



Research article

## A questionnaire-based survey on patient's interpretation and physiotherapy awareness in diabetic neuropathy

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### ABSTRACT

Physiotherapist plays an important role in prevention of diabetic polyneuropathy (DPN) by planning of exercise protocol and educating about the foot self-care behaviors. Thus, the objective of the study was to determine their interpretation and level of Physiotherapy awareness. Diabetic neuropathy population identified in the community screening camps were included after the final confirmation by the Diabetologist. Patient Interpretation of Neuropathy (PIN) Questionnaire (modified version) was given to the participants. Responses were obtained on the Likert scale. Descriptive statistics was used for finding the mean, percentage & standard deviation. 70% of the participants were uncertain about the causal domain; 74% were uncertain about the duration and course, 64% were uncertain about the physical consequences domain and 50% were uncertain about the controllability domain. Majority had a good interpretation score for nature (70%) and emotional consequences (78%) domain. Higher the education levels, better was the interpretation score. 66% of the participants were uncertain about the role of Physiotherapy in DPN. Among those who had agreed for the awareness domain, 48.46% of the participants had moderate level of Physiotherapy awareness. There is a strong need to formulate educational strategies to change their interpretation in the causal, duration and course, physical consequences and controllability domain, also increase awareness among the DPN population regarding use of Physiotherapy intervention like planning of exercise protocol & counselling for following foot self-care behaviors in the early stages of DPN as a preventive approach so that the holistic approach of Diabetic care is met.

**Keywords:** Diabetic Peripheral Neuropathy; Interpretation; Awareness; Physiotherapy; Foot self-care; Aerobic exercises.

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### INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorder which occurs either due to insufficient production of insulin, decreased tissue sensitivity to insulin or both resulting in chronic hyperglycemia [1]. DM cases are more prevalent in South India (5-17%) & more common in urban areas due to dietary changes, sedentary lifestyle & unhealthy behavior. In DM, there is failure of insulin to act on the target tissues, which leads to abnormalities in metabolic pathways of carbohydrate, fat & protein. There is either insulin deficiency due to autoimmune destruction of the beta-cells of pancreas or deficient insulin action due to tissue insensitivity. Polyuria, polydipsia, polyphagia, weight loss and blurred vision are the characteristic symptoms of hyperglycemia [2]. Diabetic Peripheral Neuropathy (DPN) is characterized by distal to proximal sensory loss associated with pain & paresthesia. In India, several regions are still underdeveloped & the people lack knowledge about its complications & also the management & prevention aspects. This poses major economic burden to the society as well as to the patients and their families when they end up with amputations.

Hence, early identification of the cases and imparting preventive strategies to diabetic neuropathy is the most essential element of healthcare system. Thus, proper patient education and foot care implementation in the rural and urban population of India as a preventive strategy is required [3].

Considering the preventive approach as a center point of the intended study, management of diabetic neuropathy & its complications must follow a holistic approach. Role of Diabetic doctor, Dietician & Physiotherapist together helps patients to set their goals and this multidisciplinary approach improves the quality of life in diabetic neuropathy. Hence, early screening by the diabetic doctor for the sensory loss using monofilament testing, adequate diet intake protocol setup by the dietician helps to halt the disease at the early stages & there is better control of the condition. Physiotherapists must provide holistic care to individuals that address the physical, social and psychological domains of health. Physiotherapist plays an important role in the treatment of both macrovascular & microvascular complications of diabetes mellitus [4].

There are 2 approaches used by Physiotherapists in prevention of diabetic neuropathy emphasized in the current study which includes prescription of individualized exercise protocol and enhancing the foot self-care behaviors. Physical modalities like magnet field, light therapy, hydro galvanic current and TENS are other adjuvant therapies proven to be effective in treating neuropathic pain which are used as complementary therapies in the treatment by Physiotherapists. These approaches followed by Physiotherapist at primary health center levels helps to prevent further complications. Exercise helps to improve glucose tolerance & insulin sensitivity, slow or prevent tissue atrophy, improves tissue tolerance to bear loads and decreases the chances of the emergence of plantar ulcers [5]. Long term prescribed & supervised aerobic exercise training or following a prescribed walking protocol proves to be effective & reasonable treatment tool to modify the natural history of DPN. Aerobic exercises along with resistance training, flexibility & balance exercises showed improvement in peripheral neuropathy symptoms and are proven in the nerve conduction studies [6].

