



Dimension of Psycho-social Distress and Associated-complications in Type 2 Diabetes Population

Amala Joseph ^{a*}, Aiswarya Thomas ^a, Jilbi Josey ^a
and Rosmin Jacob ^a

^a Department of Pharmacy Practice, St. James College of Pharmaceutical Sciences, Chalakudy- 680307, Kerala, India.

Authors' contributions

This work was carried out in collaboration among all authors. Authors AJ, AT and JJ conducted the study. Author AT designed the data entry form. Authors AJ drafted the patient counseling leaflet, manuscript, and involved in review of the article. Author RJ provided the guidance and valuable feedback for the research. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2023/v35i267436

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/107079>

Original Research Article

Received: 19/07/2023

Accepted: 26/09/2023

Published: 05/10/2023

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). Moreover, this research offers patients recommendations and guidance to enhance their overall well-being and health-related quality of life.

Methodology: Six months of prospective observational study in five departments of a tertiary care hospital was conducted. During the investigation period, 205 patients' diabetes conditions 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 ($\chi^2 = 7.225$, $p = 0.027$), Coronary Artery Disease (CAD) ($\chi^2 = 6.375$, $p = 0.041$), diabetes foot ($\chi^2 = 8.416$, $p = 0.015$),

*Corresponding author: E-mail: amalakannen@gmail.com;

and retinopathy ($\chi^2=6.189$, $p=0.045$) are the primary emotional-related issues. Additionally, in regimen-related risk, diabetes foot complications ($\chi^2 =16.354$, $p<0.001$) 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 should be above 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 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 ($\chi^2=6.539$, $p>0.05$).

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		3	4	4	
41-50	9	7	6	$\chi^2= 9.211$, df= 10, p= 0.512(NS)	3	8	11	$\chi^2= 6.539$, df= 10, p= 0.768 (NS)
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 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, χ^2 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 ($\chi^2=2.632$, $p>0.05$).

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 ($\chi^2=7.225$, $p=0.027$), diabetes retinopathy ($\chi^2=6.189$, $p=0.045$), diabetes foot ($\chi^2=8.416$, $p=0.015$), and CAD ($\chi^2=6.375$, $p=0.041$).

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, p= 0.015*
	Yes	22	16	2	40	
Diabetes keto acidosis	No	81	75	41	197	$\chi^2= 1.928$ df= 2, p= 0.381 (NS)
	Yes	2	5	1	8	
CAD	No	64	59	39	162	$\chi^2= 6.375$ df= 2, p= 0.041*
	Yes	19	21	3	43	
Lipohypertrophy	No	76	72	39	187	$\chi^2= 0.302$ df= 2, p= 0.860 (NS)
	Yes	7	8	3	18	
Dementia	No	75	74	41	190	$\chi^2= 2.173$ df= 2, p= 0.337 (NS)
	Yes	8	6	1	15	
Cellulitis	No	71	75	37	183	$\chi^2= 2.941$ df= 2, p= 0.230 (NS)
	Yes	12	5	5	22	
Sleep apnoea	No	69	71	40	180	$\chi^2= 3.926$ df= 2, p= 0.140 (NS)
	Yes	14	9	2	25	
Slow healing	No	65	51	32	148	$\chi^2= 4.724$ df= 2, p= 0.094 (NS)
	Yes	18	29	10	57	

