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Assessing The Risk of Psychological and Cognitive Disturbances in Type II Diabetes Mellitus Patients



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ABSTRACT

AIM: To assess the risk of Psychological and Cognitive disturbances in Type II Diabetes Mellitus patients. **MATERIALS AND METHODS:** A Prospective Cohort study was carried out in the Department of General Medicine with 250 patients for six months. We used Mini-Mental Status Examination, Hamilton Anxiety Rating Scale, and Hamilton Depression Rating Scale for assessing cognitive and psychological status. **RESULTS:** Females were observed to be at higher risk of cognitive impairment, anxiety, and depression. >75years aged patients were high at cognitive impairment, anxiety was highest at 65-70 years, depression was highest at 70-75 years. Illiterates had high cognitive impairment, anxiety, and depression. Patients with Fasting Blood Sugar [FBS] 121-180 mg/dl had a higher chance of cognitive impairment, anxiety, and depression. Patients with Post Prandial Blood Sugar [PPBS] 201-300mg/dl had high anxiety and cognitive impairment, whereas depression was highest in 301-400mg/dl. Homemakers had high cognitive impairment, and agriculture workers had high anxiety and depression. Patients with a duration of the disease from 21-25 years had high cognitive impairment and anxiety. Depression was highest among 16-20 years of disease duration. **CONCLUSION:** Age, gender, education, occupation, duration of diabetes, and blood glucose levels affect cognitive and psychological impairment in Type II Diabetes Mellitus patients. Proper diet, lifestyle management, medication adherence, and control of blood glucose levels can improve Cognitive and Psychological impairment.



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INTRODUCTION:

Diabetes Mellitus (DM) is a cluster of metabolic disorders that is characteristic of a condition called Hyperglycaemia. Hyperglycemia is a condition that is representative of high blood glucose levels. A rise in blood glucose levels is due to inappropriate action or unavailability of a pancreatic enzyme called Insulin ^[1].

In 2014, around 422 million population were diabetic. The count may increase to 629 million total world population ^[2]. The World Health Organisation (WHO) estimated the worldwide prevalence of diabetes among adults above the 18 years age group as 8.5% in 2014 ^[3].

In India, the estimated cases of diabetes in the adult population were 72.96 million. The prevalence in urban areas ranges between 10.9% and 14.2%, whereas in rural India, it was 0-7.8% among the population aged 20 years and above ^[3]. Around 82 million Indian population was with diabetes in 2017, and it was estimated to increase to 151 million by 2045 ^[2].

COMPLICATIONS OF DIABETES:

Complications such as Atherosclerosis, Retinopathy, Neuropathy, Foot Sores, Blisters, Numbness, Fungal infections, Hearing impairment, Foot ulcers, Nephropathy, Cognitive deficit, Alzheimer disease, Depression, and Anxiety in diabetes patients develop gradually based on the duration of diabetes and blood glucose levels ^[4]. Depression and anxiety are two common psychological problems mainly found in chronic diseases, which may progress along with the duration of the disease. Studies have shown that people with diabetes have an increased chance of cognitive decline and psychological disturbances ^[5]. According to the National Institute for Health and Clinical Excellence (NICE), people diagnosed with a chronic physical health problem such as diabetes are three times more likely to be diagnosed with depression than people without these physical health problems ^[6].

Anxiety is a normal, protective, psychological response to an unpleasant and frightening response ^[7]. It is an emotional instinct that occurs when the individual perceives as in danger. During every stressful situation, a certain amount of nervousness may develop as an adaptive response ^[8]. Anxiety is approximately 20% more likely to occur in the diabetic population than in the non-diabetic population ^[9].

In depression, individual experiences different symptoms such as persistent sadness, anxiety, hopelessness, negativity, apathy, fatigue, insomnia, oversleeping, poor concentration,

memory problems, dwelling on death or suicide, restlessness, weight changes, and appetite changes. It is one of the most common psychiatric disorders seen in the diabetic population [6].

Neuropathy is one of the severe type 2 diabetic complications. Central and peripheral neuropathy are the two types of neuropathies [5]. Cognitive impairment is mostly left unrecognized, undiagnosed, and untreated complications [5]. Hyperglycemia, Vascular disease, Insulin resistance, and Amyloid proteins are the causative factors associated with cognitive impairment [10]. Many studies observed the increased deposition and reduced clearance of amyloid β -protein in the brains of long-standing diabetic people leading to neuronal loss, microangiopathy, and cognitive impairment [10]. Multiple studies have also established T1DM as a risk factor for cognitive dysfunction and dementia in the elderly [11].

This study aims to identify the risk factors responsible for Psychological and Cognitive impairment in Type II Diabetes Mellitus patients. The objectives were a) Assessing the level of psychological status in Type II Diabetes patients. b) Assessment of cognitive status in Type II Diabetes patients. c) To assess and correlate risk factors with psychological and cognitive abnormalities among Type II Diabetes patients. d) Educate and bring awareness among the patients on various aspects of the disease.