Self-monitoring/self-care is considered as the most important component of patient-centered chronic illness management. Considering the gait alterations, inclusion of more non-weight-bearing activities, could be done as per the specific needs of each individual. To prevent the falls in DPN patients, Physiotherapist focus on development of compensatory strategies such as using canes, walkers, and managing extrinsic (environmental) fall risks in the specifically designed protocol [7].

There are existing studies which have determined patient's interpretation about their diabetic neuropathy alone; however, no studies have combined determination of interpretation and awareness in a single study [8]. Also, this study involves use of common-sense model of illness behavior which gives a holistic approach for the management and involvement of the patient himself in the treatment approach [9,10]. The objectives of the study included to determine the patient's interpretation about diabetic neuropathy and to identify the level of Physiotherapy awareness in diabetic neuropathy

## **MATERIALS AND METHODS**

Ethical clearance was obtained from the Institutional Ethical Committee of SDM College of Medical Science and Hospital, before commencement of the study. The subjects were screened for Diabetic neuropathy in various camps organized by SDM medical College and Hospital. The inclusion criteria included diabetic neuropathy cases diagnosed by a qualified medical practitioner in the age group between 20-79 years and patients of either gender. The exclusion criteria included patient having peripheral vascular disease and amputation, all other types of peripheral neuropathy excluded and gestational diabetes (GDM). The duration of the study extended to 1 year duration.

As a part of community Physiotherapy programs, 4 camps were organized by SDM College of Physiotherapy in and around Hubli-Dharwad twin cities. The advertisement for the camps was given in local newspaper and also some known organizations/ clubs were contacted for the benefits of the camps. The camps were under the title of "Screening for Diabetes and Diabetic Neuropathy and the importance of Physiotherapy in preventing and managing the complications". Also, advertisement in the poster format was done so that people could benefit from these screening camps. Patients who attended the camp were screened for Diabetes with random blood sugar levels and HbA1c used as a criterion for the diagnosis. Those with random blood sugar levels more than 150mg/Dl or HbA1c  $\geq 6.5\%$  were further assessed for neuropathy symptoms. Michigan Neuropathy Screening Instrument (MNSI) was used for screening of the neuropathy symptoms. It had 2 components, the History and the Physical assessment.

Total number of participants who attended the camps were 172. Out of 172 participants screened, 158 participants were identified for the presence of neuropathy symptoms with the help of MNSI tool, which were further referred to Diabetologist for final confirmation of Diabetic Neuropathy. Out of the 158 patients identified with the neuropathy symptoms, 11 patients were excluded by the Diabetologist for the presence of Peripheral Vascular Disease. The participants were given the information about the study and the purpose of the research. Among the 147 participants who were confirmed for the presence of the DPN, 8 participants declined to participate in the study. Thus, total 139 participants were recruited for the study. Consent form was given to the participants and the demographic data of each participant was collected i.e. age, gender, occupation, educational level, duration of diabetes and whether the participants are on oral antidiabetic drugs or insulin dependent.

The Patient Interpretation of Neuropathy (PIN) Questionnaire-modified version was given to these 139 participants. Questionnaires were considered to be incompletely filled if one of the sections of the questionnaire were left blank or not filled. Participants were reassured that information would be kept confidential and will be used only for the study purpose. Among the 139 participants, 9 patients had incompletely filled the questionnaire. Hence, total 130 patient samples were analyzed for the study.

With the permission of the author, total 37 questions were selected from the original 73 questions and further modifications in the controllability domain of the questionnaire was done and was also translated in the local language (Kannada).

In the controllability domain of the original PIN questionnaire, role of diabetic doctor, foot self-care behaviors, keeping good diabetic control was specified. But the role of Physiotherapist in

prevention of Diabetic peripheral neuropathy was not included in the original questionnaire. Hence, additional subscale was prepared with modifications in the controllability domain. Physiotherapist plays an important role in prevention of diabetic neuropathy. Role of physiotherapist in providing education about foot self-care behaviors is crucial considering the holistic aspect of management of Diabetic neuropathy. Also, prescription of exercise protocol helps in prevention of Diabetic neuropathy. Hence 2 aspects: health promotion in following of self-care behaviors, prescription of exercise protocol is considered in the awareness aspect of modified version of Patient Interpretation of Neuropathy Questionnaire (PIN).

