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Research Article

Yoga in Diabetic Peripheral Neuropathy

Potency of Yoga Therapy on Physiological Variables in Male's Diabetic Peripheral Neuropathy (DPN)

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Abstract: Peripheral neuropathy, a form of nerve damage brought on by diabetes and abnormally high blood sugar, was one of the chronic consequences. Studies reveal that the prevalence of Diabetes Peripheral Neuropathy (DPN) is high and riskier in Males than Females. Also, DPN participants have been examined crucially for physiological variables such as systolic and diastolic blood pressure and body mass index. This study aimed to analyze the potency of Yoga therapy on physiological variables in Males of the age group 35 to 70 having DPN. Yoga connects a person's physical, mental, and spiritual aspects to enhance their health and well-being. It has been proven to treat neurological diseases using Yoga therapy by combining the practice of focused posture (asana), controlled breathing (Pranayama), and meditation. Studies proved 30 males with DPN, 15 in each group, were chosen for the study from the Chennai & Chengalpattu district, Tamilnadu, India. The Experimental Group, Group-I, received a Yoga therapy practice and the control group, Group II, underwent it without any practice. The 12-week training period, six days per week, an hour in the morning. Paired sample t-test was conducted to analyze the data. The calculated 't' value of systolic, diastolic and BMI are 3.486, 2.828, and 1.060, respectively, for Group I and -0.371, -1.547, and -1.792 for Group II. The result shows that the negative t value of Group II shows no significant change in the physiological variables, and Group I data shows a significant improvement in the physiological variables. The calculated 't' value is greater than the table value of 2.14 with a degree of freedom of 14, except for BMI. An extension of the training period is suggested to improve the BMI value. This research study reveals that Yoga Therapy was a significantly more effective treatment for DPN.

Key Words: Yoga Therapy, Diabetes Peripheral Neuropathy, physiological Variables, paired sample t-test.

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1. INTRODUCTION

1.1. Diabetes

Diabetes is a disease that occurs when our blood glucose blood sugar is too high. Blood glucose is the main source of energy and comes from food. Insulin hormone made by the pancreas helps glucose from food to get into our cells and converts it into useful energy. However, sometimes our body doesn't make enough insulin or doesn't use insulin well. Glucose then stays in our blood and doesn't reach our cells. Infections, ulcers, discomfort, numbness, and dysesthesia of the extremities are a few of the foot abnormalities caused by diabetes, which is the most prevalent endocrinological illness worldwide. Physical inactivity is the greatest direct behavioural contributor to glucose intolerance and is regarded as one of the biggest global health issues. It is thought to lower the risk of developing diabetes and insulin levels and improve glucose tolerance and glycaemic management. Diabetes was initially noted in classical civilizations as a condition linked to "sweet urine" and severe muscle loss. High blood sugar (glucose) levels are a characteristic of diabetes mellitus, a set of metabolic illnesses caused by defects in insulin secretion. The term "sweet urine" refers to the overflow of glucose into the urine that results from high blood sugar levels (hyperglycaemia)[1-5]. According to the International Diabetes Federation, 425 million people worldwide are impacted by the twenty-first century's largest global epidemic of the twenty-first century, and it is reported that 73 million people in India are reportedly suffering from diabetes[6]. Studies reveal that the prevalence of Diabetes Peripheral Neuropathy (DPN) is high and riskier in Males than Females[7-10] DPN participants have been examined for crucial physiological variables such as systolic and diastolic blood pressure and body mass index. The main aim of this study was to analyse the potency of Yoga therapy on physiological variables in Males of the age group 35 to 70 having DPN. The experimental and control group was formed to initiate this study, with 15 men in each group. The experimental group underwent Yoga therapy as per the planned schedule with selected yogasanas, pranayama and OM meditation, whereas the control group continued with general medication without yoga therapy. The data captured are analysed using paired sample t-tests and reported in this article.

1.2. Signs and Symptoms of Diabetes

Fig 1. Signs and Symptoms of Diabetes[11]

Diabetes symptoms and indicators might vary from person to person, and sometimes there may be none at all. One of the symptoms that are frequently present is 1. Frequent urination (Polyuria), 2. Prolonged Thirst (Polydipsia), 3. Increasing Hunger (Polyphagia),4. Blurry eyes or trouble seeing (focus), 5. Fatigue, 6. Irritability and Mood change, 7. Loss of weight, 8. Dry Mouth, then 9. Constantly Sleepy, 10. Tired, 11. Tingling sensation or numbness in the hands or feet,12. Delayed wound healing.

1.3. Nervous system

The two main components of the body's neurological system are the central and peripheral nervous systems. The brain and spinal cord are parts of the central nervous system. Muscles, glands, and sensory organs are collectively referred to as the peripheral nervous system[12-14].