MATERIALS AND METHODS:

Our study was a prospective cohort study, carried out for a period of 6 months, from September 2019 to February 2020 in the Out-patient and In-patient facilities, Department of General Medicine, ESI Hospital, Sanathnagar, a 500 bedded secondary care hospital, located at Nacharam, Hyderabad, with the total study population of 250 Type II Diabetes Mellitus patients. Subjects were recruited based on the following selection criteria:

INCLUSION CRITERIA:

- Both male and female patients aged above 45 years visited the Inpatient and Outpatient facilities of the Department of General Medicine with Type II Diabetes Mellitus.
- Patients with abnormal blood glucose levels that is FBS (76-106 mg/dl) and PLBS (<140mg/dl).
- Patients that are conscious and interested in participating in the study.

EXCLUSION CRITERIA:

- Patients who were non-cooperative and not interested in participation.
- Patients admitted to AMC.
- Patients with extremely poor control on diabetes (PLBS >400mg/dl).
- Patients with other metabolic abnormalities.
- Patients had head trauma or stroke.
- Patients had psychological, neurological, and malignant conditions.
- Patients had a significant hearing and vision impairment.

After getting consent from the patient/caretaker, we collected the data collection with a suitable data collection form. We also included Hamilton Anxiety Rating Scale (HAM-A), Hamilton Depression Rating Scale (HAM-D), and Mini-Mental State Examination (MMSE) questionnaires.

HAM-A is used to screen and assess the severity of anxiety. It consists of 14 parameters, each identified by a set of symptoms, calculates both somatic anxiety (physical complaints related to anxiety) and psychic anxiety (mental agitation and psychological distress). It was used as a screening test and only takes 10-15 minutes to administer to patients^[12].

HAM-D, a depression assessment scale, contains 17 parameters and their related depressive symptoms experienced. It generally takes 15-20 minutes to administer and score the results^[13].

We used the MMSE questionnaire for assessing the cognitive impairment, severity, and cognitive changes over time. It takes 5-10 minutes to administer. The MMSE consists of 5 categories, Orientation, Short-term memory (retention), Attention, Short-term memory (recall), and Language^[14].

Patient Information Leaflets (PIL) in English and Telugu languages were distributed to the patients to educate them regarding their disease and all the necessary activities for preventing different types of complications.

They consist of various aspects of patient health, including information on type II diabetes mellitus, diabetic neuropathy, and preventive measures.

RESULTS: We completed the study with 250 patients in total. The results were as follows:

Table No. 1: DEMOGRAPHIC DISTRIBUTION OF STUDY POPULATION

CHARACTERISTICS		NUMBER	PERCENTAGE
GENDER	Male	121	48.4%
	Female	129	51.6%
AGE	45-50	95	38%
	50-55	45	18%
	55-60	48	19.2%
	60-65	30	12%
	65-70	20	8%
	70-75	10	4%
	>75	2	0.8%
LOCALITY	Urban	241	96.4%
	Rural	9	3.6%
MARITAL STATUS	Married	249	99.6%
	Unmarried	01	0.4%
EDUCATION	Illiterate	98	39.2%
	Primary	33	13.2%
	High school	65	26%
	Intermediate	27	10.8%
	Graduation	25	10%
	Post-graduation	02	0.8%
SMOKING	Smoker	27	10.80%
	Non-smoker	223	89.20%
ALCOHOL	Consumer	70	28%
	Non-consumer	180	72%
PAN & TOBACCO PRODUCTS	Consumer	8	3.20%
	Non-consumer	242	96.80%
OCCUPATION	Homemakers	103	41.21%
	Private employees	46	18.4%
	Retired	26	10.4%
	Business	19	7.6%
	Labour work	16	6.4%
	Security	14	5.6%
	Driving	8	3.2%
	Industrial workers	6	2.4%
	Agriculture worker	4	1.6%
	Tailor	4	1.6%
	Teacher	2	0.8%
	Nursing	1	0.4%
	Carpenter	1	0.4%

Table No. 2: DISTRIBUTION BASED ON THE DURATION OF THE DISEASE

DURATION (Years)	NO. OF PATIENTS	% OF PATIENTS
0-5	114	45.60%
6-10	72	28.80%
10-15	37	14.80%
15-20	21	8.40%
20-25	5	2%
25-30	1	0.40%

Table No. 3: DISTRIBUTION BASED ON PAST HISTORY

CHARACTERISTICS		NUMBER	PERCENTAGE
PAST MEDICAL HISTORY	Hypertension	164	65.60%
	No comorbidity	44	17.60%
	Other	39	15.60%
	Hypothyroidism	29	11.60%
	Coronary artery disease	14	5.60%
	Peripheral neuropathy	12	4.80%
	Seizures	6	2.40%
	Chronic kidney disease	5	2%
	Paraesthesia	1	0.40%
PAST MEDICATION HISTORY			
ORAL HYPOGLYCEMICS	METFORMIN	242	97%
	GLIMEPIRIDE	127	50.80%
	VOGLIBOSE	39	15.60%
	SITAGLIPTIN	37	14.80%
	VILDAGLIPTIN	4	5.60%
	GLICLAZIDE	7	2.80%
	GLIBENCLAMIDE	3	1.20%
	PIOGLITAZONE	2	0.80%
	GLIPIZIDE	2	0.80%
INSULIN	NO INSULIN	190	76%
	H MIX	25	10%
	HAI	13	5.20%
	ASPART	7	2.80%
	HUMAN INSULIN	6	2.40%
	LISPRO	5	2%
	GLARGINE	2	0.80%