The modifications done in the controllability domain therefore helped to emphasize holistic approach in the management of diabetic peripheral neuropathy i.e. the role of diabetic doctor, dietician and Physiotherapist and to determine the level of Physiotherapy awareness in Diabetic Neuropathy patients.

Sample size

Prevalence of diabetic neuropathy in Indian population,  $p=30\%$  Sample size thus calculated using the formula:

$$N = \frac{Z^2 pq}{d^2}$$

Where  $N=d^2$  sample size,  $p$ = prevalence,  $Z=2.58$  at 99% confidence level,  $q=(100-p)$

$d$ =Precision limit or proportion of sampling error which is 10% confidence limit.

$$N = \frac{Z^2(100-p)}{d^2}$$

$$N = 150$$

Descriptive analysis was used for finding the mean, percentage, standard deviation.

## RESULTS

The figure 1 explains that 36.92% of the participants were in the age group 20-60 years followed by 63.08% of participants in the age group more than or equal to 61 yrs. Maximum participants were employees with post-graduation. 80% had Diabetes mellitus from more than 11 years with majority of them were insulin dependent.

**Table1:** Item wise responses of respondents towards awareness

Items	SDA	%	DA	%	U	%	A	%	SA	%	Mean	SD
p1. q1	5	3.85	25	19.23	60	46.15	32	24.62	8	6.15	3.10	0.91
p1. q2	5	3.85	25	19.23	60	46.15	32	24.62	8	6.15	3.10	0.91
p1. q3	6	4.62	25	19.23	66	50.77	26	20.00	7	5.38	3.02	0.89
p1. q4	6	4.62	27	20.77	63	48.46	27	20.77	7	5.38	3.02	0.91
p1. q5	6	4.62	27	20.77	63	48.46	27	20.77	7	5.38	3.02	0.91
p1. q6	6	4.62	27	20.77	63	48.46	27	20.77	7	5.38	3.02	0.91
p1. q7	6	4.62	27	20.77	63	48.46	25	19.23	9	6.92	3.03	0.93

The above table shows the Item wise responses of respondents towards awareness with mean & standard deviation (SDA-Strongly disagree, DA-Disagree, U-Uncertain, A-Agree, SA-Strongly agree)

**Table2:** Comparison of demographic profile of respondents with mean nature scores by one-way ANOVA and independent t test

Profile	Mean	SD	Statistic	p-value
<b>Age groups</b>				
<=60yrs	23.29	3.23	t=-0.5878	0.5577
>=61yrs	23.78	5.20		
<b>Gender</b>				
Male	23.09	4.96	t=-2.0178	0.0457*
Female	24.84	3.14		
<b>Occupations</b>				
Business	22.75	4.23	F=1.4095	0.2481
Employees	23.23	5.04		
Housewife	24.67	3.14		
<b>Educations</b>				
Secondary	24.29	4.53	F=0.7631	0.5168
Higher secondary	23.38	3.41		
Graduates	22.78	3.76		
Postgraduates	24.17	5.68		
<b>Duration of diabetes (yrs)</b>				
<=10yrs	22.62	3.06	t=-1.2323	0.2201
>=11yrs	23.85	4.85		
<b>Insulin dependent</b>				
Yes	23.36	4.53	t=-0.9154	0.3617
No	24.15	4.64		
Total	23.60	4.56		

\*p<0.05

**Table 3:** Comparison of demographic profile of respondents with mean controllability scores by one-way ANOVA and independent t test

Profile	Mean	SD	For t value	p-value
<b>Age groups</b>				
<=60yrs	6.54	1.24	t=-0.3308	0.7414
>=61yrs	6.63	1.69		
<b>Gender</b>				
Male	6.70	1.59	t=1.1079	0.2700
Female	6.37	1.36		
<b>Occupations</b>				
Business	6.50	1.60	F=1.1961	0.3057
Employees	6.74	1.58		
Housewife	6.28	1.39		
<b>Educations</b>				
Secondary	7.29	1.07	F=3.0184	0.0324*
Higher secondary	6.06	1.16		
Graduates	6.44	1.56		
Postgraduates	6.87	1.73		
<b>Duration of diabetes (yrs)</b>				
<=10yrs	6.54	1.30	t=-0.2280	0.8200
>=11yrs	6.62	1.59		
<b>Insulin dependent</b>				
Yes	6.62	1.60	t=0.2470	0.8053
No	6.55	1.38		
Total	6.60	1.53		

\*p<0.05

There is statistically significant difference (p<0.05) in the education profile in interpreting the controllability domain. Those who are in secondary education are having higher controllability scores

compared to the graduates and postgraduates.