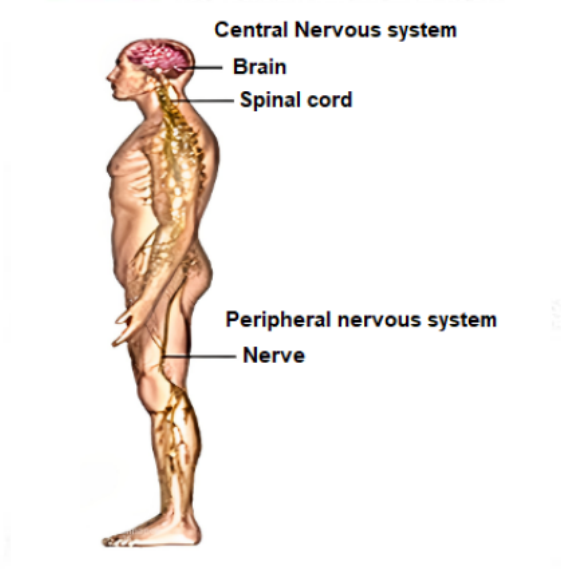


Fig 2. A Simplified View Nerve System (NS)

1.4. Peripheral Neuropathy

Peripheral neuropathy refers to the many conditions that involve damage to the peripheral nervous system. This vast communication network sends signals between the central nervous system (the brain and spinal cord) and all other parts of the body[15,16].

1.5. Classification of peripheral neuropathies

Peripheral neuropathy can be classified into more than 100 categories, each with its own symptoms. The symptoms differ depending on whether motor, sensory, or autonomic nerves are affected.

Table 1: Functions of Peripheral Nerves

Types of Peripheral Nerves	Functions
1.Motor Nerves	Control the movement of all muscles under conscious control, such as those used for walking, grasping things, or talking.
2. Sensory Nerves	Transmit information such as the feeling of a light, touch, temperature, or pain from a cut.
3. Autonomic nerves	Control organs regulate activities people do not control consciously, such as breathing, digesting food, and heart and gland functions.

Table 1 illustrates the involvement of motor nerves in the function of peripheral nerves. It controls all muscles under your conscious control, including those utilized for walking, grabbing objects, and speaking. The role of sensory nerves is to Send information like the temperature, the sensation of a light touch, or the pain from a cut. autonomic nerves Control organs to control unconscious human functions like breathing, food digestion, heartbeat, and glandular activity[17].

1.6. Diabetic peripheral neuropathy (DPN)

A condition that affects about 50% of diabetic persons is diabetic neuropathy [18,19]. The hands and lower limbs are most commonly affected by diabetic peripheral neuropathy (DPN) [20]. It causes loss of protective feeling, which results in continuous harm to feet that are not sensitive[21]. In addition, the balance and sensorimotor aspects of the gait were lost or impaired in DPN patients due to altered motor responses. Around 30% of DPN patients have balance and coordination issues[22-23].

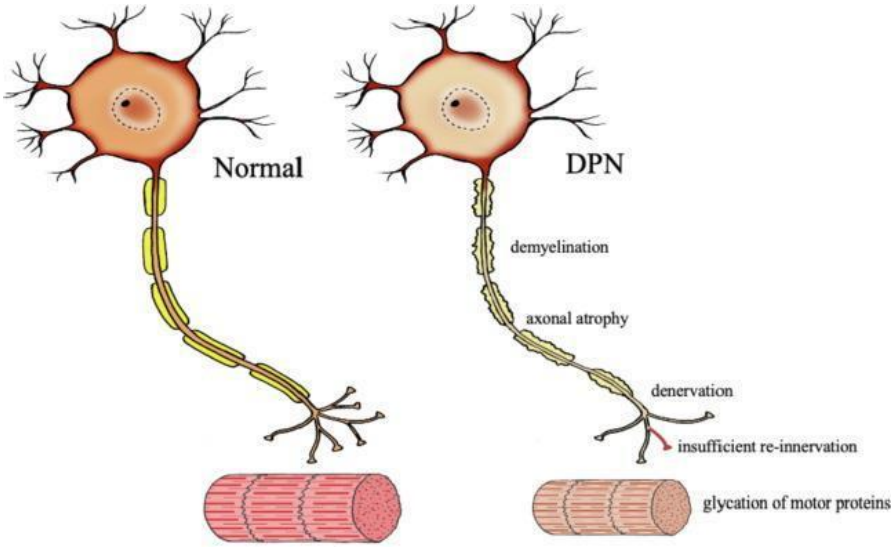


Fig 3: Depiction of nerve damage in DPN[24]

The main causes of abnormality in DPN are dorsal root ganglia neuronal apoptosis-induced damage to myelinated and unmyelinated fibres, segmental demyelination, segmental demyelination, predominantly distal axonal degeneration, basal lamina hypertrophy, onion bulb formations, and Wallerian degeneration. identified axonal degradation and subsequent morphological alterations in the myelinated and unmyelinated fibres[25-30].

