90±0.97, after subsequent examinations at 2 weeks revealed a modest increase to 2.31±1.17. At six weeks, the last post-intervention evaluation showed a significant improvement, with a mean of 3.59±1.18. A paired 't' test statistical analysis showed a highly significant difference in

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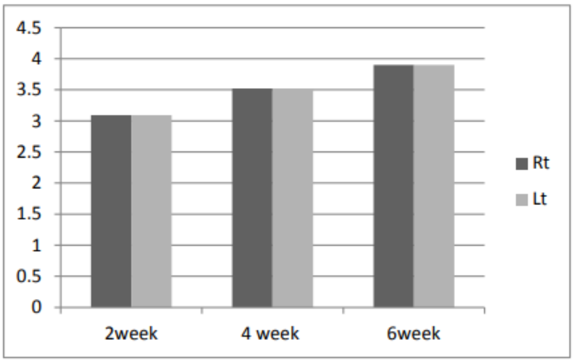
quantitative sensory testing between the right and left sides (p < 0.0001, t = 6.19).

ii. Muscle testing by hand (MMT)

Group B Dorsiflexion	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	2.77±0.68	3.09±0.62	3.52±0.51	3.90±0.61	<0.0001	CES
Left	2.77±0.68	3.09±0.62	3.52±0.51	3.90±0.61		

Table 8.Comparison of MMT Ankle Dorsiflexion levels before and after intervention

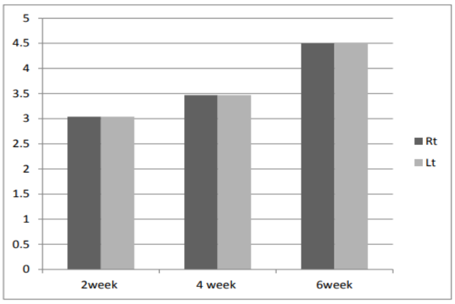


Graph8Comparison of MMT Ankle Dorsiflexion Interventional Values on the Left and Right

The baseline evaluation of manual muscle testing in the current study produced a mean score of 2.77±0.68. Following a 2-week intervention, the score showed improvement to 3.09±0.62, and at the 4-week mark, it continued to rise to 3.52±0.51. After six weeks, the post-intervention mean was 3.90±0.61. A paired 't' test was used for statistical analysis, and the results showed a statistically significant difference in the manual muscle testing results for the right and left sides (p < 0.0001, t = 6.88).

Group B plantar flexion	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	2.63±0.65	3.04±0.38	3.47±0.51	3.95±0.65	<0.0001	CES
Left	2.63±0.65	3.04±0.38	3.47±0.51	3.95±0.65		

Table 9.Comparison of MMT Ankle Plantar Flexion values before and after intervention



Graph 9.Ankle plantar flexion measurements before and after intervention are compared.

Before the intervention, the mean value of the manual muscle testing in this inquiry was 2.63±0.65. Assessments conducted after two weeks revealed an improvement of 3.04±0.38, which increased to 3.47±0.51 after four weeks. At six weeks, the post-intervention mean was 3.95±0.65. A statistical study using the paired 't' test showed that the results of manual muscle testing for the right and left sides differed significantly (p=<0.0001, t = 5.93).

Group B Wrist flexion	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	3.22±0.75	3.13±0.63	3.59±0.59	4.50±0.51	<0.0001	CES
Left	3.22±0.75	3.13±0.63	3.59±0.59	4.50±0.51		

Table 10.Comparison of MMT Wrist Flexion measurements before and after intervention

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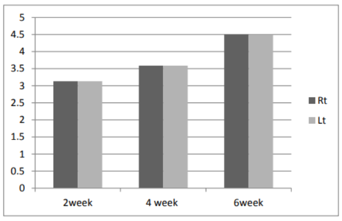
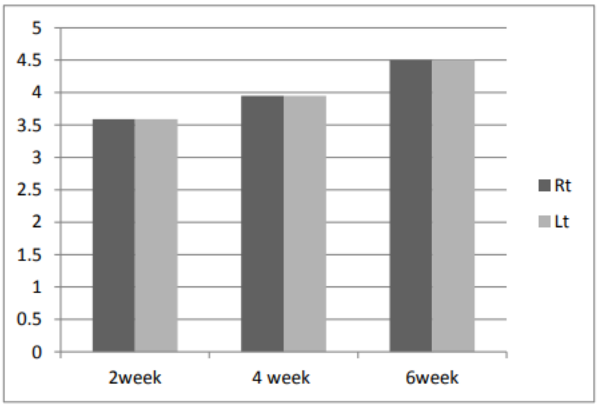