Table No. 4: DISTRIBUTION BASED ON THE GLUCOSE LEVELS

CHARACTERISTICS		NUMBER	PERCENTAGE
FASTING BLOOD SUGAR (FBS)	61-120	102	40.80%
	121-180	92	36.80%
	181-240	30	12%
	241-300	26	10.40%
POSTPRANDIAL BLOOD SUGAR (PPBS)	101-200	103	41.20%
	201-300	93	37.20%
	301-400	54	21.6%

Table No. 5: DISTRIBUTION BASED ON THE TREATMENT GIVEN DURING STUDY PERIOD

CHARACTERISTICS		NUMBER	PERCENTAGE
ORAL HYPOGLYCEMICS	METFORMIN	233	93.2%
	GLIMEPIRIDE	136	54.4%
	SITAGLIPTIN	43	17.2%
	VOGLIBOSE	36	14.4%
	VILDAGLIPTIN	13	5.2%
	GLICLAZIDE	8	3.2%
	GLIBENCLAMIDE	1	0.4%
	GLIPIZIDE	1	0.4%
	TENELIGLIPTIN	1	0.4%
INSULIN	NO INSULIN	188	74.90%
	H MIX	34	13.54%
	HAI	11	4.38%
	ASPART	11	4.38%
	LISPRO	4	1.59%
	HUMAN INSULIN	2	0.79%
	ISOPHENE	1	0.39%
OTHER MEDICATIONS	Cardiovascular drugs	182	72%
	Supplements	100	40%
	Antacid	57	22.8%
	Anticonvulsants	56	22.4%
	Lipid-lowering agents	52	20.8%
	Antiplatelet agents	48	19.2%
	Analgesics	34	13.6%
	Thyroid hormones	22	8.8%
	Antibiotics	13	5.2%
	Respiratory agents	10	4%
	Enzymes	9	3.6%
	Antiemetics	4	1.6%
	Gall stones stabilizing agents	3	1.2%