1.7. Yoga System

Yoga is a combination of Body, Mind and Soul. It means balancing and harmonizing the body, mind, and emotions. It has concepts of all individual energy connected to universal energy, which greatly influences the nature of the universe. Yoga originated in India. Yoga practice is useful in the management of various lifestyle diseases, including diabetes. Psycho-neuro-endocrine and immune mechanisms are involved in the beneficial effects of yoga on diabetes. Incorporating yoga practice in daily life helps attain glycaemic control and reduces the risk of complications in people with diabetes[31-32]. Hypersensitivity to pain or touch, pain or cramps, a tingling, burning, or prickling feeling, and a loss of sensations such as proprioception, vibration, touch, and temperature are all possible signs of DPN[33]. The holistic method of yoga helps to strengthen the entire body. It is a closed-chain exercise performed with hands or feet in contact with the floor[34]. Yoga improves co-morbidities related to DPN, such as muscular strength, balance, balance confidence, sleep patterns, QoL, sadness and pain, and maybe a helpful technique for people with DPN[35-36].

1.8. Yoga System of DPN Treatment

Yoga is a form of exercise that integrates meditation, physical postures, and breathing exercises. Yoga eliminates anxiety, stabilizes the nervous system, and keeps gait balances in shape. It unites the mind, body, and spirit. Yoga involves resisting gravity by pushing and pulling while simultaneously stretching inward and outward. It has a rejuvenation method that addresses Paralysis, Sciatica, Migraine, Bell's palsy, Spondylitis, frozen shoulder, Hand-foot syndrome aching muscles, frozen joints, breathing difficulties, exertion in the muscles and difficulties with digestion Parkinson's disease, Diabetes, Nerve damage, Tremors, Muscle cramps and twitching due to neuropathic pain. Yoga may significantly improve balance, balance confidence, occupational performance, and satisfaction for adults with diabetic peripheral neuropathy. Yoga improves co-morbidities related to DPN, such as muscular strength, balance, balance confidence, sleep patterns, QoL, sadness, and pain, and maybe a helpful technique for people with DPN[37-39]. Yogasana effectively improved static and dynamic balance performance, lower extremity muscle strength, and reduced fear of falls among people with DPN. Yogasana intervention demonstrated marginally greater improvement in static and dynamic balance performance and lower extremity muscle strength compared to conventional exercise[40]. The Yoga exercises were performed for 30-40 minutes every day for 40 days in the SuryaNamaskar, Tadasana, Padmasana, Pranayama, Paschimothasan, Ardhamatyendrasana, Pavanamukthasana, Sarpasana and Savasana sequence. Their basal & post-40-day parameters were recorded for comparison. In the earlier review study, the median nerve conduction velocity in the right hand and left hand increased from 52.8 m/s to 53.87 m/s and 52.46 m/s to 54.75 m/s, respectively[41]. Patients were administered a comprehensive yogic breathing program and monitored to regularly practice yoga in addition to standard treatment of diabetes. At six months, quality of life and postprandial plasma glucose significantly improved[42]. Yoga has reduced co-morbidities related to DPN, such as muscular strength, balance, balance confidence, sleep patterns, QoL, depression, and pain. It is a helpful technique for people with DPN [43].

1.9. Methods of Yoga Therapy

There are various methods of Yoga Therapy to treat a patient according to the type of DPN condition.
I. Asanas Method (Physical posture)
II. Pranayama Method (Breathing Exercise)
III. Dyana Method (Meditation)

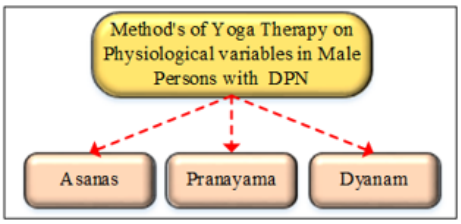


Fig 4: Methods of Yoga Therapy in DPN

I. Asanas Method: Yogasanas' also known as the practice of yoga postures and techniques in the treatment of health problems, refer to the practises used to prevent, decrease, or eliminate restrictions brought on by structural, physiological challenges[44].

II. Pranayama method: Pranayama is an awareness of breathing technique used in yoga; it focuses on correcting your breathing technique, so oxygen is delivered to the blood and brain effectively. According to recent research, practising pranayama positively impacts clinical concern measures[45].

III. Meditation is a practice where someone utilizes a method to train their attention and awareness and reach a cognitively clear, emotionally peaceful, and stable state. Examples of such methods include mindfulness or focusing the mind on a certain object, thought, or activity[46].

2. METHODOLOGY

Thirty men with Diabetic Peripheral Neuropathy (DPN) from Tamil Nadu, in the age group of 35 to 70 years, were chosen for this study. The participants were split into Group I and Group II as the Experimental Group and Control Group, respectively. Each group has fifteen participants. The study sample's data was examined for Physiological factors about pre and post-tests. The experimental group, i.e., Group I, received Yoga Therapy per the preplanned schedule, and the control group, i.e., Group II, had no such Yoga practices. Instead, they follow regular medication. The workflow of this study is shown in Figure 5. The study includes the physiological variables such as Systolic Blood Pressure, Diastolic Blood Pressure, and BMI (Body Mass Index) obtained before and after the test. The data is analyzed through the paired sample t-test using the statistical analysis tool.

