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Effect of Yoga in addition to Pharmacotherapy on Symptomatic Depression and Quality of Life in Patients of Diabetic Neuropathy: A Pilot Study

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Abstract:-
Background: Neuropathy is a common diabetes complication that can't be treated. Diabetes mellitus causes insulin resistance or decreased insulin production. India is considered as the "diabetes world capital," with 98 million patients expected by 2030. 150 million people worldwide have diabetes mellitus, and this number could double by 2025.

Aim of this study: To see effect of 1 month of Yoga module practice on depression and quality of life in patients of Diabetic Neuropathy.

Materials and Methods: This study used n=10 type 2 diabetes mellitus patients from AIIMS Rishikesh's OPD. This study aims to determine the effect of 30 days of Yoga asanas on diabetic neuropathy patients' depression and quality of life. WHO-5 well-being index was used to measure life quality. 0-10 years of diabetes. DAN patient. Participants were asked to do daily yoga online with a yoga pro using Zoom. 30-45 minutes of yoga 6 days a week for 1 month. Subjects were given medications and food. After 30 days of Yogic practice, the PHQ-9 and WHO-5 Well-being index scores were repeated.

Results: Total 10 patients were included for this pilot study, mean age 59.4 and average BMI was 26.76 We found that yoga practice is beneficial for diabetic neuropathy patients in managing the symptoms of depression ($p < 0.005$) and improving quality of life ($p < .005$)

Conclusion: Yoga is a recognized non pharmaco-therapy. Yoga in addition to Pharmacotherapy is to be beneficial in managing symptoms of depression and to improving Quality of Life of Diabetic neuropathy patients.

Keywords:- *Yoga therapy, Diabetic Neuropathy, QOL, Depression.*

I. INTRODUCTION

Because of its high symptom burden and long-term effects, type 2 diabetes is a major cause of illness and death globally. Complications such as cardiovascular disease, retinopathy, nephropathy, and diabetic neuropathy are all common in patients with type 2 diabetes, especially those who have poor glycemic control. [1,2] Diabetic neuropathy (DN) is a frequent condition described as symptoms and signs of peripheral nerve impairment in a patient with diabetes mellitus (DM) who has ruled out other potential reasons of peripheral nerve dysfunction. [3] When compared to the West (1–2%) [4], India has a higher prevalence of diabetes (4.3 %).[5] Insulin resistance and cardiovascular death are probably more common in Asian Indians. Although the prevalence of DN in India is unknown, research from South India found that 19.1% of type II people with diabetes had peripheral neuropathy.[6] One of the most frequent causes of peripheral neuropathy is diabetes mellitus (DN). It is the most common reason for non-amputation and is more common than other diabetic complications in terms of hospitalization.[7] Diabetic autonomic neuropathy causes hidden cardiovascular disease and shortens life expectancy, with death occurring in 25% to 50% of patients around 5–10 years of diagnosis.[8] Two-thirds of diabetes people have clinical or subclinical neuropathy, according to estimates. Electrodiagnostic tests, as well as quantifiable sensory and autonomic testing, are required for the determination of subclinical DN. [9] Peripheral neuropathy is a common consequence in diabetic patients, with prevalence rates ranging from 5.3 to 47.6% in population and clinic-based studies. [10] Neuropathy can affect all diabetic patients, including those with insulin-dependent diabetes mellitus (IDDM), non-insulin-dependent diabetes mellitus (NIDDM), and secondary diabetic patients. The prevalence of neuropathy rises as diabetes mellitus progresses. Neuropathy was shown to rise from 7.5 percent on admitting to 50 percent after 25 years in research. [11] Diabetic neuropathy classified in four subcategories: (i) small fiber predominant neuropathy (ii) Radiculopathy (iii) Mononeuropathy and (iv) autonomic Neuropathy. [12]

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A. Risk factors for Diabetic neuropathy

Diabetic Neuropathy of any diabetic patient can be predicted by two predictors (i) Duration of diabetes and (ii) LEVEL OF Hemoglobin A1c (HbA1c). [13] Other metabolic markers linked to diabetic neuropathy, particularly in T2DM, like insulin resistance and hypertension, are typically associated with these two predictors. Others common risk factors are hypertriglyceridemia, hypertension, abdominal obesity and low high-density lipoprotein (HDL) levels [14,15], smoking, alcohol abuse, increased height and older age.[16]

