



Correlation between Duration of Type II Diabetes Mellitus with Depression by Using Paid Scale-A Cross-Sectional Study

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ABSTRACT

Background: The prevalence of depression in diabetes mellitus is 46.15%. There is an association of mood, glycemic control, and cognition and behavior problems in Type II DM which disturbs the HPA-axis and increases the production of cortisol leading to an increase in insulin resistance. Thus, we aimed to analyze the correlation between the duration of type 2 DM and Depression. **Methods:** A total of 60 participants were recruited in this cross-sectional correlation study. The patients were between 20-40 years of age with 5, 10, and 15 years of type 2 diabetes mellitus who are on medications. The individuals who are diagnosed with type 1 DM, uncontrolled type 2 diabetes mellitus, cancer, or any neurological conditions were excluded. The correlation between the duration of type 2 DM and Depression was assessed using Problem Areas In Diabetes scale (PAID). **Results:** The Chi-square test showed a higher depression level in Group C than A and lowest in Group B. There was no significant correlation seen in Depression with age and BMI. But there was a significant correlation seen between the Duration of type 2 DM and Depression (p -value=0.0137*). It indicates a strong positive correlation between Depression and Duration of type 2 DM. **Conclusion:** The study demonstrated there was a significant correlation between Depression and Duration of type 2 DM.

Keywords: Depression, Duration of type 2 DM, Problem Areas In Diabetes scale (PAID)

Abbreviations: T2DM: Type 2 Diabetes Mellitus; PAID scale: Problem Areas In Diabetes Scale; HPA-axis: Hypothalamus-Pituitary-Adrenal axis; SNS: Sympathetic Nervous System; Asteric: Significant Value

INTRODUCTION

Diabetes Mellitus (DM) has reached epidemic proportions globally. According to WHO “Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body’s systems, in particular, the blood vessels and nerves” [1].

The prevalence of diabetes mellitus worldwide is 8.5%, in India 7.1%, Karnataka (Belagavi region) 16% [2-4]. Type 2 diabetes mellitus is the most common type, which results from the body’s inability to respond properly to the action of insulin produced by the pancreas [3]. The prevalence of type 2 DM is 4.7% of the world’s population, in India 8.7% and Karnataka 18.8% [4-6]. The causes are overweight, obesity, physical inactivity, genetic mutations, hormonal diseases, damage or removal of the pancreas, etc. [7]. According to WHO depression is a very serious problem with a global prevalence of 4.4% of the world’s population, in India 7.5% and Karnataka 11.6% [8-10]. American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders (DSM-5), depression is also known as major depressive disorder or clinical depression which is a common and serious mood disorder. Those who have depression experience persistent feelings of sadness and hopelessness and lose interest in activities they once enjoyed [11].

The symptoms must be present for at least two weeks [11]. The common chronic medical conditions which lead to depression are HIV/AIDS, diabetes mellitus, arthritis, strokes and Parkinson’s disease, Alzheimer’s disease, metabolic

conditions, autoimmune conditions, infections, and cancers that cause depression. About 25%-40% of people with neurological conditions will develop depression at some point [12].

A study was done which showed the prevalence of depression has slightly increased in pre-diabetic patients and undiagnosed diabetic patients and markedly increased in the previously diagnosed diabetic patients compared to normal glucose metabolism individuals [13]. The prevalence of depression in diabetes mellitus is 46.15% [14]. It is two times higher in type 2 diabetes mellitus compared with the general population worldwide [15].

Depression in diabetes mellitus could be caused due to stress which activates the Hypothalamus-Pituitary-Adrenal axis (HPA-axis) and the Sympathetic Nervous System (SNS) which increases the production of cortisol leading to an increase in insulin resistance. Also, the high level of cortisol disturbs the neurogenesis of the hippocampus leading to depression [13]. There have been studies conducted to correlate mood, glycemic control, cognition, and behavior problems in Type II diabetes mellitus. It leads to mortality, decrease quality of life, and social isolation [16]. But, there was a dearth of literature on the association of depression with the duration of type II diabetes mellitus. The depression can be analyzed with Problem Areas In Diabetes Scale (PAID) which was developed by Novo Nordisk in 2006. This scale has good validity and reliability. Hence, we designed this study intends to analyze the correlation between the duration of Type II diabetes mellitus with Depression. The secondary objective was to analyze the correlation between 5, 10, and 15 years of type II diabetes mellitus with depression using the PAID scale.

METHODS

It was a cross-sectional correlational study analyzing the relationship between the duration of Type II diabetes mellitus with depression. It was an open-ended study with a convenience type of sampling. Ethical clearance was obtained from the Institutional ethical committee. The participants were recruited from KLES Dr. Prabhakar Kore Charitable Hospital and Medical Research Centre in Belagavi from October 2018 to March 2019. The inclusion criteria were age between 20-60 years with 5, 10, and 15 years of type 2 diabetes mellitus who was on medication. Participants diagnosed with type 1 diabetes mellitus, uncontrolled type 2 diabetes mellitus, cancer, or any neurological conditions were excluded.