**Table4:** Comparison of demographic profile of respondents with mean Physical consequences scores by one-way ANOVA and independent t test

Profile	Mean	SD	Statistic	p-value
<b>Age groups</b>				
<=60yrs	13.42	2.89	t=0.3481	0.7284
>=61yrs	13.24	2.64		
<b>Gender</b>				
Male	13.28	2.57	t=-0.1629	0.8709
Female	13.37	3.09		
<b>Occupations</b>				
Business	16.00	3.02	F=4.4216	0.0139*
Employees	13.09	2.40		
Housewife	13.22	3.11		
<b>Educations</b>				
Secondary	13.43	3.27	F=0.4909	0.6892
Higher secondary	13.25	1.88		
Graduates	13.72	3.34		
Postgraduates	13.00	2.54		
<b>Duration of diabetes (yrs)</b>				
<=10yrs	14.00	3.58	t=1.4563	0.1478
>=11yrs	13.13	2.45		
<b>Insulin dependent</b>				
Yes	13.13	2.93	t=-1.0964	0.2749
No	13.70	2.15		
Total	13.31	2.72		

\*p<0.05

There is statistically significant difference (p<0.05) in the occupation profile in interpreting the physical consequences domain. Those who are in business are having higher physical consequences scores compared to those who are employees and house wives.

**Table 5:** Comparison of demographic profile of respondents with mean emotional consequences scores by one-way ANOVA and independent t test

Profile	Mean	SD	Statistic	p-value
<b>Age groups</b>				
<=60yrs	25.63	4.11	t=-0.2530	0.8007
>=61yrs	25.85	5.41		
<b>Gender</b>				
Male	25.96	4.91	F=0.6692	0.5046
Female	25.32	5.10		
<b>Occupations</b>				
Business	29.75	3.24	F=2.8450	0.0618
Employees	25.56	4.83		
Housewife	25.39	5.27		
<b>Educations</b>				
Secondary	27.00	2.15	t=7.1221	0.0002*
Higher secondary	23.75	5.26		
Graduates	28.44	4.32		
Postgraduates	24.75	4.92		
<b>Duration of diabetes(yrs)</b>				
<=10yrs	27.31	4.33	t=1.7850	0.0766
>=11yrs	25.38	5.04		
<b>Insulin dependent</b>				
Yes	25.82	5.50	t=0.1822	0.8557
No	25.65	3.48		
Total	25.77	4.95		

\*p<0.05

There is statistically significant difference (p<0.05) in the education profile in interpreting the emotional consequences domain. Those who are graduates are having higher emotional consequences scores.