B. Pathophysiology of Diabetic Neuropathy

Diabetic neuropathy is a rare peripheral nerve system neurodegenerative condition that primarily affects sensory axons, autonomic axons, and, to a lesser extent, motor axons**.** It's still unclear how diabetes mellitus affects sensory neurons. Diabetic neuropathy's 'stocking and glove' pattern of involvement indicates damage to the longest sensory axons first, with destruction of distant leg epidermal axons occurring before damage in more proximal limbs; as a result, diabetic neuropathy is referred to as a length-dependent neuropathy. [17] In this regard, the mechanism that lead to DNP are not fully known, while it is widely agreed that hyperglycemia's toxic effects are a key factor in the development of this complication. [18-20] Diabetic neuropathy is caused mostly by metabolic problems. The increased activity of the polyol pathway is caused by hyperglycemia, which is caused by reduced insulin production or insulin resistance. The first enzyme in this route, aldose reductase, catalysis the conversion of nicotinamide adenine dinucleotide phosphate (NADPH) to NADP, resulting in the synthesis of sorbitol from glucose. [18] Neuropathic pain is pain that is produced by a somatosensory nervous system injury or disease. Approximately 30–50% of diabetic neuropathy patients experience neuropathic discomfort, [21] It is most usually manifested as spontaneous (i.e., non-stimulated) burning pain in the foot. Brush-induced allodynia (pain triggered by a typically non-noxious stimulus) and paresthesia's are other positive sensory symptoms that patients can describe. This function optimally symptoms are frequently coupled by sensory impairments, and sufferers may often lament the contradiction that their legs are constantly aching while being sensation insensitive.[22]

C. Diagnosis and Screening of Diabetic neuropathy

Even though aberrations in lower-limb NCV and sensorimotor and motor nerve amplitudes assessed in nerve conduction velocity (NCS) provide even more evidence, the presence of more symptoms or signs of nerve dysfunction typically denotes higher certainty about the diagnosis [23], abnormalities in lower-limb nerve conduction velocity (NCV) and sensorimotor and motor nerve amplitudes assessed in NCV provide even more evidence. Diabetic neuropathy is diagnosed in the great majority of patients based only on their medical history and physical examination, with no extra testing required. [24,25] A loss of sensitivity to pinprick, temperature (usually cold), vibration, and proprioception in a' stocking and glove' distribution are clinical symptoms of diabetic neuropathy. The administration of the sensory stimuli to an area where normal reactions are indicated, such as the forehead, is used to evaluate these sensory modalities first. [26] Numbness, tingling, discomfort, weakness, and unsteadiness are all symptoms of diabetic neuropathy, which begin distally (at the toes) and move proximally then to the upper extremity digit when the lower-limb problems reach the knees. Early on in the onset of diabetic neuropathy and when detected with prediabetes, patients frequently exhibit primarily small-fiber neuropathy.[27] Additional testing may include plasma vitamin B12 levels, thyroid dysfunction test, "serum protein electrophoresis with" immunofixation, and indicators of autoimmune illnesses, depending on the clinical presentation. In atypical clinical presentations, cerebrospinal fluid evaluation with lumbar puncture to determine protein levels, genetic testing, and "MRI of nerve roots" and "peripheral nerves" are frequently required for the right diagnosis.[12]

Screening for diabetic neuropathy is recommended by the "American Diabetes Association (ADA)" and the Canadian Diabetes Association (CDA) at diagnosis and yearly for patients with T2DM, and 5 years after diagnosis and thereafter annually for people with T1DM. [23] Diabetic neuropathy should be screened at diagnosis and annually for t2dm patients and 5 years after assessment for patients with T1DM, and thereafter annually for people with T1DM9, [28]. Screening tests must be quick, accurate, and easy, and arguing for anything but these test models will result in a lack of screenings. Several basic sensory tests can be used to diagnose diabetic neuropathy [29,30]. The 10 g monofilament test, for example, can be used to forecast incident diabetic neuropathy [31].