Procedure

The participants between 20-60 years of type 2 diabetes mellitus were screened according to inclusion criteria 60 participants were finally recruited in the study. Demographic data of each participant was obtained and the one-self report questionnaire, "Problem Areas In Diabetes Scale" was filled by participants. The data collected were classified into 3 groups; Group A included participants with 5 years, Group B with 10 years while Group C included 15 years of type 2 diabetes mellitus.

Outcome Measure

Problem Areas In Diabetes Scale (PAID): It has reliability (81%) and validity (74%). It consists of twenty questions. Each question has five answers (scoring 0-4 points). The sum of the score is obtained and multiplied by 1.25 to give a score out of 100 (40 or above is emotional burnout and warrant special attention) and a score (0-10 is indicative for denial). It is simple and takes around 5 minutes to complete.

Statistical Analysis

The descriptive and quantitative data in the study did not follow a normal distribution. Therefore, non-parametric tests were applied. Group A, B, and C values of males and females were analyzed using the Chi-square test. Age-wise and mean BMI comparison of Group A, B, and C values were done by one way ANOVA. Age and BMI pairwise comparison of Group A, B, and C was done by Tukey's multiple posthoc tests. The comparison of three groups (A, B, and C) with levels of depression was analyzed by Chi-square test. The comparison of three groups (A, B, and C) with mean depression scores was done by one-way ANOVA and pairwise comparison by Tukeys multiple posthoc test. The correlation between age, BMI, and duration of type 2 DM with depression score was done by Karl Pearson's correlation coefficient method. Statistical significance was set at p-value <0.05.

RESULTS

A total of 60 participants were evaluated in the KLES Dr. Prabhakar Kore Charitable Hospital and Medical Research Centre, out of which 39 were males and 21 were females. The participants were divided into 3 groups i.e. 5, 10, and

15 years of diabetes. The mean age of total participants was 50.07 ± 8.97 years, the mean BMI score was 23.87 ± 4.82 while the mean depression score was 43.22 ± 14.97 . The mean age values of the three groups (A, B, and C) are 48.75 ± 7.24 , 46.30 ± 10.58 , and 55.15 ± 6.44 respectively. There was a significant difference in the mean age values across the groups with a p-value of 0.0040*. The pairwise age Comparison values between Groups B and C and groups A and B were significant with p-values of 0.0460 *and 0.0038* respectively, while that of groups A and C was not significant as $p > 0.05$ (Table 1). The mean BMI values of the three groups (A, B, and C) are 21.28 ± 3.83 , 23.20 ± 3.22 , and 27.13 ± 5.34 respectively. There was a significant difference in the mean age values across the groups with a p-value of 0.0002*. The pairwise BMI Comparison values between the groups B and C and groups A and C were significant with p-values 0.0131* and 0.0003* respectively, while that of groups A and B was not significant as $p > 0.05$ (Table 1).

Table 1 The mean age, BMI, and pairwise comparison values of Group A, B, and C *p-value<0.05

AGE	Mean \pm SD AGE	Total	F-value	p-value
Group A	48.75 ± 7.24	50.07 ± 8.97	6.0841	0.0040*
Group B	55.15 ± 6.44			
Group C	46.30 ± 10.58			
Pairwise comparisons of Groups (p-value)	Group B vs. Group C p=0.0460*	Group A vs. Group C p=0.6206	Group A vs. Group B p=0.0038*	
BMI	Mean \pm SD BMI	Total	F-value	p-value
Group A	21.28 ± 3.83	23.87 ± 4.82	9.9539	0.0002*
Group B	23.20 ± 3.22			
Group C	27.13 ± 5.34			
Pairwise comparisons of Groups (p-value)	Group B vs. Group C p=0.0131*	Group A vs. Group C p=0.0003*	Group A vs. Group B p=0.3284	

The Comparison of three Groups A, B, and C with levels of depression using a Chi-square test showed 55%, 45%, and 80 % respectively. It means a higher depression level was seen in Group C than A and lowest in Group B. There was no significant difference in the level of depression values across the groups with a p-value of 0.067 (Table 2).

Table 2 The level of Depression comparison values of Group A, B, and C *p-value<0.05

Level of Depression	Group A%	Group B%	Group C%	p-value
Without depression	45	55	20	0.067
With depression	55	45	80	
Total	100	100	100	

The mean depression values of the three groups (A, B, and C) were 39.30 ± 14.78 , 39.55 ± 14.52 , and 50.81 ± 13.26 respectively. There was a significant difference in the mean Depression values across the groups with a p-value of 0.0184*. The pairwise depression comparison values were between groups B and C and groups A and C were significant with p-values 0.0394* and 0.0334* respectively, while that of groups A and B was not significant as $p > 0.05$ (Table 3).