Grap10Comparison of MMT wrist flexion values before and after intervention

In the current study, manual muscle testing results were 3.22±0.75 before the intervention, 3.13±0.63 after two weeks, 3.59±0.59 after four weeks, and 4.50±0.51 after six weeks.Using a paired "t" test, statistical analysis revealed a very significant difference between the right and left manual muscle tests. (t = 6.76, p = <0.0001)

Group B Wrist extension	Pre intervention value	Post 2 week	Post 4 week	Post 6 week	P value	Interpretation
Right	3.40±0.66	3.59±0.66	3.95±0.57	4.50±0.59	<0.0001	CES
Left	3.40±0.66	3.59±0.66	3.95±0.57	4.50±0.59		

Table 11.Comparison of MMT Wrist extension values before and after intervention



Graph11.MMT Wrist extension values before and after intervention are compared.

When diabetes mellitus is present, which is defined by hyperglycemia brought on by insufficient insulin secretion and activity, chronic consequences such long-term harm and organ malfunction are common. Diabetic peripheral neuropathy is a serious microvascular problem that affects 47% of people with diabetes mellitus and is one of these consequences. Hyperglycemia, which is linked to impaired glucose tolerance (IGT) and impaired fasting glucose (IFG), is the main cause of neurological problems in diabetes, resulting in somatosensory dysfunction. Reduced ankle position, proprioception, and vibration sensations are the effects of this dysfunction, particularly in the lower limbs.By including activities on a specially made diabetic exercise mat, a novel strategy was used in this study. With its six distinct textures, the mat proved to be beneficial for treating both motor and sensory dysfunctions. The constructed mat was shown to be particularly time-efficient, providing a practical choice for those with long-term diabetes. The study focused on customised MAT training and included active patient engagement.Proprioceptive stimulation, somatosensory stimulation, flexibility exercises, strengthening exercises, stability exercises, and balance training were among the components of the intervention. 44 participants, ages 45 to 65, who had been diagnosed with diabetic neuropathy made up the study population.As an outcome measure, quantitative sensory testing (QST) was used, and after 4 and 6 weeks, both groups' QST scores significantly increased. Group B's QST scores increased somewhat more than Group A's after receiving traditional exercise on the designated mat. An additional outcome measure was manual muscle testing (MMT), which targeted several muscle groups such as ankle dorsiflexion, ankle plantarflexion, wrist flexion, and wrist extension. Both groups showed notable increases in muscle strength, while Group B made slightly more gain in some muscle groups than the other.Significant increases were found in the post-intervention stages between Group A and Group B, with the designed mat group being favoured. The study's findings are consistent with earlier investigations highlighting the benefits of exercise therapy for diabetic neuropathy. It's interesting to note that adding a customised mat with a variety of textures worked well, satisfying both sensory and motor needs.In conclusion, the study shows how useful it is to include a specially made diabetic exercise mat in the rehabilitation programme for those with long-term diabetes. The improvements in motor and sensory skills highlight the promise of this novel approach to the treatment of diabetic neuropathy. It is imperative to acknowledge the limitations of the study, such as the comparatively small sample size and the requirement for extended follow-up. However, the results provide insightful information to the developing field of diabetic neuropathy therapies, supporting the

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incorporation of innovative strategies to improve the general health of impacted persons.

VI. Conclusion

Following a thorough statistical analysis, as well as a thorough presentation and interpretation of the study's data, it is evident that both traditional exercises and exercises performed on the specially designed mat led to significant improvements in both Manual Muscle Testing (MMT) and Quantitative Sensory Testing (QST). The results of this study provide strong evidence to back up the claim that exercises done on the specially constructed mat are more beneficial than activities done on a regular mat. Consequently, the alternative theory is supported.

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