**Figure 1:** Demographic pro file of respondent

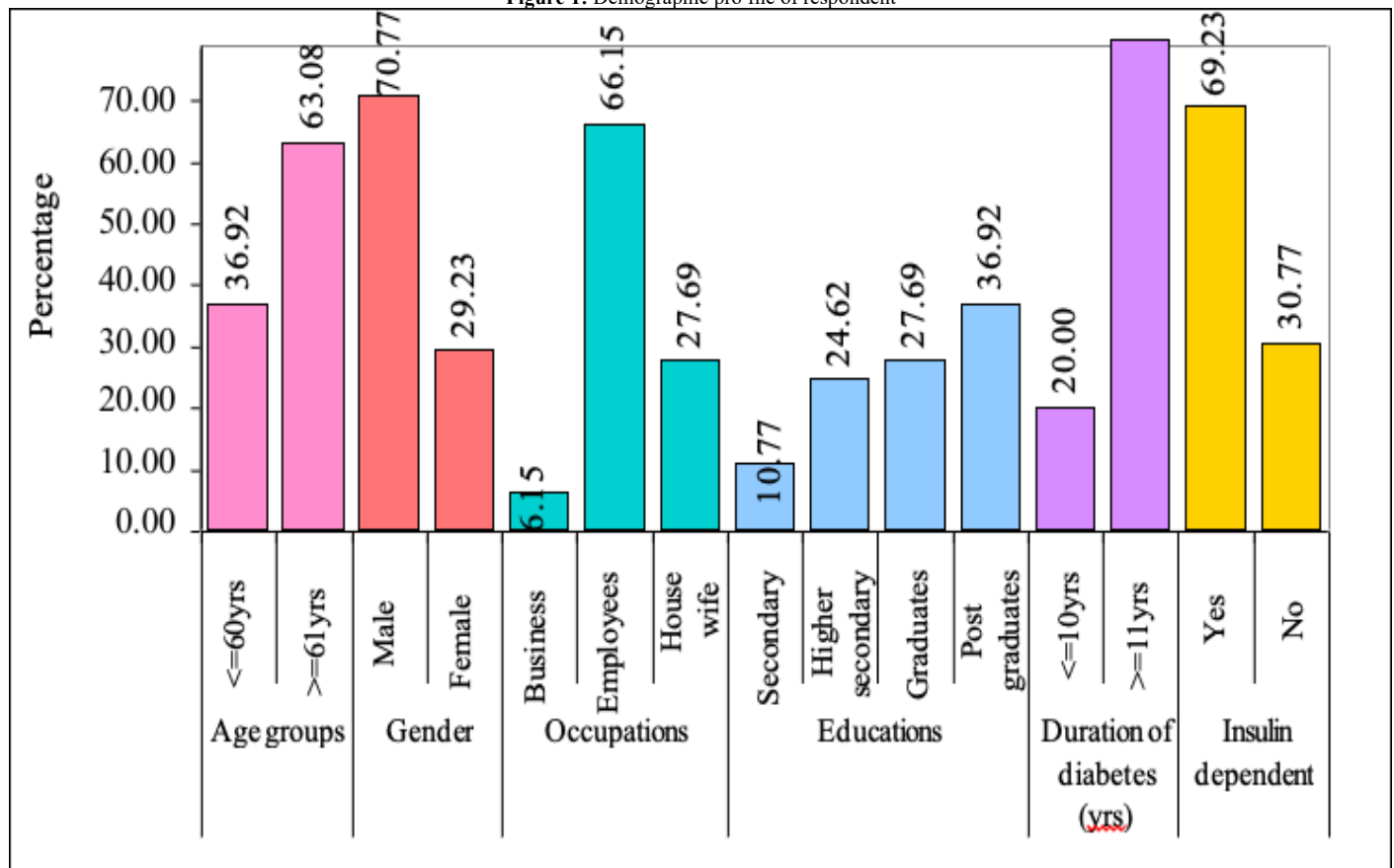
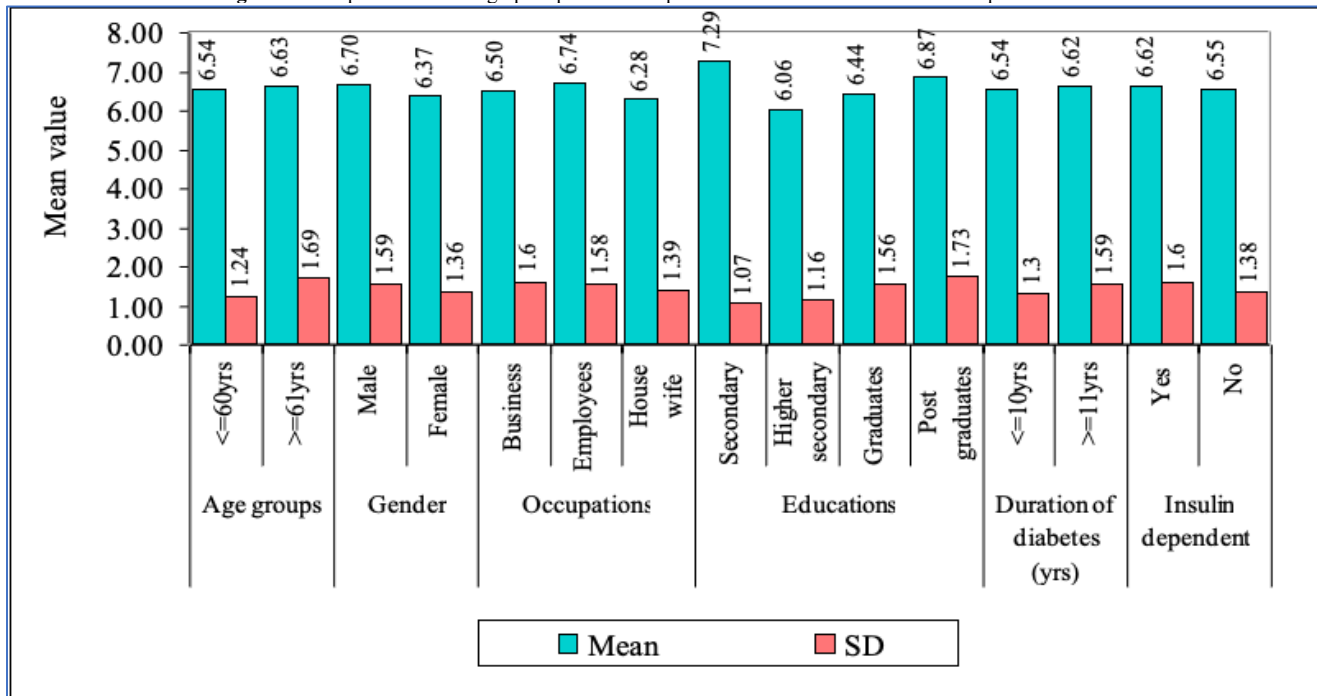