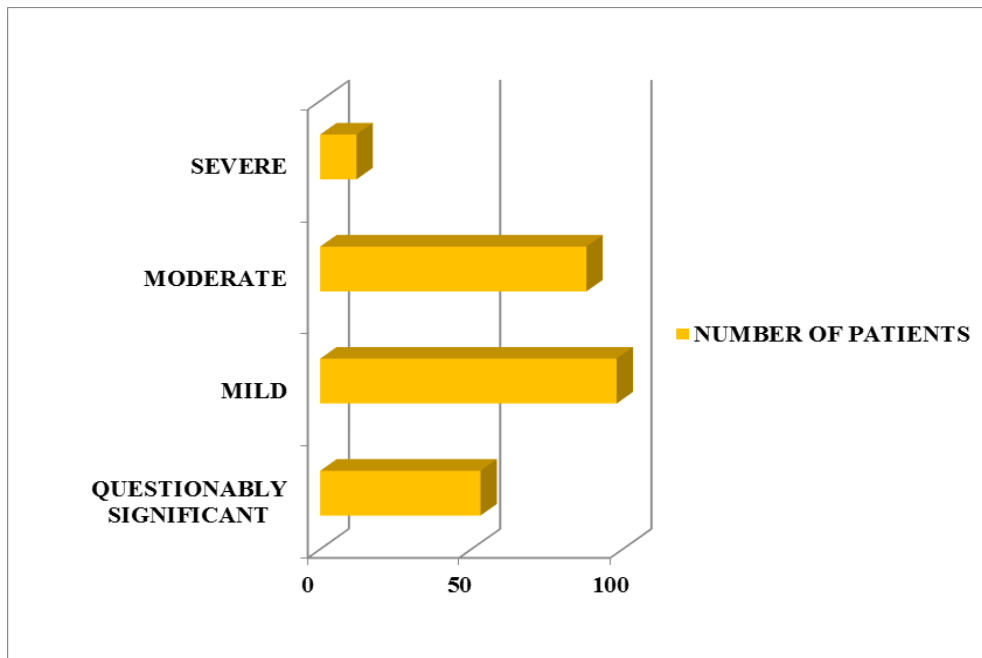


Figure No. 1: DISTRIBUTION OF STUDY PATIENTS BASED ON THE LEVEL OF COGNITIVE DISTURBANCE

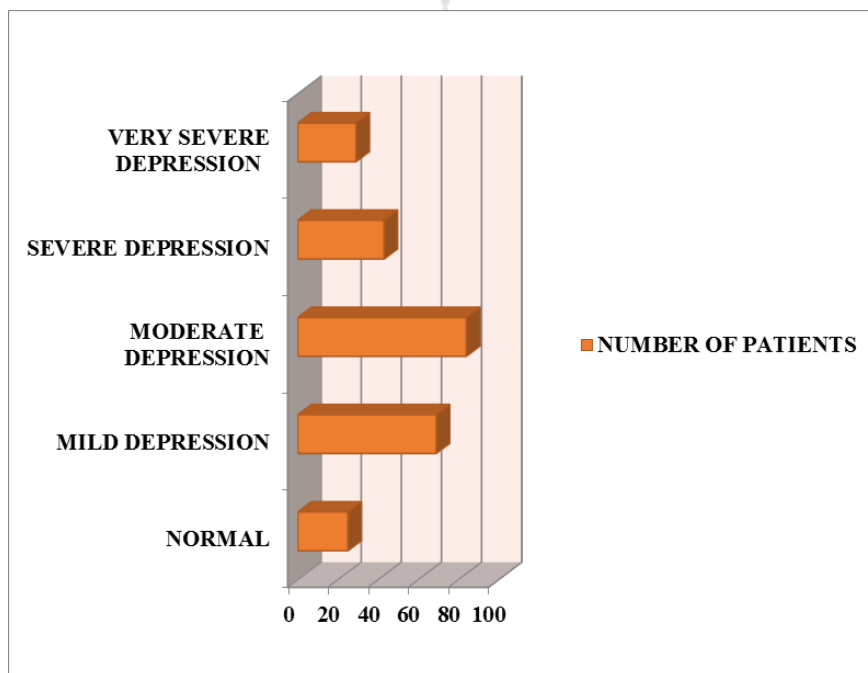


Figure No. 2: DISTRIBUTION OF STUDY PATIENTS BASED ON THE LEVEL OF DEPRESSION

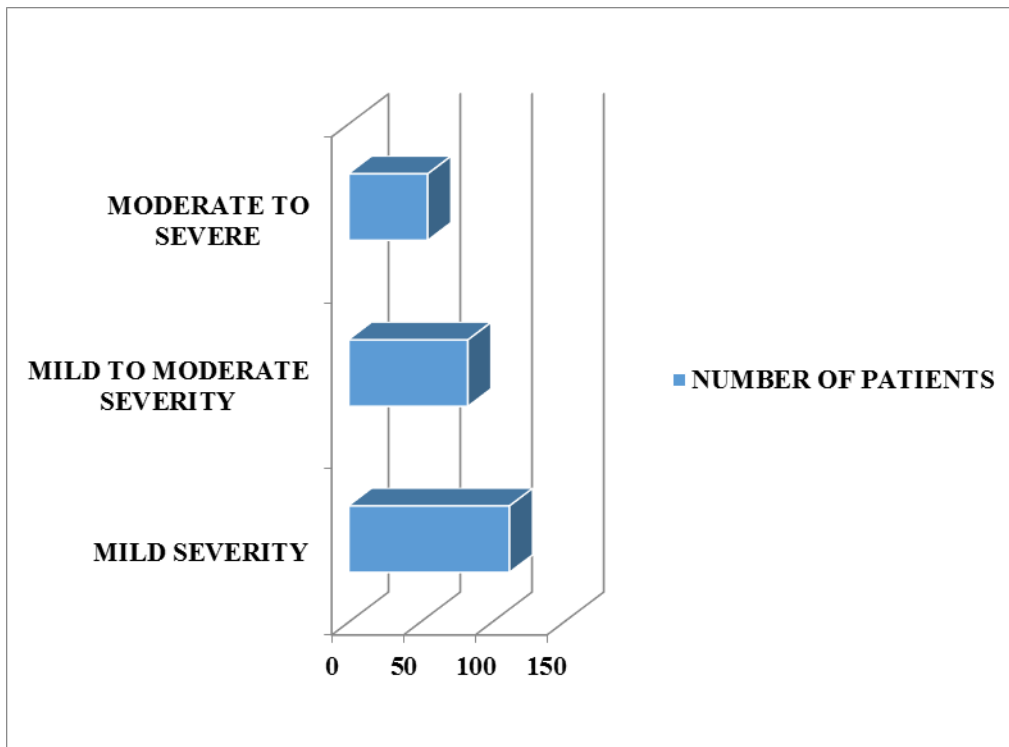


Figure No. 3: DISTRIBUTION OF STUDY PATIENTS BASED ON THE LEVEL OF ANXIETY

