Original Research Article

Dimensionality and scale properties of psycho-social distress and complications in type 2 diabetes population using Diabetes Distress Scale

ABSTRACT

Aim: This study analyzes the psycho-social challenges and problems experienced by individuals diagnosed with type 2 diabetes, utilizing the diabetes distress scale (DDS). During the investigation period, 205 patients' medical records were analyzed and assessed through direct patient interviews, and the results were analyzed using a chi-square test.

Methodology: Six months of prospective observational study in five departments of a tertiary care hospital was conducted. During the investigation period, 205 patients' medical records were analyzed and assessed through direct patient interviews, and the results were analyzed using a chi-square test.

Results: According to statistical analysis, it has been determined that neuropathy ($\chi2$ =7.225, p=0.027), Coronary Artery Disease (CAD) ($\chi2$=6.375, p=0.041), diabetes foot ($\chi2$ =8.416, p=0.015), and retinopathy ($\chi2$=6.189, p=0.045) are the primary emotional-related issues. Additionally, in regimen-related risk, diabetes foot complications ($\chi2$ =16.354, p<0.001) exhibit a high significance level, along with others.

Conclusions: The study facilitated the assessment and examination of diabetes patients' emotional, dietary, medical, and social suffering. Diabetes neuropathy, retinopathy, foot ulcer, CAD, and poor healing were the higher perplexities discovered by the investigation.

*Keywords***:** Diabetes, Diabetes Distress Scale, Diabetes complications, Psycho-social distress

1. Introduction

Diabetes can exert a substantial impact on individuals' quality of life, including several dimensions, such as physical, mental, and emotional well-being [1]. The identification of obstacles faced by persons with diabetes is of utmost importance, particularly concerning the management of their condition, the emotional load they experience, the accessibility to support groups, and the regulation of their emotions. As the majority of individuals go through the early stages of adulthood, there is a consistent and increasing pattern observed in the occurrence of type 2 diabetes as well as the experience of distress related to diabetes, referred to as diabetes distress (DD) [2]. Therefore, it is imperative to investigate the association between emotional DD and diabetes-related

complications in India, a nation widely recognized for its significant contributions to diabetes research.

The term DD describes the specific emotional burdens and concerns that individuals with diabetes can encounter when managing their chronic disease, which may be challenging and demanding [3]. Although the symptoms of DD are comparable to those of depression, they are not severe enough to satisfy the diagnostic standards for major depression [4]. The emergence of type 2 diabetes can be significantly influenced by depression, as evidenced by its association with an increased likelihood of severe complications and mortality. Therefore, it is vital to acknowledge the importance of addressing depression in individuals with type 2 diabetes [5].

Research findings have demonstrated that DD significantly predicts suboptimal glycemia management in subsequent periods [2]. Coronary artery disease (CAD), peripheral arterial disease, and stroke are illustrative instances of macrovascular consequences, whereas diabetes nephropathy, neuropathy, and retinopathy serve as instances of microvascular issues [6]. If left unaddressed, this has the potential to lead to consequences that might be life-threatening [7-9]. Promoting active disease management and engagement in constructive activities, such as monitoring blood glucose levels and implementing risk mitigation strategies, will help to prevent diabetes complications.

This study utilizes the diabetes distress scale (DDS) to examine and evaluate the psycho-social challenges encountered by individuals with type 2 diabetes. The framework takes into account several characteristics, including age, gender, social habits, and co-morbidities, in order to provide recommendations aimed at improving individuals' health-related quality of life. The outcomes are subsequently assessed by the chi-square statistical method, which is a reliable and elementary tool in data distribution and computation.

The rest of the paper is structured as follows: Section 2 discusses the materials and methods for the study. Section 3-4 includes results and discussions obtained after the investigation is reported. Finally, Section 5 concludes the investigation and outlines recommendations for further research.