D. Prevention and management

Exercising is emerging as an important diabetic neuropathy prevention approach. In one study, people with diabetes (without neuropathy) who got a weekly organized and supervised exercise routine raised their proximal leg Intraepidermal Nerve Fibre Density (IENFD) but IENFD held steady in patients receiving lifestyles advising. [32] The current care of diabetic neuropathy aims to improve glycemic control (mostly in T1DM patients), lifestyle adjustments (primarily in T2DM patients) [33], and neuropathic pain management. The best treatment for patients with T2DM is a combination of lifestyle changes, such as diet and exercise, as well as cholesterol and blood pressure control. Because glycemic management with a HbA1c aim of 6 increases mortality and has very little effect on neuropathic pain in individuals with T2DM,[33] it is not advocated as standard of therapy. [32,34,35] Exercise has been demonstrated to enhance neuropathy outcomes in patients with existing neuropathy in 3 uncontrolled studies and one small randomized study. In one trial, 32 individuals with neuropathic caused by decreased glucose tolerance were given a 12-month lifestyle treatment consisting of personalized diet and exercise. [36-39] **Because diabetic is a chronic that necessitates lifelong medication, monitoring, and dietary adherence, the number of patients face physical and mental health problems. Diabetes distress is a word used to express the emotional toll that diabetes has on people. [40]** Diabetic neuropathy has a substantial impact on quality of life. Individuals with

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diabetic neuropathy have a worse quality of life than patients without neuropathy, and this disparity began years before and continued for years after their neuropathic pain diagnosis. Furthermore, painful neuropathic pain has a particularly negative impact on quality of life. [41]

II. MATERIAL AND METHODS

A. Patient selection

Patients diagnosed with type 2 diabetes who visited an outpatient clinic for general medicine at AIIMS Rishikesh were all given a screening. Participants were required to be between the ages of 30 and 60, of either gender, have a stable diagnosed case of diabetic neuropathy, patient consent, a HbA1c of less than 11 percent, not be reliant on insulin, and be able to practise yoga.

B. Study Design:

This was a Pre-post in single arm pilot study that was conducted at the All-India Institute of Medical Sciences in Rishikesh between the months of March and April 2022. During the entirety of the course of the research, the principles that are mentioned in the Declaration of Helsinki were strictly adhered to.

C. Intervention

Patients took part in supervised yoga sessions taught by an experienced yoga instructor every morning for up to thirty days, with each session lasting for fifty minutes and taking place online. The total number of days that patient participated in the sessions was not specified. The compliance rate is forty-three percent, or four days out of every seven days.

[Table 1]

D. Outcomes:

The most important result WHO-5 well-being index used to see Quality of life, Depression and Anxiety scores as measured by the Patient Health Questionnaire (PHQ-9). We gathered some baseline information, such as ages and genders, BMI, weight and height. Patients were monitored for 30 days, during which outcome parameters were collected.

E. Statistical Analysis

Data were expressed as mean (Standard deviation) as well as Median [Interquartile range] for quantitative variables. The difference between values at baseline and 30 days was calculated for all the quantitative variables. We performed Paired t-test. A p-value of <0.05 was considered statistically significant. Statistical Analysis was performed using IBM SPSS software version 20.

F. Results:

We use ten patients for this pilot study, and their average ages are (59.40 ± 8.605), their average weight is (70.70 ± 11.126), their average height is (161.60 ± 8.195) and their average BMI is (27.11 ± 4.210) and their average duration of T2DM is (5.60 ± 1.578). By utilising the paired t-test, the absolute value of the PHQ-9 means, which was (4.700 ± 4.572), saw a substantial improvement. ($p = 0.010$). The use of the paired t-test revealed a statistically significant rise in the absolute value of the World Health Organization's Five Well-Being Index (WHO-5), which stood at 25.60 with a standard deviation of 12.394. ($p = 0.001$) .

[Fig 1]
[Table 2]
[Table 3]

III. DISCUSSION AND INTERPRETATION

In terms of age, years with diabetes, and years with painful symptoms, this sample (N = 10) exhibited similar demographic features to those reported in the literature. In this study, average ages are (59.40 ± 8.605), their average weight is (70.70 ± 11.126), their average height is (161.60 ± 8.195) and their average BMI is (27.11 ± 4.210) and their average duration of T2DM is (5.60 ± 1.578). These results matched those published by Gore and colleagues. Although the average age in this pilot study was higher than in Gore's group (74.6 vs. 59.40), the findings suggest that many Diabetic Neuropathy patients are older persons who have had diabetes for a long time. [42] Other chronic pain sufferers have been demonstrated to benefit from a formalised MBSR programme that incorporates mindfulness meditation. [43,44] In neuropathic pain populations, more research on the benefits of Yoga is needed. Recruitment bias, self-report assessments, generalisation, lose control over therapeutic intervention, and duration of research and follow-up were all limitations of the study. Although a convenience sample may eliminate potential participants, selection bias was reduced by assigning participants to the research and attention-placebo groups at random.