Fig 5: Work Flow of Physiological Variable in Males with DPN

2.1. Investigations

Repeating the procedure for the blood pressure, BMI and metabolism were run to rule out any additional illness and identify the underlying cause. Both fasting and postprandial blood sugar levels were controlled within acceptable ranges. According to yoga, practice will enhance nerve function without having any negative side effects. Table 2 shows the Summary of demographic data from a single sample test technique comparing yoga group intervention and control group intervention mean values. Table 3 shows Each participant underwent a clinical examination using their foot feeling following their Douleur Neuropathy Questionnaire 4 (DN4) Objective and Subjective type and Michigan Neuropathy Instrument (MNSI) score (Objective & Subjective type).

Table 2: Summary of demographic Information

Variables	Yoga Group intervention(n=15)	Control Group Intervention(n=15)
	Mean(SD)	
Age	48.74	57.00
Duration of Diabetes	6.767	9.466
Marital Status	.9334	1.000
No.of Children's	2.200	2.000

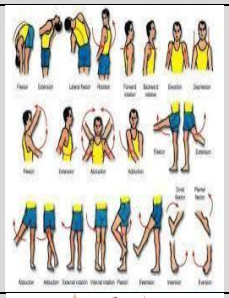
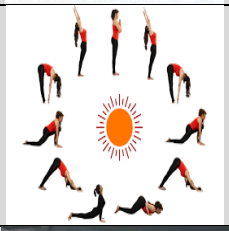
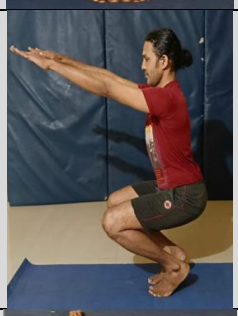
Table 3: DPN Foot Sensation Clinical Test

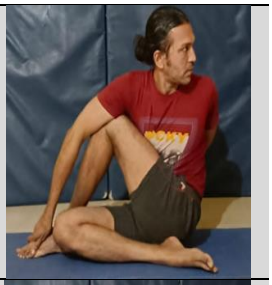
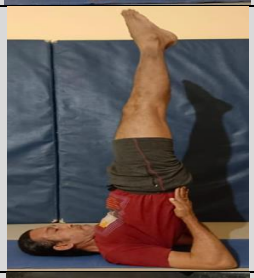
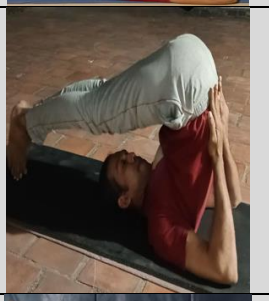
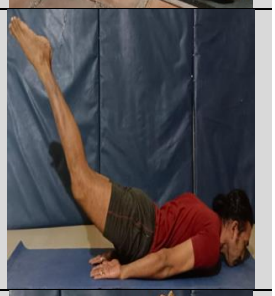
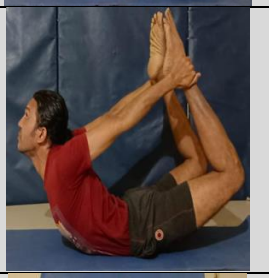
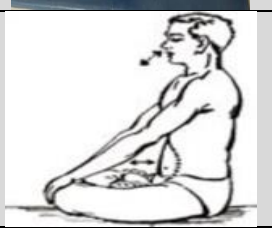
S.No.	Test	Image	Method
1	Monofilament Test		The monofilament test is used to identify **loss of sensitivity** for people with diabetes.
2	Brush Test		The brush test can identify **mechanical allodynia (simple touch).**
3	Hot Cold Test		The hot/Cold test is used to identify **thermal allodynia** (the abnormal sensation of pain from the hot or cold stimulus).Test tube with cold water (5 -10 C) and another Warm water (35 -45 C)
4	Pinprick Test		The pinprick test is used to identify any nerve damage.
5	Vibration Test		The vibration test can evaluate the **integrity of large nerve fibres**. A 128-Hz tuning fork is used. Place the vibrating fork on the patient's distal Hallux (big toe) joint and ask them if they can feel the vibration.
6	Reflexion Test		This test helps determine your nervous system's effectiveness by assessing the reaction between your motor pathways and sensory responses.

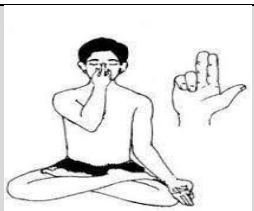
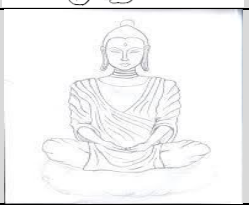
2.2. Treatment Protocol

The experimental group underwent a training period of 12 weeks, six days per week received Yoga practice. The subject's drugs were also continued. Table 4 below gives brief descriptions of the treatment protocol.