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

Table 4. Association of regimen distress and complications

Complications		Regimen distress			Total	χ^2 test
		High	Moderate	Nil		
Neuropathy	No	18	44	92	154	$\chi^2= 10.248$ df= 2, p=0.006**
	Yes	14	18	19	51	
Retinopathy	No	20	44	96	160	$\chi^2= 10.943$ df= 2, p=0.004**
	Yes	12	18	15	45	
Nephropathy	No	21	53	96	170	$\chi^2= 8.046$ df= 2, p=0.018*
	Yes	11	9	15	35	
Diabetes foot	No	18	49	98	165	$\chi^2= 16.354$ df= 2, p<0.001***
	Yes	14	13	13	40	
Diabetes keto acidosis	No	31	59	107	197	$\chi^2= 0.223$ df= 2, p= 0.895 (NS)
	Yes	1	3	4	8	
CAD	No	24	47	91	162	$\chi^2= 1.286$ df= 2, p= 0.526 (NS)
	Yes	8	15	20	43	
Lipohypertrophy	No	29	56	102	187	$\chi^2= 0.139$ df= 2, p= 0.933(NS)
	Yes	3	6	9	18	
Dementia	No	29	58	103	190	$\chi^2= 0.270$ df= 2, p= 0.874 (NS)
	Yes	3	4	8	15	
Cellulitis	No	28	51	104	183	$\chi^2= 5.554$ df= 2, p= 0.062 (NS)
	Yes	4	11	7	22	
Sleep apnoea	No	27	56	97	180	$\chi^2= 0.737$ df= 2, p= 0.692 (NS)
	Yes	5	6	14	25	
Slow healing	No	23	48	77	148	$\chi^2= 1.286$ 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 ($\chi^2=16.354$, $p<0.001$), diabetes neuropathy ($\chi^2=10.248$, $p=0.006$), diabetes retinopathy ($\chi^2=10.943$, $p=0.004$), and nephropathy ($\chi^2=8.046$, $p=0.018$).

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. Similarly as mentioned in the study [17] the menstrual cycle, pregnancy, and the menopausal transition are all impacted by ovarian hormones, which also affect insulin sensitivity among women. And the effects hormones such as estrogens and progestins can alter the glucoseregulation in women. Discussing about the social habits of the participants we came to know that, Alcohol use 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 [18,19] states that the alcohol and other social habits increases the chances for developing diabetes. And in the analysis of co-morbidities along with diabetes, 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 [20] 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 [21] 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 ($\chi^2 = 16.354$, $p < 0.001$), neuropathy ($\chi^2 = 10.24$, $p = 0.006$), retinopathy ($\chi^2 = 10.94$, $p = 0.004$), and nephropathy ($\chi^2 = 8.046$, $p = 0.018$). A similar study [22] also found that the prevalence of microvascular complications varied according to low (28%), moderate (45%), and high (76%) regimen complexity ($\chi^2 = 11.8$, $p = 0.003$). There is a substantial link between emotional distress and consequences, including neuropathy ($\chi^2 = 7.225$, $p = 0.027$), retinopathy ($\chi^2 = 6.189$, $p = 0.045$), diabetes foot ($\chi^2 = 8.41$, $p = 0.015$) and coronary artery disease ($\chi^2 = 6.375$, $p = 0.041$) 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 which focuses on preventing diabetes, mitigating its effects, and reducing annual healthcare expenses.