2. Materials and Methods

2.1. Study area and sample collection

The investigation was undertaken during the period spanning from December 2022 to May 2023 within the premises of a tertiary care hospital, St. James' Chalakudy, situated in the state of Kerala, located in the southern region of India. A prospective observational study was undertaken in several departments, including general medicine, cardiology, orthopedics, surgery, and gynecology, beneath a tertiary care hospital with a bed capacity of 450. In order to be eligible for the study, individuals must have a confirmed diagnosis of type 2 diabetes for a minimum duration of six months. Additionally, participants must be at least 20 years old, regardless of gender, and satisfy the specified inclusion requirements. The study excluded patients in the categories of pediatrics and psychiatry, as well as outpatients, those who expressed unwillingness to participate, and patients diagnosed with type 1 diabetes.

Patients' demographic information, including current complaints, past medical history, and current medications, together with details about drug interactions, adverse drug reactions, laboratory results, and diagnostic tests, were systematically collected during ward rounds. These data were recorded on a dedicated data entry form designed for this purpose. The study investigated the psychological challenges, hardships, and complexities by employing the DDS questionnaire during the direct patient interview. Moreover, the patients were provided with disease-related information via patient counseling sessions and informational leaflets.

2.2. Instruments and measures

Tools created to gauge DD include the ATT39, the problem areas in the diabetes scale, and the questionnaire on stress in patients with diabetes-revised QSD-R12. The DDS was developed by Polonskys et al. based on the QSD-R 12. To address the shortcomings of earlier scales, he created DDS in 2005 [10-11]. The DDS, a self-report evaluation tool, identifies the issues of diabetes patients pertaining to disease management, emotional load, social support, and accessibility to healthcare [10]. Higher DDS scores are more significantly correlated with lower self-care and metabolic control. DDS has a high internal reliability and validity level across four distinct distress areas and a stable, generalized factor structure. Seventeen questions make up the scale used to measure DD [12].

Four separate subscales of distress can be identified, which are as follows: regimen-related distress, which consists of five questions; physician-related distress, composed of four questions; emotional-related distress, which encompasses five questions; and interpersonal-related distress, which involves three questions. Regimen-related discomfort encompasses concerns over the effectiveness of the diabetes regimen, inconsistent monitoring of blood sugar levels, and a lack of self-assurance in the individual's ability to manage their diabetes daily. Physician-related distress encompasses concerns over patients healthcare accessibility, the quality of treatment provided, and apprehensions regarding the adequacy of healthcare experts' advice. The concept of emotional burden pertains to the adverse psychological and emotional consequences of diabetes. It involves experiencing various adverse feelings such as despondency, internal strife, apprehension of lifelong diabetes, and a sense of being overwhelmed by numerous societal demands. Finally, interpersonal stress poses challenges in maintaining a wholesome lifestyle and diminishes the availability of emotional support, exacerbating stress associated with diabetes.

The severity of these problems is rated by respondents on a six-point Likert scale (1 = "no problem" to 6 = "serious problem"). The total score was divided by 17 to determine the overall distress score [3]. The subscale scores for each domain were calculated by dividing the overall score by the number of questions that fell under that subscale. The entire DDS and each of its components were evaluated using mean scores of 2, which indicate no distress; mean ratings between 2 and 2.9, which indicate moderate discomfort; and mean scores of 3 and above, which indicate severe distress, with a possible range of 1 to 6 [13].

2.3. Health-related quality of life

The provision of patient counseling plays a crucial role in the effective management of problems associated with diabetes. Complications arising from diabetes might be attributed to insufficient glycemic control and a lack of awareness of the illness. Various forms of communication, such as oral, written, or counseling aids, can be employed to effectively transmit information pertaining to the drug's route of administration, dosage, frequency, intended usage within a specific demography, etiology, risk factors, complications, clinical management, as well as lifestyle and dietary modifications [14]. The best glycemic control

has been demonstrated to be significantly correlated with medication adherence [15]. According to numerous studies, patients who adhere to diabetes education have a very high quality of life.