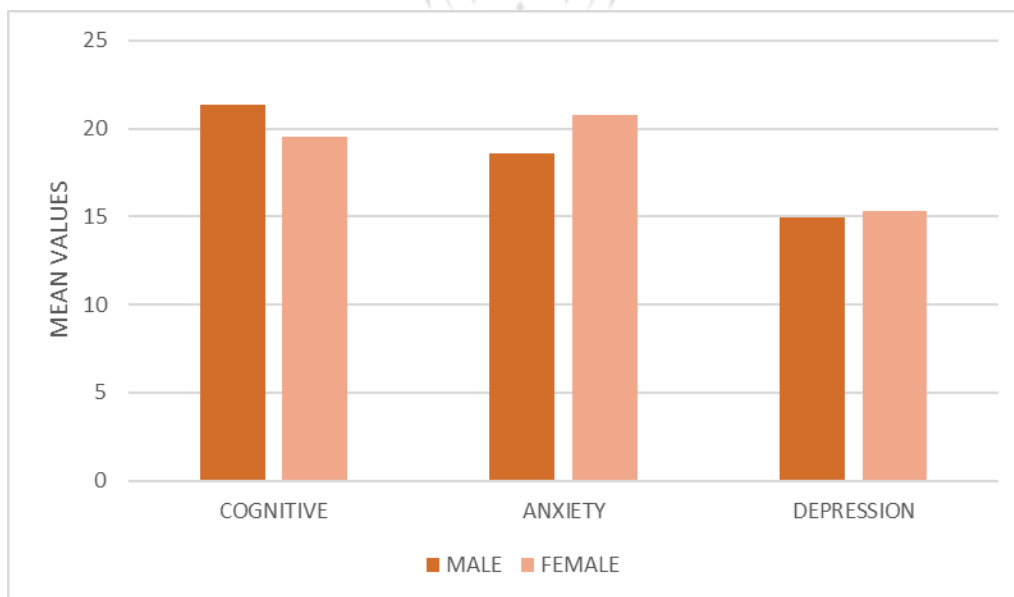


Figure No. 4: STATUS OF COGNITIVE DISTURBANCE, ANXIETY, AND DEPRESSION BASED ON GENDER

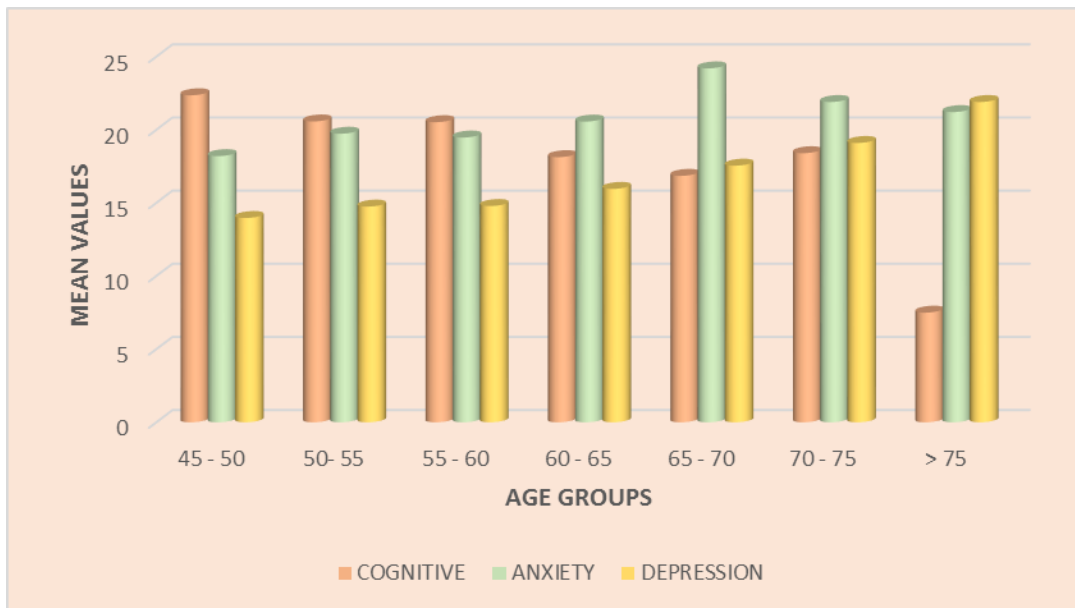


Figure No. 5: STATUS OF COGNITIVE DISTURBANCE, ANXIETY, AND DEPRESSION BASED ON AGE

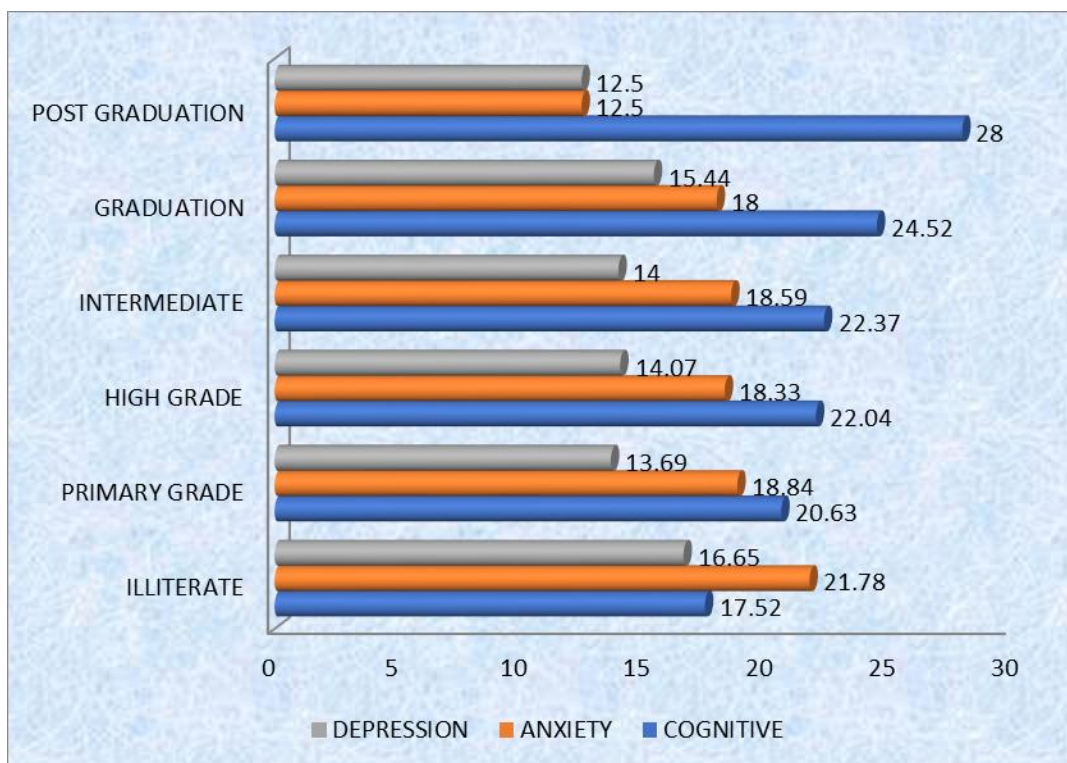


Figure No. 6: MEAN DISTRIBUTION OF COGNITIVE, ANXIETY, AND DEPRESSIVE STATUS BASED ON EDUCATION