Table 4 : Treatment Protocol[27-48]

Treatment protocol for Yoga Treatment	Effects	Image
Sukshma Vyayama	It initiates blood and oxygen flow to the body's soft tissues, including the muscles, tendons, ligaments, and bones, and helps your body get ready for the asanas with greater strength.	
Surya namaskar (sun salutation) 12-Steps Sequences	Stimulates insulin production through brain signalling. Significantly decreases hip circumference, exerting beneficial effects on glycaemic outcomes.	
Tadasana	Bilateral heel & hand rise. Enhances spinal flexibility and balance. Improves concentration.	
Utkatasana	Musculoskeletal Stabilisation. the flat feet and mild leg abnormalities should be corrected. R educing shoulder aches and discomforts strengthening the balance and hand-eye coordination	
Vriksasana	Single limb stance with support. Enhances spinal flexibility and balance. Improves concentration. Improves Neuromuscular coordination. stimulates mental activities	
Gomukhasana	Enhances Body Posture. All body joints are in operation which increases blood flow and ensures the body gets more blood and nutrition.	
Paschimottanasana	By energizing the Pancreas & kidneys, it can help diabetic patients.	

Ardha Matsyendrasana	Sitting Half Spinal Twist . Increases the elasticity of the spine . Opens the chest and increases the oxygen supply to the lungs.	
Uthanapadasana	Leg Raise Pose.it tones your abdomen by stretching its muscles. This burning of excess abdominal fat prevents obesity-related disorders.	
Sarvangasana	Shoulders Stand Pose. It helps in maintaining diabetic blood sugar levels under control. It enhances the pancreas' functionality, which regulates the amount of insulin production.	
Halasana	Plow pose. It helps relieve anxiety and stress-related problems . It stimulates the system to restrict excess production of blood sugar. Plow pose helps to circulate the blood to every tip of the nerve endings	
Salabhasana	Locust Pose. Your entire nervous system is stimulated, mainly by the parasympathetic outflow. It helps in the proper regulation of metabolism and assists in weight loss .Irregular bowel symptoms are also corrected, and it generates an increased functioning of the bowels.	
Dhanurasana	Bow pose.Bow position promotes digestion by strengthening the stomach muscles.Bow Pose enhances the function of the liver and kidneys in the body. It keeps the stomach, liver, kidneys, pancreas, and other organs of the body healthy.Consistent practice is beneficial to both physical and emotional well-being	
Savasana	Corpse Pose. It helps reduce blood pressure, anxiety, and insomnia. which may help in the repair of tissues and cells, and in releasing stress.	
Kapalbhati Pranayama	Enhances the capacity of the lungs and makes them stronger. subtle energy channels. Energizes the nervous system and rejuvenates brain cells. Stimulates the abdominal organs and thus is extremely useful to those with diabetes.	

Nadi Shodhana Pranayama	Nadi is a Sanskrit word meaning "channel" or "flow" and shodhana means "purification." Therefore, nadi shodhana is primarily aimed at clearing and purifying the subtle channels of the mind-body organism, while bringing balance to the system as a whole. It is balancing for all three doshas and is a suitable practice for most anyone.	
Ujjayi Pranayama	It calms the mind, regulates the nervous system, and sharpens psychic perception. It relieves insomnia, decreases blood pressure, and slows heart rate. It is a calming pranayama.	
Bhramari Pranayama	To practice this style of yoga, the practitioner must make a bee-like humming sound. This breathing method can instantly quiet the mind.	
Simha Pranayama	Simhasana pranayama, also known as the lion's breath, is a powerful breathing technique that can help you clear your throat chakra and boost your energy.	
Om Meditation	The universe was created by the vibrations of cosmic energy, which first manifested as the sound Om. It is the creator's expression.	

2.3. Data collection

Acceptance/exclusion criteria Patients with DPN, with or without pain, who met the inclusion criteria were included in the study. They had to be at least 35 years old. The Clinical test looked into the patients' physiology variables, peripheral neuropathy duration, patient's perception of benefits of yoga treatment use before diagnosis, classification of yoga practices, resources surveyed, safety, and efficacy of yoga treatment. Patients received pre-made standard forms that the experimenter had evaluated. The patients' histories, diagnoses, and other information, along with their demographics, were recorded.

3. RESULTS

3.1. Calculations in statistics

Statistical analysis was performed on the studies by using SPSS 19.0. The Percentages, averages, and standard deviations were used to characterize the results. From its roots as a tool for statistical analysis, SPSS has evolved into a favourite among academics in a range of features[47-48].

3.2. Interpretation of Result

If $t_{cal} < t_{tab}$ Value, Accept $H_{o,}$ there is no relationship between Yoga practice (Experimental Group) to three variables. If $t_{cal} > t_{tab}$ Value, Rejected H_o there is a relationship between Yoga practice (Experimental Group) to three variables. If $t_{cal} < t_{tab}$ Value, Accept $H_{o,}$ there is no relationship between without Yoga practice (Control Group) to three variables. If $t_{cal} > t_{tab}$ Value, Rejected H_o, there is a relationship between without Yoga practice(Control Group) to three variables. Degree of freedom (df) = n-1, So df= 14. Then t table value is 14 df = 2.14.