Table 3 The mean depression and pairwise comparison values of Group A, B, and C, *p<0.05

Groups	Mean \pm SD Depression	Total	F-value	p-value
Group A	39.30 ± 14.78	43.22 ± 14.97	4.287	0.0184*
Group B	39.55 ± 14.52			
Group C	50.81 ± 13.26			
Pairwise comparisons of groups (p-value)	Group B vs. Group C	Group A vs. Group C	Group A vs. Group B	

Depression	p=0.0394*	p=0.0344*	p=0.9984
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Karl Pearson's correlation coefficient of depression with age and BMI was not statistically significant but with duration, it was statistically significant. It means there was a significant correlation seen in the values of duration (0.0137*) and no significant correlation in age and BMI concerning depression. Thus, it indicates a strong positive correlation between depression and duration of type 2 DM which can be seen in Graph 1 (Table 4).

Table 4 Correlation between age, BMI, and duration of type 2 DM with depression scores by Karl Pearson's correlation coefficient method, *p<0.05

Variables	Correlation between depression scores with		
	r-value	t-value	p-value
Age in yrs	0.1509	1.1627	0.2497
BMI	0.2016	1.5677	0.1224
Duration of type 2 DM (in yrs)	0.3165	2.5413	0.0137*

DISCUSSION

The burden associated with diabetes is enormous in terms of increased morbidity and mortality and the economic strains associated with the disease. The poorly managed patients have prolonged and frequent hospital admissions [16]. Depression occurs comorbidly with diabetes although it is unrecognized and untreated in approximately two-thirds of patients with type 2 diabetes mellitus [17].

The result of the present study showed that the level of depression is highest in 15 years and the lowest in 10 years of duration may be due to poor glycemic control, higher cost of medical care, less motivation, lack of social support, and lack of physical activity [18]. A study was done by David P. Nau on 391 patients to understand the complication of non-adherence to diabetes medications which concluded that stress, susceptibility to severe complications, work loss, hopelessness, dependence on others, poor quality of life, and perceived barriers to self-care are the factors causing depression [18].

The depression level in 5 years of type 2 DM was higher than 10 years and this could be attributed due to lifestyle alteration, increased level of cholesterol, and poor diligence in maintaining dietary restrictions [19-21]. Literature showed that mood changes are related to HbA1C and poor food choices which accompany major depressive symptoms [19]. A study was done by Mathew CS et al, on 5 years of type 2 DM had depressive symptoms which are similar to this study [19].

The present study showed the level of depression was lowest in 10 years of type 2 DM among all the groups, probably due to they started maintaining blood sugar level, self-care, spacing in carbohydrate and had fewer complications [21]. By improving, glycemic control and self-diabetes behavior care can reduce the impact on HPA axis leading to less depression [21]. A study done by Paul S. Ciechanowski et.al, on 826 patients showed that depressive symptoms in type 2 DM are associated with factors mentioned above [21]. Another study was done by Richard R. Rubin et al, which culminate that adherence to the treatment of type 2 DM and antidepressant medications helps in lowering the depression and complication of diabetes [22].

Previous studies had suggested that the stress which activates the Hypothalamus-Pituitary-Adrenal axis (HPA-axis) and the Sympathetic Nervous System (SNS) leads to the production of cortisol in the adrenal cortex and the production of adrenalin and noradrenalin in the adrenal medulla which increases insulin resistance. This Increased cortisol disturbs the neurogenesis in the hippocampus leading to depression [22]. In the present study, the pairwise comparison of depression with a duration of type 2 DM between groups A vs. group B and group A vs. group C was statistically significant but Group B vs. Group C was clinically significant.

The current study reports a statistically significant positive correlation between depression and duration of type 2 DM this might be due to the inflammatory response which is involved in the pathophysiology of depression. These pro-in-

flammatory cytokines interact with pathophysiological domains that characterize depression, including neurotransmitter metabolism, neuroendocrine function, synaptic plasticity, and behavior [23]. This suggested that pro-inflammatory cytokines can promote depression in type 2 DM giving a feasible common link between them.

The limitation of the present study, we did not consider the socio-economic status which could cause depression too in type 2 DM.

Future Scope: A longitudinal study is recommended to study the exact mechanism behind the relationship between the duration of type 2 DM with depression. Multi-centered intervention studies are recommended to decrease depression in type 2 DM.

CONCLUSION

The present study showed a significant correlation between Depression and Duration of type 2 DM.

DECLARATIONS

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