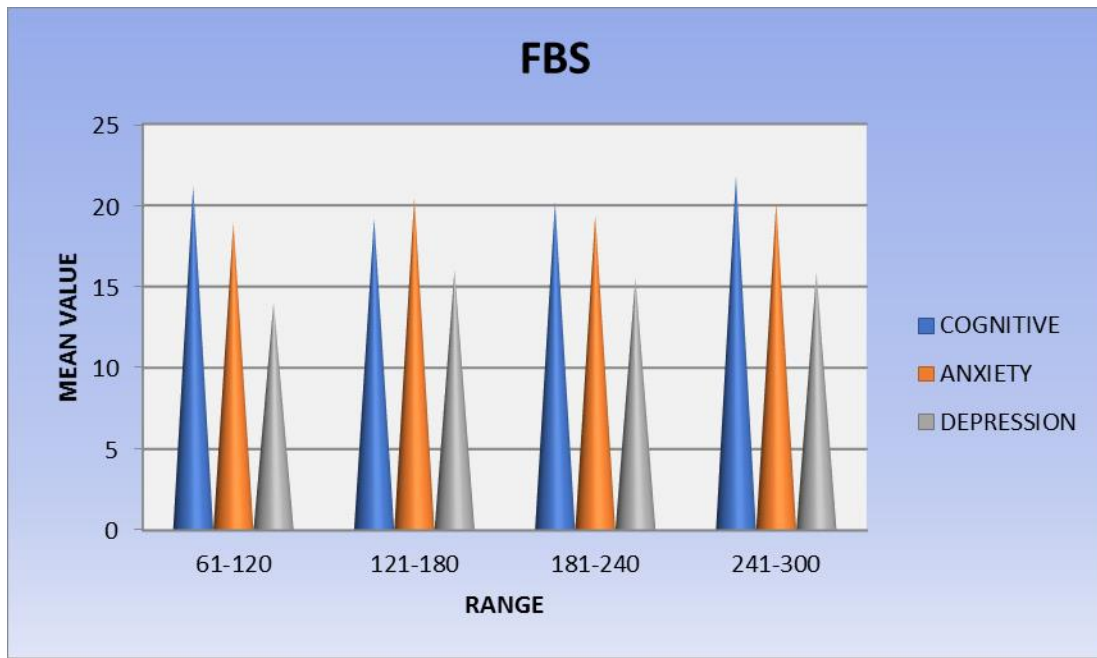


Figure No. 7: MEAN DISTRIBUTION OF COGNITIVE, ANXIETY, AND DEPRESSIVE STATUS BASED ON BLOOD SUGAR LEVELS (Fasting Blood Sugar levels)

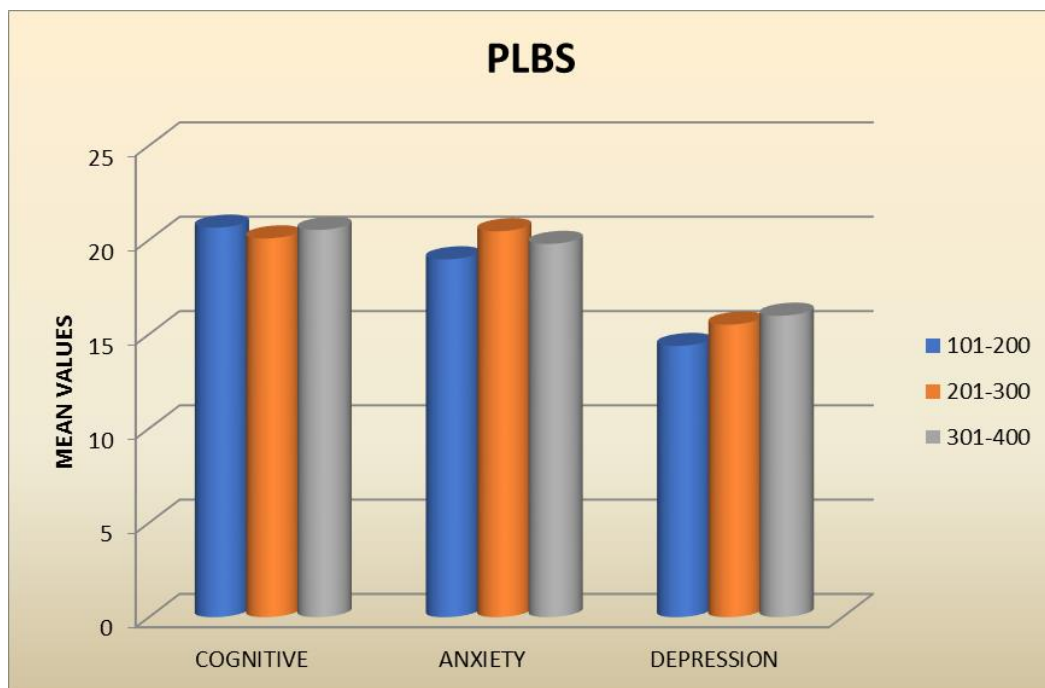


Figure No. 8: MEAN DISTRIBUTION OF COGNITIVE, ANXIETY, AND DEPRESSIVE STATUS BASED ON BLOOD SUGAR LEVELS (Postprandial Blood Sugar levels)