3.3. Paired Samples T-Test for Pre-test and Post-test for Group I

Table 5 : Paired Samples T Test for Pre-test and Post-test for Group I (experimental Group-I)

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Blood Pressure	Systolic Pre-Test	148.80	15	19.121	4.937
	Systolic Post-Test	135.73	15	8.276	2.137
Blood Pressure	Diastolic Pre-Test	98.47	15	14.725	3.802
	Diastolic Post-Test	89.60	15	8.339	2.153
BMI	BMI Pre-Test	25.6073	15	4.43326	1.14466
	BMI Post-Test	25.2140	15	3.36131	0.86789

Examining the experimental Group-I involved using the analysis tool. Table 5 displays the pre-test and post-test values for yoga therapy based on systolic blood pressure, Diastolic blood pressure and BMI. The results were accordingly mentioned in the Mean Value, Standard Deviation, Standard Error Mean, and Number of Participants 15.

Table 6 : Paired Samples T Test for Pre-test and Post-test for Group I

Paired Samples Correlations

		N	Correlation	Sig.
Blood Pressure	Systolic Pre-Test & Systolic Post-Test	15	0.706	0.003
Blood Pressure	Diastolic Pre-Test & Diastolic Post-Test	15	0.566	0.028
BMI	BMI Pre-Test & BMI Post-Test	15	0.969	0.000

Table 6 displays the pre-test and post-test for yoga therapy based on Correlation and Significant values.

Table 7 : Paired Samples T Test for Pre-test and Post-test for Group I

Paired Samples Test

Paired Samples Variables	Test	Paired Differences Mean	Std. Dev.	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Systolic Pressure (Pair-1)	Pre-test Post-test	13.067	14.518	3.749	5.027	21.107	3.486	14	0.004
Diastolic pressure (Pair-2)	Pre-test Post-test	8.867	12.141	3.135	2.143	15.590	2.828	14	0.013
Body Mass Index (Pair-3)	Pre-test Post-test	0.3933	1.4362	0.37091	-0.4021	1.18885	1.060	14	0.307

The analysis tool was used to examine the experimental Group-I. Table 7 shows that Systolic blood Pressure presents the pre-test and post-test values of Yoga Therapy. The Mean Value 13.067, Std.Deviation 14.518, Std. Error Mean 3.749, lower value 5.027, upper value 21.107, t value 3.486, df 14 respectively, resulted in Sig. (2-tailed) of .004, the t calculation value of 3.486 is greater than the table value of 2.14, so it's considered a statistically significant difference between the pre & post-test means at 0.05 level of confidence for both tests of Systolic blood pressure in Yoga Therapy. Diastolic Pressure presents the pre-test and post-test in Yoga Therapy as a Mean Value of 8.867, Std. Deviation 12.141, Std. Error Mean 3.135, lower value 2.143, upper value 15.590, t value 2.828, df 14 and resulted in Sig. (2-tailed) of .0013, the t calculation value of 2.828 is greater than the table value of 2.14, so it's considered a statistically significant difference between the pre & post-test means at 0.05 level of confidence for both tests of Diastolic blood pressure in Yoga Therapy. BMI presents the pre-test and post-test in Yoga Therapy as a Mean Value of 0.3933, Std. Deviation 1.4362, Std. Error Mean 0.37091, lower value -0.4021 upper value 1.18885, t value 1.060, df 14 and resulted in Sig. (2-tailed) of 0.307, the t calculation value of 1.060 is Less than the table value of 2.14, so it's considered statistically no significant difference between the pre & post-test means at 0.05 level of confidence for both tests of BMI in Yoga Therapy. Table 7 reveals that the Systolic and Diastolic pre-test and post-tests of yoga Therapy had a significant value except for BMI pre-test and post-test values. The BMI level doesn't drop significantly. Then the level is somewhat lowered.

3.4. Paired Samples T-Test for Pre-test and Post-test for Group II

Table 8: Paired Samples T Test for Pre-test and Post-test Group II (Control Group)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Blood Pressure	Systolic Pre-Test	142.33	15	22.324	5.764
	Systolic Post-Test	142.87	15	20.149	5.202
Blood Pressure	Diastolic Pre-Test	91.67	15	17.360	4.482
	Diastolic Post-Test	92.27	15	17.572	4.537
BMI	BMI Pre-Test	25.652	15	4.53628	1.17126
	BMI Post-Test	25.996	15	4.44618	1.14800

Examining the experimental Group II involved using the analysis tool. Table 8 displays the pre-test and post-test values for yoga therapy based on systolic blood pressure, Diastolic blood pressure and BMI. The results were accordingly mentioned in the Mean Value, Standard Deviation, Standard Error Mean, and Number of Participants 15.

Table 9: Paired Samples T Test for Pre-test and Post-test for Group II

Paired Samples Correlations

		N	Correlation	Sig.
Blood Pressure	Systolic Pre-Test & Systolic Post-Test	15	.971	.000
Blood Pressure	Diastolic Pre-Test & Diastolic Post-Test	15	.996	.000
BMI	BMI Pre-Test & BMI Post-Test	15	.986	.000

Table 9 displays the pre-test and post-test for yoga therapy based on Correlation and Significant values.