2.4. Statistical analysis

Data were analyzed using the statistical package for social sciences (SPSS) version 22.0 software (SPSS, IBM). A chi-square test was done to assess the association between emotional distress, regimen-related distress in age, gender, and diabetes complications. The chi-square test, a statistical hypothetic test, is generally used to determine whether two categorical variables or two contingency table dimensions have independent effects on the test statistic (i.e., the values within the table). In particular, if there is a statistically significant discrepancy between the predicted and observed frequencies in one or more categories of a contingency table, the test is valid when the test statistic is chi-squared distributed under the null hypothesis

3. Results

The study results were derived using chi-square statistical analysis, revealing significant connections between age, gender, and complications with emotional discomfort and regimen-related suffering. They were examined based on three levels: high, moderate, and no distress, and the analysis included a total of 205 respondents. The attainment of significance is contingent upon the p-value being less than 0.05. These associations will now be addressed in detail.

Table 1: Association of emotional-regimen distress and age in years (N=205)

Age in years	Emotional distress				Regimen distress			
	High	Moderate	Nil	χ^2 test	High	Moderate	Nil	χ^2 test
≤40	3	5	3	χ^2= 9.211, df= 10, p= 0.512(NS)	3	4	4	χ^2= 6.539, df= 10, p= 0.768 (NS)
41-50	9	7	6		3	8	11	
51-60	19	17	6		7	14	21	
61-70	22	33	14		9	16	44	
71-80	21	12	11		6	14	24	
>80	9	6	2		4	6	7	

NS- Not Significant, χ^2 test- chi-square test, df- degree of freedom, p-p value.

Table 1 shows the association between emotional distress, regimen distress, and age in years. The participants were categorized into six age groups regardless of their gender. In emotional distress analysis, 83 respondents were classified as experiencing severe distress, 80 were classified as experiencing moderate discomfort, and 42 subjects were classified as experiencing no distress. The majority of individuals within the age range of 61-70 were classified as being at a heightened risk, with the subsequent group of patients aged 71-80 also exhibiting an elevated level of risk. We examined the regimen discomfort experienced by these individuals; 111 were classified as belonging to the no-distress group, 62 participants were classified as experiencing moderate distress, and the remaining 32 were

classified as belonging to the high-distress category. The demographic group consisting of individuals aged 61-70 exhibited a higher risk profile, with the subsequent highest risk observed among patients aged 51-60. Moderate discomfort was often observed among those aged 61 to 70. There was no statistically significant correlation seen between emotional discomfort and chronological age. The chi-square test was calculated to be 9.211, with a p-value greater than 0.05. Similarly, no statistically significant connection was found between regimen-related distress and age in years ($\chi2=6.539$, $p>0.05$).

Table 2: Association of emotional-regimen distress and gender (N=205)

Gender	**Emotional distress**			**χ^2 test**
	High	**Moderate**	**Nil**	
Male	46	43	18	$\chi^2= 1.892$ df= 2, p= 0.388 (NS)
Female	37	37	24	
Gender	**Regimen distress**			**χ^2 test**
	High	**Moderate**	**Nil**	
Male	20	28	59	$\chi^2= 2.632$ df= 2, p= 0.268 (NS)
Female	12	34	52	

NS- Not Significant, $\chi2$test- chi-square test, df- degree of freedom, p-p value.

Table 2 shows the association between emotional-regimen distress and gender. In emotional distress analysis, the majority of the males, around 46, showed high distress, whereas 37 females were only found in this category. The moderate distress range of males was also high (43) compared to females (37). A significant proportion of the male participants, around 20 individuals, exhibited elevated levels of distress, while only 12 females were shown to fall under the regimen distress group. The male individuals had a moderate distress range of 28, which was lower than the female ones (34). The estimated chi-square test result was 1.892, with a p-value higher than 0.05. There was no significant association between emotional distress and gender. No statistically significant correlation was seen between regimen distress and gender, as shown by the chi-square test ($\chi2=2.632$, $p>0.05$).