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

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

ACKNOWLEDGEMENTS

We express our utmost gratitude to St. James Medical Academy and St. James Hospital in Chalakudy, Kerala, for their invaluable help in facilitating our research endeavor. We express our gratitude to all the patients who participated in the data-collecting process, and we extend our deep appreciation to Albert Poulouse for his invaluable assistance in reviewing and correcting the manuscript along with the contribution of the statistician, Manu K. J for the guidance to the mathematical tools and analysis in this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Centre for disease control and prevention. Available:<https://www.cdc.gov/diabetes/library/spotlights/diabetes-facts-stats.html#:~:text=In%20fact%2C%20people%20with%20diagnosed,%2C%20and%20emotional%20well%2Dbeing>
2. Marit Graue, Anne Haugstvedt, Tore Wentzel-Larzen, Bjørg Karlsen, Berit Rokne. Diabetes-related emotional distress in adults: Reliability and validity of the Norwegian versions of the Problem Areas in Diabetes Scale (PAID) and the Diabetes Distress Scale (DDS). *Int. J. Nurs. Stud.* 2012;49:174-182
3. Fisher L, Hessler DM, Polonsky WH, Mullan J. When is diabetes distress clinically meaningful?: establishing cut points for the Diabetes Distress Scale. *Diabetes Care.* 2012;35(2):259-64.
4. Thanakwang K, Thinganjana W, Konggumnerd R. Psychometric properties of the Thai version of the Diabetes Distress Scale in diabetic seniors. *Clin Interv Aging.* 2014;9:1353-61.
5. Messina R, Iommi M, Rucci P, Reno C, Fantini MP, Lunghi C, et al. Is it time to consider depression as a major complication of type 2 diabetes? Evidence from a large population-based cohort study. *Acta Diabetol.* 2022;59(1):95-104.
6. Michael Fowler. Microvascular and Macrovascular complications of Diabetes. *Clin Diabetes.* 2008;26(2):77-82. DOI: 10.2337/diaclin.26.2.77
7. Bjornstad P, Drews KL, Caprio S, Gubitosi-Klug R, Nathan DM, et al. Long-term complications in youth-onset type 2 diabetes. *N Engl J Med.* 2021;385(5):416-26.
8. Omorogieva OJO. An overview of Diabetes and its complications. *Diabetes Res Open J.* 2016;2(2):e4-e6. DOI: 10.17140/DROJ-2-e005
9. Karthika Paul. Diabetes mellitus and its complications: A review. *Int. j. Curr.* 2012;4(2):12-17.
10. Krzemińska S, Bąk E. Psychometric properties of the Polish version of the diabetes distress scale (DDS). *Psychol Res Behav Manag.* 2021;14:1149-56.
11. Polonsky WH, Anderson BJ, Lohrer PA, Welch G, Jacobson AM, Aponte JE, et al. Assessment of diabetes-related distress. *Diabetes Care.* 1995;18(6):754-60. DOI: 10.2337/diacare.18.6.754
12. Akter J, Islam RM, Chowdhury HA, Selim S, Biswas A, Mozumder TA, et al. Psychometric validation of diabetes distress scale in Bangladeshi population. *Sci Rep.* 2022;12(1):562.
13. Schmitt A, Reimer A, Kulzer B, Haak T, Ehrmann D, Hermanns N. How to assess diabetes distress: comparison of the Problem Areas in Diabetes Scale (PAID) and the Diabetes Distress Scale (DDS). *Diabet Med.* 2016;33(6):835-43. DOI: 10.1111/dme.12887
14. Dr. Kandavalli Sridevi M, Venkata Subbaiah M, Surekha Harini J, Kavya L. Impact of Patient Counseling On Blood Glucose Levels of Diabetes Mellitus Patients. *Indo Am. j. Pharm. Res.* 2017; 7(5): 2231-6876
15. Javedh Shareef, Jennifer Fernandes, Laxminarayana Samaga, Bhat ML. Evaluating the effect of pharmacist's delivered counseling on medication adherence and glycemic control in patients with diabetes mellitus. *J Diabetes Metab.* 2016;7(3). DOI: 10.4172/2155-6156.1000654
16. Kautzky-Willer A, Harreiter J, Pacini G. Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus. *Endocr Rev.* 2016; 37(3):278-316.
17. Cristin M. Bruns, Joseph W. Kemnitz, Sex Hormones, Insulin Sensitivity, and Diabetes Mellitus, *ILAR Journal.* 2004;45 (2):160-169, Available:<https://doi.org/10.1093/ilar.45.2.160>
18. Ahmed A, Osman Maha, Bilal M, Anoud Rashad, Omer I. The relationship between smoking, alcohol consumption and development of complication in patients having type 2 diabetes mellitus, A Cross-Sectional Study. *IJRRIS.* 2018;5(3):1-6
19. Craig Knott, Steven Bell, Annie Britton. Alcohol consumption and the risk of type 2 diabetes: A systematic review and dose-response meta-analysis of more than 1.9 million individuals from 38 observational studies. *Diabetes Care* 1. 2015;38(9): 1804-1812. Available:<https://doi.org/10.2337/dc15-0710>
20. Iglay K, Hannachi H, Joseph Howie P, Xu J, Li X, Engel SS, et al. Prevalence and

- co-prevalence of co morbidities among patients with type 2 diabetes mellitus. *Curr Med Res Opin.* 2016;32(7):1243–52.
21. Raman Yadav. A case study on complication of diabetes on nephropathy, neuropathy, retinopathy and diabetic foot ulcer. *IJMSCR.* 2019;2(4):99-107.
22. Luzuriaga M, Leite R, Ahmed H, Saab PG, Garg R. Complexity of antidiabetic medication regimen is associated with increased diabetes-related distress in persons with type 2 diabetes mellitus. *BMJ Open Diabetes Res Care.* 2021;9(1): e002348.

© 2023 Joseph et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/107079>