Figure 2: Comparison of demographic profile of respondents with mean emotional consequences scores

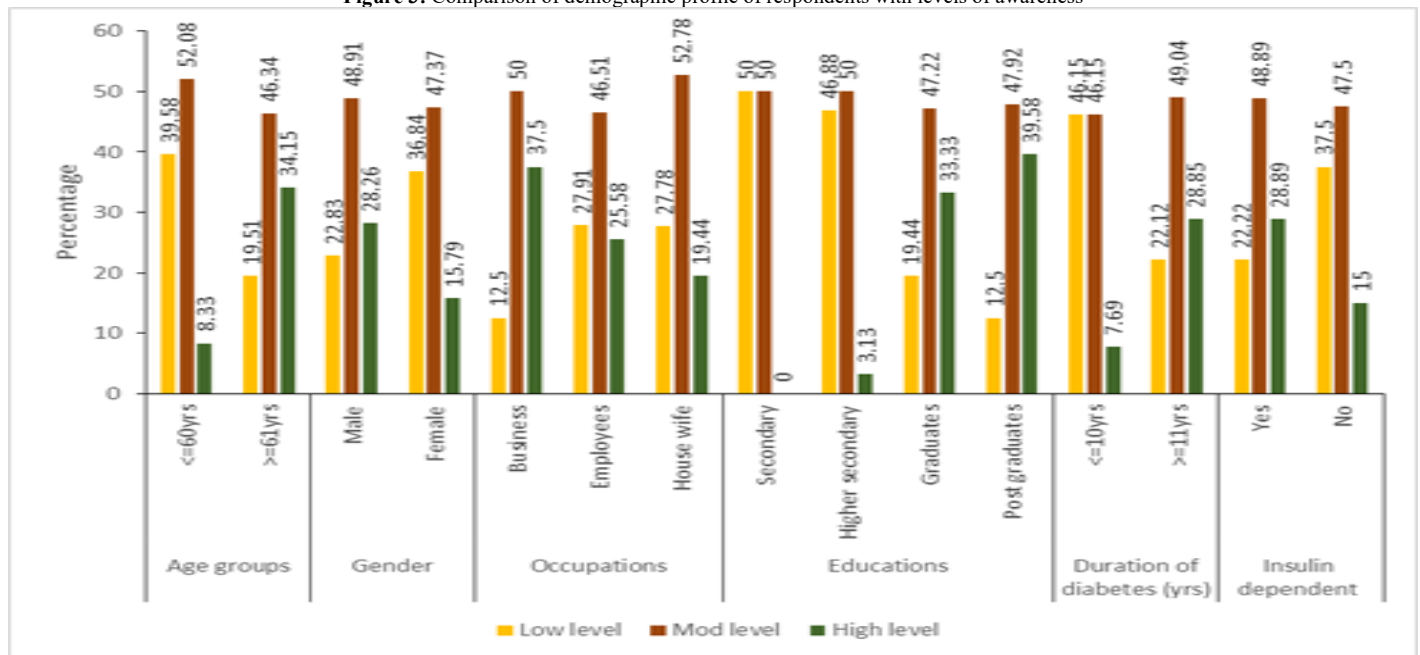


There is overall moderate level of Physiotherapy awareness in Diabetic Neuropathy (48.46%).