IV. CONCLUSION

Diabetic persons over the age of 40 are more likely to develop painful diabetic neuropathy. The longer any person have diabetes, the more likely they are to develop this consequence, which causes unpleasant and distressing symptoms. The goal of this study was to see if (i) Yoga protocol could improve QOL and depression people with Diabetic Neuropathy, and (ii) to see if Yoga protocol for Diabetic Neuropathy could be implemented in primary care. The findings of this study cannot be applied to the entire diabetes community. Participants were given the option to continue or start new therapies during the study, which could have compromised the study's internal validity.

S.No.	Name of the practice	Duration
1	Starting prayer: Asatoma Sat Gamaya	2 min
2	Asana Preparatory Sukshma Vyayamas and Shithilikarana Practices, Tadasana, Tiryak Tadasana, Katichakrasana, Bhujangasana, Pashchimottanasana, Malasana, Mandukasana, Ardhaustrasana, Ardhmatsyendrasana	20-25 min.
3	Pranayama Anulom-Vilom Naadi-shodhan Bharamari	10 min
4.	Kriya and Mudra-Bandh Kapalbhati Agnisara	5 min
5.	Meditation Savita dhyan [Meditation (for stress management for deep relaxation and silencing the mind)]	2 min
6.	Closing prayer: Sarvebhavantu Sukhinah	1 min

Table 1: Yoga Protocol

Conflicts of Interest: There is no any conflicts of Interest For this study.

A. Figures and Tables

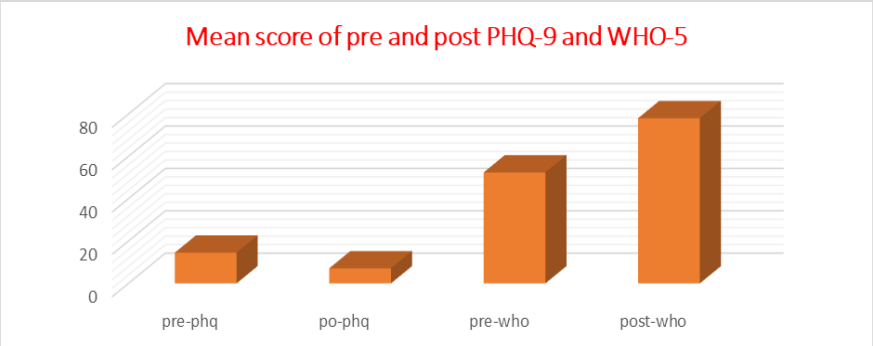

Fig.1: Graphical presentation of significant changes on both tools (PHQ-9 and WHO-5 wellbeing index)

Pre- PHQ-9: Pre score of Patients Health Questionnaire, **Post- PHQ-9:** post score of Patients Health Questionnaire, **Pre-WHO-5:** Pre score of world health organization -5 wellbeing index and **post-WHO-5:** post score of world health organization -5 wellbeing index

	N	Minimum	Maximum	Mean	Std. Deviation
Age		**48**	**74**	**59.40**	**8.605**
Weight	**10**	**55**	**90**	**70.70**	**11.126**
Hight	**10**	**152**	**176**	**161.60**	**8.195**
BMI	**10**	**22**	**34**	**27.11**	**4.210**
Duration	**10**	**3**	**8**	**5.60**	**1.578**

Table 2: Demographics of Participants

		Mean	N	Std. Deviation	Std. Error Mean
Pair- (i)	**PHQ-9 pre**	**11.80**	**10**	**4.849**	**1.533**
	PHQ-9 post	**7.10**	**10**	**2.183**	**.690**
Pair- (ii)	**WHO-5 pre**	**52.40**	**10**	**14.167**	**4.480**
	WHO-5 post	**78.00**	**10**	**11.353**	**3.590**

Table 3: Paired Samples test

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