Table 3: Association of emotional distress and complications

Complications		**Emotional distress**			**Total**	**χ^2 test**
		High	**Moderate**	**Nil**		
Neuropathy	No	57	59	38	154	$\chi^2= 7.225$ df= 2, p= 0.027*
	Yes	26	21	4	51	
Retinopathy	No	58	65	37	160	$\chi^2= 6.189$ df= 2, p= 0.045*
	Yes	25	15	5	45	
Nephropathy	No	66	68	36	170	$\chi^2= 1.155$ df= 2, p= 0.561(NS)
	Yes	17	12	6	35	
Diabetes foot	No	61	64	40	165	$\chi^2= 8.416$ df= 2,
	Yes	22	16	2	40	

						p= 0.015*
Diabetes keto acidosis	No	81	75	41	197	χ^2= 1.928 df= 2, p= 0.381 (NS)
	Yes	2	5	1	8	
CAD	No	64	59	39	162	χ^2= 6.375 df= 2, p= 0.041*
	Yes	19	21	3	43	
Lipohypertrophy	No	76	72	39	187	χ^2= 0.302 df= 2, p= 0.860 (NS)
	Yes	7	8	3	18	
Dementia	No	75	74	41	190	χ^2= 2.173 df= 2, p= 0.337 (NS)
	Yes	8	6	1	15	
Cellulitis	No	71	75	37	183	χ^2= 2.941 df= 2, p= 0.230 (NS)
	Yes	12	5	5	22	
Sleep apnoea	No	69	71	40	180	χ^2= 3.926 df= 2, p= 0.140 (NS)
	Yes	14	9	2	25	
Slow healing	No	65	51	32	148	χ^2= 4.724 df= 2, p= 0.094 (NS)
	Yes	18	29	10	57	

*Significant at 0.05 level, NS- Not Significant, χ2test- chi-square test, df- degree of freedom, p-p value.

The findings in Table 3 indicate a significant correlation between emotional distress, microvascular and macrovascular problems in individuals with diabetes. The study observed a notable level of discomfort among participants with neuropathy; 26 individuals reported such symptoms. This was closely followed by retinopathy, which 25 respondents reported. Moderate anguish was reported by 18 patients concerning sluggish healing. A notable correlation was seen between emotional distress and diabetes complications, including neuropathy (χ2=7.225, p=0.027), diabetes retinopathy (χ2=6.189, p=0.045), diabetes foot (χ2=8.416, p=0.015), and CAD (χ2=6.375, p=0.041).

Table 4: Association of regimen distress and complications

Complications		**Regimen distress**			**Total**	**χ^2 test**
		High	**Moderate**	**Nil**		
Neuropathy	No	18	44	92	154	χ^2= 10.248 df= 2, p=0.006**
	Yes	14	18	19	51	
Retinopathy	No	20	44	96	160	χ^2= 10.943 df= 2, p=0.004**
	Yes	12	18	15	45	
Nephropathy	No	21	53	96	170	χ^2= 8.046 df= 2, p=0.018*
	Yes	11	9	15	35	
Diabetes foot	No	18	49	98	165	χ^2= 16.354 df= 2,
	Yes	14	13	13	40	

						p<0.001***
Diabetes keto acidosis	No	31	59	107	197	χ^2= 0.223 df= 2, p= 0.895 (NS)
	Yes	1	3	4	8	
CAD	No	24	47	91	162	χ^2= 1.286 df= 2, p= 0.526 (NS)
	Yes	8	15	20	43	
Lipohypertrophy	No	29	56	102	187	χ^2= 0.139 df= 2, p= 0.933(NS)
	Yes	3	6	9	18	
Dementia	No	29	58	103	190	χ^2= 0.270 df= 2, p= 0.874 (NS)
	Yes	3	4	8	15	
Cellulitis	No	28	51	104	183	χ^2= 5.554 df= 2, p= 0.062 (NS)
	Yes	4	11	7	22	
Sleep apnoea	No	27	56	97	180	χ^2= 0.737 df= 2, p= 0.692 (NS)
	Yes	5	6	14	25	
Slow healing	No	23	48	77	148	χ^2= 1.286 df= 2, p= 0.526(NS)
	Yes	9	14	34	57	

*Significant at 0.05 level, **Significant at 0.01 level, ***Significant at 0.001 level, NS- Not Significant, χ^2 test- chi-square test, df- degree of freedom, p-p value.