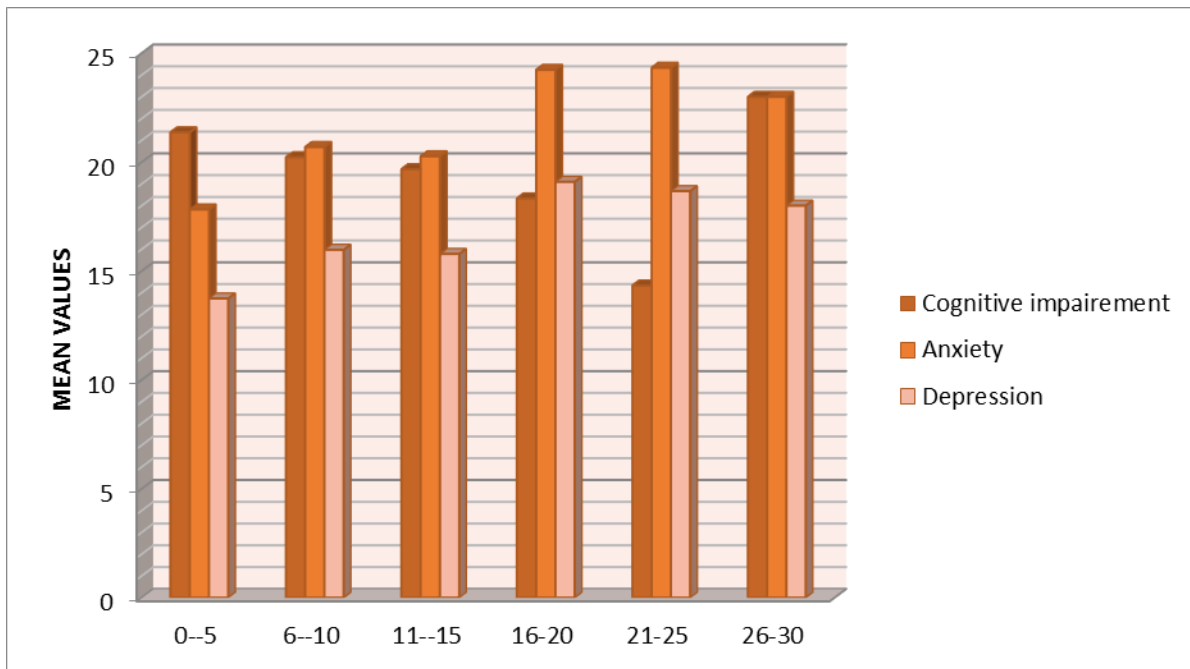


Figure No. 9: STATUS OF COGNITIVE DISTURBANCE, ANXIETY, AND DEPRESSION BASED ON DURATION OF DISEASE

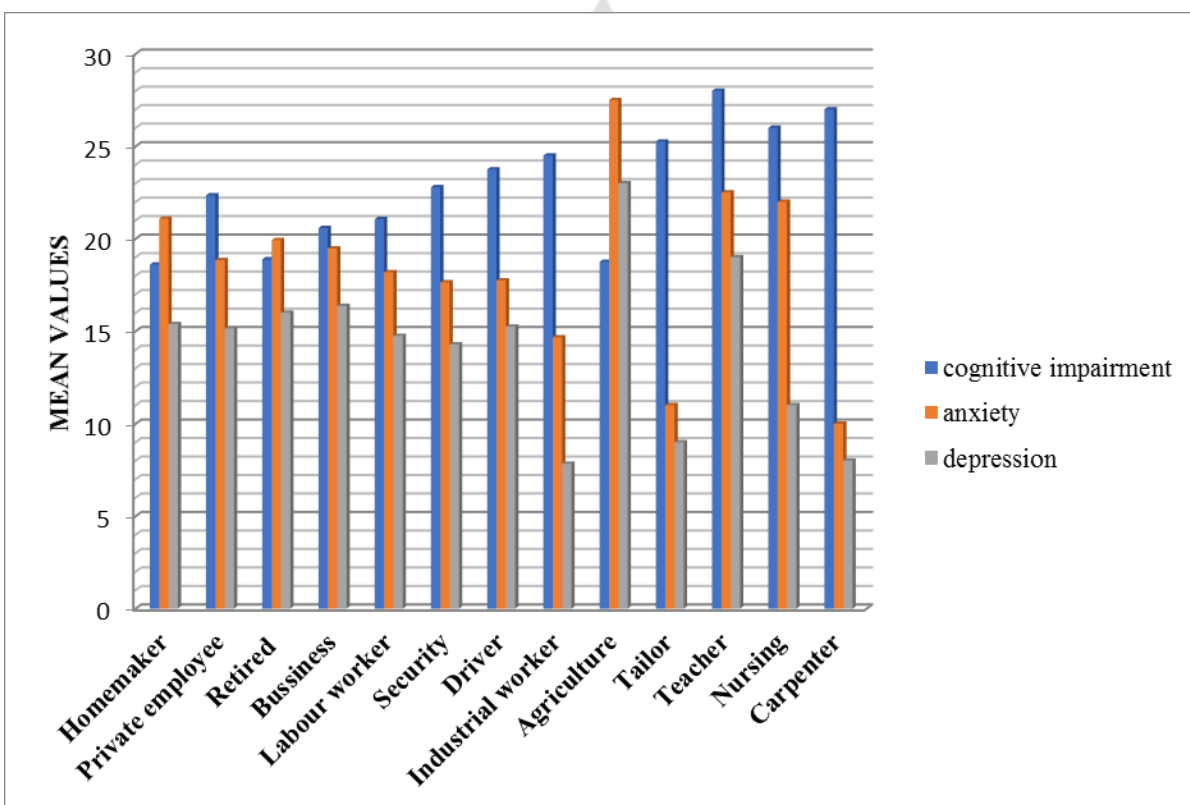


Figure No. 10: STATUS OF COGNITIVE DISTURBANCE, ANXIETY, AND DEPRESSION BASED ON OCCUPATION

DISCUSSION:

Our study aimed at identifying the risk of developing psychological and cognitive impairment in Type 2 Diabetes Mellitus patients. We observed few demographics and disease-related factors are having relation with the development of such abnormalities.

In our study, most of the population (39.2%) are with mild cognitive impairment, 35.2% with moderate, 21.1% with questionably significant, and only 4.8 % were with severe impairment. A study conducted by *D. Degemecic et al.* ^[15] showed 74.2% have normal cognition and 25.8% have cognitive impairment.

Only 11.6% of the population were very severely depressed, followed by 17.2%, 33.6%, and 27.6% with severe, moderate, and mild forms of depression, respectively. However, in a study conducted by *D. Degemecic et al.* ^[15], only 7% were very severely depressed, less compared to our observation.

In our study, only 2% of the population were moderate to severely anxious, followed by 33.2% and 44% with mild to moderate and mild anxiety, respectively. In a similar study conducted by *D. Degemecic et al.* ^[15], 51.5% have pathological anxiety, extremely high compared to our result.

We observed females were at high risk of cognitive and psychological impairment (anxiety and depression) than males, which is the same as the study conducted by *Mayilananthi K et al.* ^[16]. In our study, mean values in females were *19.53+/- 5.13, 20.77+/-7.76, and 15.34+/- 6.69, and in males, they were 21.35+/-5.35, 18.56+/-7.32 and 14.95+/-6.67 for cognitive impairment, anxiety, and depression, respectively.

The lowest and highest cognitive impairment was in the 45-50 years and >75 years age group, respectively. A study conducted by *Tiwari et al.* ^[17] shows a similar result as our study, where the 70-79 years old population has a high prevalence of cognitive impairment. It implicates that cognitive impairment increases with age.

Anxiety is highest and least in age groups 65-70 years and >75 years respectively, indicating the older population has increased anxiety levels as their function abilities decrease.

Depression was highest and least in age group 70-75 years and 45-50 years, respectively. However, a study conducted by *Raval et al.* ^[18] shows depression is related to the age >54 years.