Table 10 : Paired Samples T Test for Pre-test and Post-test for Group II

Paired Samples T Test									
Paired Samples Variables	Test	Paired Differences Mean	Std. Dev.	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Systolic Pressure (Pair-1)	Pre-test Post-test	-.533	5.566	1.437	-3.616	2.549	-.371	14	.716
Diastolic pressure (Pair-2)	Pre-test Post-test	-.600	1.502	.388	-1.432	.232	-1.547	14	.144
Body Mass Index (Pair-3)	Pre-test Post-test	-.3440	.7435	.1919	-.7557	.0677	-1.792	14	.095

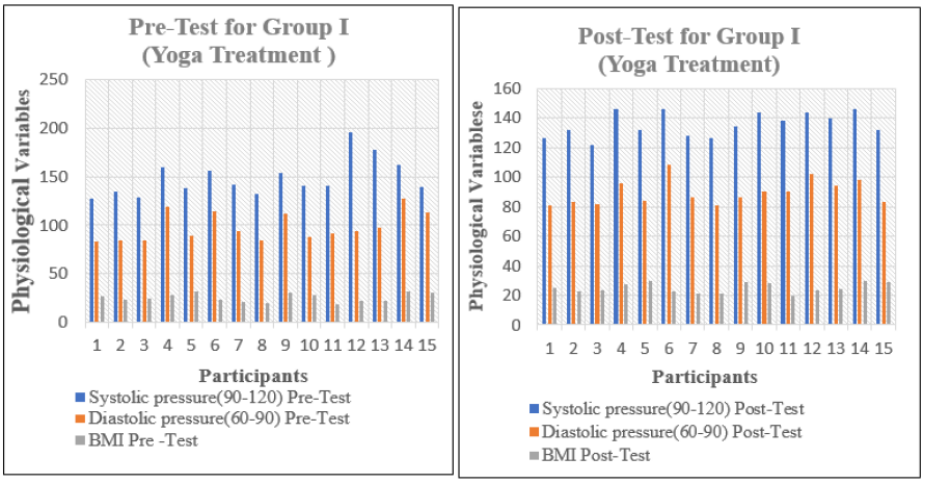
Table 10 shows the SPSS analysis of Systolic pressure presents the pre-test and post-test in Control Group-II. the Mean Value is -0.533, Std. Deviation 5.566, Std. Error 1.437, lower value -3.616, upper value 2.549, t value -0.371, df 14 and respectively, resulted in Sig. (2-tailed) of 0.716. the t calculation value of -0.0371 is Less than the table value of 2.14, so it's considered statistically no significant difference between the pre & post-test means at 0.05 level of confidence for both tests of Systolic blood pressure Without Yoga Therapy. Diastolic Pressure presents the pre-test and post-test without Yoga Therapy as a Mean Value of -0.600, Std. Deviation 1.502, Std. Error Mean 0.388, lower value -1.432 upper value .232, t value -1.547, df 14 and respectively, resulted in Sig. (2-tailed) of 0.144. the t-calculation value of -1.547 is Less than the table value of 2.14, so it's considered statistically no significant difference between the pre & post-test means at 0.05 level of confidence for both tests of Diastolic blood pressure Without Yoga Therapy. BMI presents the pre-test and post-test without Yoga Therapy as a Mean Value of -0.3440, Std. Deviation 0.7435, Std. Error 0.1919, lower value -0.7557, upper value 0.0677, t value -1.792, df 14 and respectively, resulted in Sig. (2-tailed) of 0.095. the t calculation value of -1.792 is Less than the table value of 2.14, so it's considered statistically no significant difference between the pre & post-test means at 0.05 level of confidence for both tests of BMI without Yoga Therapy. Table 10 reveals that the Systolic, Diastolic and BMI pre- and post-tests without Yoga Therapy had no significant value.

4. DISCUSSION

We examined two groups; one group showed a significant difference, while the other Control group did not; as a result, they were assessed for the study. After a 12-week study period, the yoga group's Systolic blood pressure and Diastolic Pressure levels significantly decreased. But BMI level doesn't drop significantly. Then the level is lowered. The Control group without yoga practice showed no changes. However, the Control Group did not indicate much of a difference in Systolic blood pressure, Diastolic Pressure and BMI levels. We observed a significant reduction in Physiological variables scores in Yoga groups. Therefore, Yoga practices effectively reduced physiological factors in Group I Participants. Diabetes-related peripheral neuropathy (DPN), which is characterized by gradually worsening discomfort, decreased proprioceptive and sensory acuity, vibration awareness, and suboptimal postural stability, is one of the most common consequences of diabetes. The morbidity and mortality rates are frequently high in DPN patients. yoga is widely used in therapeutic settings to treat DPN. Yoga has improved outcomes for DPN patients. However, a meticulously planned systematic evaluation is still required to demonstrate the effectiveness of yoga therapy in the DPN on a global wise[49-54].

4.1. Graph I and II Pre-test and Post-test for Group I

According to the graph analysis, Group -I Yoga Therapy participants outperformed the Control group. Twelve weeks of yoga therapy has shown to be effective and causes significant physical changes in systolic, diastolic, and Body Mass.