Those who are in secondary and higher secondary education have low-moderate awareness. Graduates & Postgraduates are having moderate level of awareness. Those who are having diabetes from less

than 10 years are having low to moderate level of awareness. Those more than 11 years are having moderate level of awareness. Both who are on insulin or on oral hypoglycemic are having moderate level of awareness.

Figure 3: Comparison of demographic profile of respondents with levels of awareness



**RESULTS AND DISCUSSION**

This particular study as per the previous search of the literature, the first of its kind to investigate patient’s interpretation about different domains in DPN and to determine the level of Physiotherapy awareness in a single study.

Majority of the participants in our study were uncertain about the causal domain (cause for occurrence of DPN), the duration

& course with which DPN progresses [11]. They were also uncertain about physical consequences of DPN such as foot injuries, amputation and foot gangrene. Also, their interpretation about whether a Diabetic doctor can prevent the worsening of the neuropathy symptoms & a good diabetic diet can help in prevention of DPN was uncertain. However, a majority of the participants had good interpretation about

the nature of DPN and emotional consequences of lost or reduced feeling in the feet [12].

Females had a better interpretation scores in nature domain compared to males, thus it could be emphasized that they tend to follow the foot self-care behaviors. Among those who had good interpretation for the controllability domain were those with secondary education had good interpretation. Those who were graduates had higher emotional consequences scores [13,14].

Many of the participants were uncertain about the role of Physiotherapist in planning protocol in DPN and their role in promoting foot self-care behaviors. A few of them who had agreed for having understood the role of Physiotherapy in prevention of DPN, 48.46% had moderate level of Physiotherapy awareness in DPN and belonged to the age group less than or equal to 60years, with higher education categories (graduates & postgraduates). Those with longer duration of DM and those who are insulin dependent also had moderate level of physiotherapy awareness. On the contrary, 26.92% of the participants had low level of awareness.

The original version of PIN questionnaire was used in the study done in 2013, to identify the cognitive representations of peripheral neuropathy and self-reported foot-care behavior in an Australian sample of people with Diabetic peripheral neuropathy [15]. The study showed that people with diabetes and peripheral neuropathy have different illness interpretations that may influence health-related behavior. The results of the study concluded that educational approach aimed to improve interpretations regarding different domains should be considered in diabetic neuropathy patients [16].

In the previous study done in 2017, common sense model of illness behavior was used by Physiotherapist in treating chronic musculoskeletal conditions to identify their different perceptions regarding their symptoms. Also, this model proves to be beneficial in those with chronic illness. Hence, the intended study was conducted in diabetic neuropathy population [17].

The nature domain emphasizes the patient's understanding of the DPN. In the present study, majority of the participants had agreed for the nature domain with 58.46% had interpreted that good circulation means healthy feet, followed by 55.38% had agreed that if the feet feel warm to touch, it means healthy feet. Although good circulation is one of the factors for healthy feet in diabetes, some people lack awareness that only improving the circulation will improve the neuropathy symptoms and hence, tend to engage in activities like walking barefoot to improve circulation in the feet [18]. This is according to the qualitative study done in 2008 to determine patient's perspective about foot complications which indicated that participants gave poor circulation in the feet as the only reason for their symptoms and engaged in activities like walking barefoot to improve circulation

in the feet which led to unnoticed injury to the foot [19].

Also, females had a better interpretation scores in nature domain compared to males, thus it could be concluded that they tend to follow the foot self-care behaviors. For the Diabetes population, effective self-management is the most critical step for the healthy life. However, it requires a great deal of personal motivation and change in behavior. This could be explained by the fact that females are highly motivated to understand the reasoning behind their health issues and more negligence is seen in males regarding their health issues with incidence of amputation being more in males [20].

Thus, this study emphasizes that there is a need to correct patient's interpretation regarding the poor circulation and design a specific and safe exercise protocol other than walking to improve their circulation or to simultaneously improve their neuropathy symptoms.

According to the qualitative study done in 2008, to determine patient's perspective regarding foot complication Sande very day foot self-care practices, very few participants thought there was a relationship between glycemic control and foot complications i.e. poor is the glycemic control, higher the chances of amputation. Most of the participants had poor knowledge about what a foot ulcer is and its cause [17]. Despite uncertainty about what exactly foot ulcers are, the general interpretation was that they could be treated and cured. And the interpretation of the patients was that foot ulcers will heal automatically in few days without taking consultation with doctor or therapist. Neglect of self-care or delay in the treatment was thought be the most common pathway to lower limb amputation as per the study [21].