The data concerning the association between regimen distress and complications is presented in Table 4. The research conducted in this study identified a significant degree of distress experienced by patients afflicted with neuropathy and diabetes foot ulcers, as evidenced by the self-reported sensations of agony by 14 participants. Furthermore, it was observed that retinopathy served as a cause of discomfort for 12 participants. In addition, 18 patients who presented with both neuropathy and retinopathy reported experiencing significant discomfort. In order to establish statistical significance, the p-value must be below the threshold of 0.05, 0.01, and 0.001. A significant association was seen between the discomfort caused by the treatment regimen and the occurrence of diabetes problems, such as diabetes foot (χ2=16.354, p<0.001), diabetes neuropathy (χ2=10.248, p-0.006), diabetes retinopathy (χ2=10.943, p-0.004), and nephropathy (χ2=8.046, p-0.018).

4. Discussion

The age groups of the subjects are divided into seven, and the highest proportion (33.65%) was 61-70 years old, while the group with the lowest percentage (5.36%) was 31-40 years old and 81-90 years old. Men comprised the majority of participants (52.19%), while women comprised 47.8%. According to [16], men appear to be more vulnerable than women to the adverse effects of indolence and obesity, presumably due to variations in insulin sensitivity and regional fat deposition. Alcohol use as a social habit is practiced by 36.66% of research participants, whereas smoking is practiced by 21.66%, drinking and smoking together by 12.5%, and no social habits are practiced by 54.16% of participants, and an identical study [17] states the above. Single co-morbidity is present in 30% of the study participants, two or more co-morbidities are present in 58.3% of patients, and diabetes is

present in 11.66% of participants. In addition to type 2 diabetes, 97.5% of patients in the study [18] reported having at least one co-morbid disease.

The most common diabetes consequences are sluggish wound healing (27.80%), neuropathy (24.8%), retinopathy (21.95%), coronary artery disease (CAD), and diabetes foot (19.51%). A case study [19] states that 43.33% of subjects had cardiac autonomic neuropathy, and the second fascinating consequence that frequently affects patients is retinopathy, followed by 18.66% of diabetes foot ulcers.

Based on the data, there is a strong correlation between regimen-related burden and complications like diabetes foot ($\chi2$ =16.354, p<0.001), neuropathy ($\chi2$ =10.24, p=0.006), retinopathy ($\chi2$ =10.94, p=0.004), and nephropathy ($\chi2$ =8.046, p=0.018). A similar study [20] also found that the prevalence of microvascular complications varied according to low (28%), moderate (45%), and high (76%) regimen complexity ($\chi2$ =11.8, p = 0.003). There is a substantial link between emotional distress and consequences, including neuropathy ($\chi2$=7.225, p=0.027), retinopathy ($\chi2$=6.189, p=0.045), diabetes foot ($\chi2$ =8.41, p=0.015) and coronary artery disease ($\chi2$=6.375, p=0.041) pursuant to the study.

It is vital to possess an understanding of the subsequent constraints. The DDS platform is exclusively available in its global language variant. The utilization of the language posed a significant challenge in our research endeavor due to its nature as a self-report rating instrument. Nevertheless, we partially overcome this obstacle by converting information into the native language of the individuals involved. Moreover, the duration of our research period, which spanned six months, proved inadequate in comprehensively addressing all of the issues at hand. Further investigation is necessary to have a more comprehensive understanding of the ramifications of diabetes.

5. Conclusion

This study incorporates many factors, including self-efficacy, personal sickness, and health attitudes. The present study employed the DDS to investigate the psychosocial challenges and concerns encountered by individuals diagnosed with type 2 diabetes. The investigation revealed many significant perplexities, including diabetes neuropathy, diabetes retinopathy, diabetes foot ulcer, CAD, and impaired wound healing. Diabetes is regarded as the central concern in the forthcoming landscape by the year 2025. Undoubtedly, this work will serve as a catalyst for future research endeavorsaimed at preventing diabetes, mitigating its effects, and reducing annual healthcare expenses.

Ethical Approval

The hospital authority and institutional Human Ethics Committee (SJPCEC/P25/PP/2020/003)

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