Even though there is no proper relation of educational status with cognitive and psychological impairment, we noticed the highest level of cognitive impairment, anxiety, and depression in Illiterate patients. Mean values were 17.52 ± 5.14 , 21.78 ± 8.12 , and 16.65 ± 7.11 , respectively.

The highest level of cognitive impairment, anxiety, and depression was identified, in the patients with FBS (Fasting Blood Sugar) range of 121-180 mg/dL with mean scores of 19.21 ± 5.32 , 20.48 ± 7.64 , and 16.01 ± 6.87 , respectively.

The highest level of cognitive impairment and anxiety was identified, in the patients with PLBS (Post-Lunch Blood Sugar) range of 201-300 mg/dL, with the mean scores of 20.08 ± 4.91 and 20.46 ± 7.47 , respectively.

The highest level of depression was in the patients with the highest PLBS range (301-400 mg/dL) and with a mean score of 15.98 ± 6.83 .

Many studies found a directly proportional relationship between cognitive impairment and the duration of diabetes. An observation clears that, in the brain of long-standing diabetic people, there is an increased deposition and reduced clearance of amyloid β -protein, which is responsible for neuronal loss, microangiopathy, and cognitive impairment. In our study, we observed people suffering from diabetes from a range of 21-25 years were having the highest cognitive impairment and severe anxiety with mean scores of 14.33 ± 6.12 and 24.33 ± 5.88 , respectively. However, people suffering from 16-20 years were severely depressed with a mean score of 19.09 ± 7.49 .

We identified the highest cognitive impairment in homemakers with a mean score of 18.60 ± 5.13 , Severe anxiety and depression in agriculture workers with a mean score of 27.5 ± 7.04 , and 23 ± 5.09 , respectively.

CONCLUSION:

In our present study, we assessed the relation between diabetes mellitus and cognitive, psychological disturbances. We observed that 45-50 years age group people were suffering highly from diabetes. People above 60 years of age, female gender, illiterate population than highly educated personnel, homemakers, agriculture workers, high levels of Fasting Blood Sugar (FBS) and Post Prandial Blood Sugar (PPBS), duration of the disease were negatively impacting the cognitive and psychological impairment in type II diabetic population.

Finally, we conclude that various demographic and disease-related factors are responsible for psychological and cognitive abnormalities. Proper education of the diabetic patients regarding maintaining glucose levels at a normal range, following all the dietary, lifestyle, and therapeutic instructions strictly is required to avoid such complications.






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