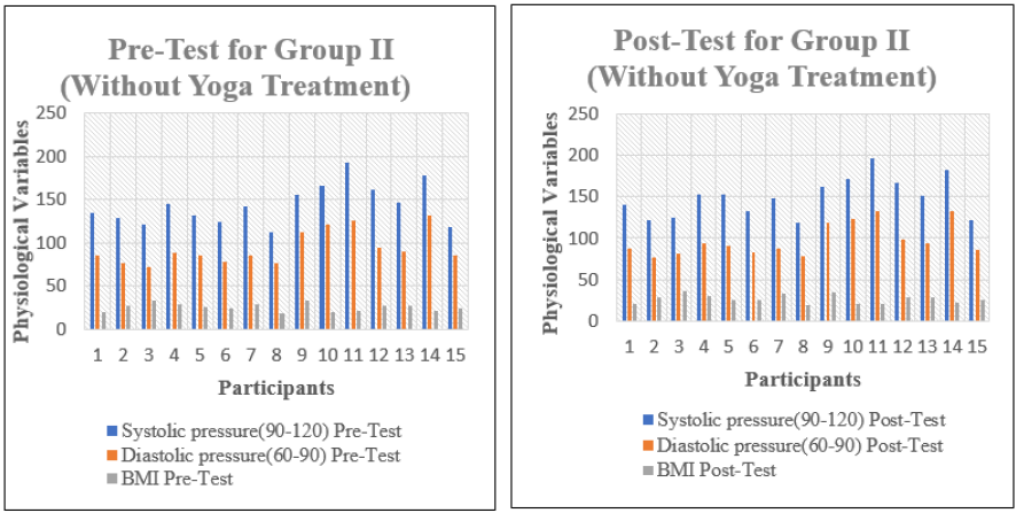
Graph-I Pre-Test for Yoga Treatment **Graph-II Post-Test for Yoga Treatment**

Fig. 6: Pre and Post Test data of Experimental Group I (With Yoga Practice)

In graphs I and II, the 'x-axis represents the number of 15 participants, while the 'y' axis represents physiological data, including Systolic, Diastolic, and Body Mass Index. Following the pre-test, the participants were given yoga poses such as SukshmaVyayama (PavanmuktasanaSeries), Surya Namaskar, Tadasana, Utkatasana, Vrikshasana, Gomukhasana, Paschimottanasana, Sarvangasana, Utthanapadasana, Ardha Matsyendrasana, Utthanapadasana, Sarvangasana, Halasana, Salabhasana, breathing exercise and Om Meditation focuses on helping with diabetic peripheral neuropathy perform better physiologically. After post-test diagnosis, patients' assessments of the benefits of Yoga treatment were used with positive outcomes in experimental group 1. All graphs on the 'y-axis reflected physiological data, Systolic indicating blue, Diastolic indicating orange, and Body Mass Index indicating grey.

4.2. *Graph III and IV Pre-test and Post-test for Group II*

Participants in Group -II control group did not benefit significantly, as seen in graph III and IV, as shown in Figure 4. The participants were not provided with any practice after the pre-test. Comparing the pre-and post-test results, there was no significant difference in systolic, diastolic and BMI. The graph shows that there are no positive outcomes.



Graph-III Pre-Test for Control Group **Graph-IV Post-Test for Control Group**

Fig. 7: Pre and Post Test data of Control Group II (Without Yoga Practice)

5. CONCLUSION

Compared to Control Group II, Yoga Therapy performed much better in Experimental Group I. After practising yoga for 12 weeks, the experimental group showed better results in physiological characteristics, such as Systolic and Diastolic blood pressure considerably improved, and BMI level did not dramatically decrease, but it slightly reduced. The values of Systolic Blood Pressure, Diastolic Blood Pressure, and BMI in the Control Group did not show signs of a difference. In the yoga groups, we saw a significant decline in the scores for physiological parameters. Yoga practice successfully reduced physiological variables in Group I DPN Participants. We conclude that practising yoga enhances balance, vitality, nerve function, and stability for the person with Diabetic Peripheral Neuropathy.

6. ETHICAL CLEARANCE STATEMENT

The Methods carried out in this study that involved people were approved ethically by the Eden Siddha Herbal Centre (Ref No: 231/ME-1/ESHC/2021 Guduvanchery , Chengalpattu -603202. Tamil Nadu). as standard, routine evaluations for patients with DPN.

7. AUTHORS CONTRIBUTION STATEMENTS

Mr P.Sudhan conceptualized, designed, performed the experiment, and gathered and analyzed the data. Dr Rajeev Sukumaran encouraged Mr P.Sudhan to investigate the effect of Yoga Therapy on Diabetic patients through a spark to conduct this experimental study on the Physiological changes in Diabetic Peripheral Neuropathy(DPN) Patients. As an initiative, this study has begun with Male persons under the supervision of Dr Babu Subbiah and Dr.Narendran Rajagopalan with the help of the Yoga Teachers Ms Prema Nagesh from Vyaniti Yoga Center, Oman and Ms L.Kalpana from Athma Gnanalayam, India. Dr G. Janaki helped write the manuscript, Dr.Radha Krishnan M and Dr.Suresh Perumal providing critical feedback and helping shape the research analysis. All authors contributed to their fullest extent to complete this manuscript successfully.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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