In our study, 56.92% of the population were uncertain about how the course of the diabetic neuropathy is and how fast it can progress. It could be emphasized that due to uncertainty about duration domain, diabetic neuropathy patients tend to ignore their neuropathy symptoms in the early stages until it progresses and they lend up with foot gangrene and amputation. In the study, majority of the population were uncertain about the physical consequences of diabetic neuropathy symptoms. Physical consequences could be either injuries to the feet, foot gangrene, foot ulcers and amputation. 49.23% of the population were uncertain that lost or reduced feeling in their feet could lead to foot gangrene.

According to the study done in 2010 by Koliopoulos et. al., emotional representations like fear, sadness, anger, guilt are associated with foot self-care behavior. Knowing the emotional consequences help the individuals to adhere to foot self-care recommendations. The more emotion one affirms, the more likely they are to adhere to foot self-care recommendations. The more perceived risk of an amputation without an emotional response, the less likely they are to adhere to foot self-care recommendations [22].

In our study, majority of the participants agreed to emotional consequences of lost or reduced feeling in the feet. 60% of the participants agreed that having lost or reduced feeling in their feet makes them worry about a foot injury & feeling worried makes them more determined to take good care of my feet. According to the previous studies, worry is a motivator of adherence, whereas anger hinders foot self-care actions [23]. Thus, in the present study, participants were knowing about the emotional consequences of DPN symptoms, which would be a motivator for these patients to take care of their feet.

Comprehensive diabetic foot complications risk assessments and foot care based on prevention, education and support by a multi-disciplinary team reduces foot complications and amputations by up to 85% [24]. Thus, frequent visit to the Diabetician and following of diabetic diet is crucial. In our study, 50%, were uncertain about the role of Diabetic doctor in preventing the lost or reduced sensation in feet from getting worse, with 48% being uncertain about following a good diabetic diet will help to prevent the neuropathy symptoms. However, in the original PIN questionnaire, role of Physiotherapist in preventing the diabetic neuropathy was not included, the present study intended to emphasize Physiotherapy awareness in diabetic neuropathy [25].

Among those who are agreeing to the awareness domain, it was found that there was moderate level of Physiotherapy awareness in Diabetic Neuropathy (48.46%) in the participants who belong to the higher education classes, as they might have heard about the Physiotherapy services in their lifespan. In the present study, moderate level of awareness was identified in the participants belonging to less than 60 years, where this is the age group where neuropathy symptoms begin, maybe they tend to gather information about different treatment approaches. However, very few numbers of participants had higher level of awareness; this could be attributed to the fact that no Physiotherapy awareness sessions are being held in the community for increasing the awareness about Physiotherapy intervention in prevention of Diabetic neuropathy in public. There was moderate level of awareness found in participants with more duration of DM & those who are insulin dependent, as these are always associated with neuropathy symptoms.

Thus, in this study as majority of the participants were uncertain about the different domains of Diabetic neuropathy and have moderate level of Physiotherapy awareness in Diabetic neuropathy, there is a need to impart educational strategies in the respective domain where patients are uncertain and increase awareness among the DPN population regarding use of Physiotherapy intervention like planning of exercise protocol & counselling for following foot self-care behaviors in the early stages of DPN as a preventive approach so that the holistic approach of Diabetic Care is met.

## CONCLUSIONS

This study concluded that in the included population there are different interpretations in different domains. Majority of the participants were uncertain about the causal, duration and course domain, physical consequences like occurrence of foot injuries and amputation & controllability domain of Diabetic Neuropathy.

Considering the emotional consequences domain, majority of the population tend to feel worried about their DPN symptoms which could be considered as a motivator for adherence to foot self-care practices.

Thus, there is a strong need to formulate educational strategies in this population to change their interpretation in the domain where they are uncertain & also increase awareness among the DPN population regarding use of Physiotherapy intervention like planning of exercise protocol & counselling for following foot self-care behaviors in the early stages of DPN as a preventive approach so that the holistic approach of Diabetic Care is met.

## Author's Contribution

All authors contributed equally to the manuscript.

## Conflict of Interest

The authors declare no conflict of interest.

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