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A Cross Sectional Study Assessing the Prevalence of Depression in Diabetesandinfluence of Illness Related Factors in Diabetes and Depression

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Abstract:
Background: *In the last few decades,escalating prevalence of diabetes is seen in the Asian countries can be attributed mostly to the change in lifestyle as result of rapid socio-economic growth, related to an interplay of higher rates of central obesity ,insulin resistance,genetic predisposition and /or influence of adverse intrauterine influences present among the Asian Indian Population.*
Aims: *To study the prevalence and the influence of illness related factors in diabetes and depression.*
Methods: *All subjects were diagnosed as diabetes,categorized into complicated and uncomplicated groups. Subjects were administered HAM-D 24 scale and semi-structured intake proforma designed to collect illness related factors.*
Results: *In this study, statistically significant differences were found between two groups of depression. Most of the symptom variables of depression in the complicated group shows statistically significant 'p'value. The influence ofillness related factors suchas age, sedentary lifestyle, smoking and alcohol abuse with exception of family history and high carbohydrate diet are found to be significant statistically.*
Conclusions: *Rapid socioeconomic growth and industrialization adversely affecting the lifestyle of Asian Indian populations.The health consequences are devastating in Asian populations due a strong genetic predisposition to metabolic disease like diabetes. Current lifestyle parameters perhaps accelerate the clinical expression ofdiabetes at a very young age itself.*
Keywords: *diabetes, depression and illness related factors.*

I. Introduction

Diabetes is a major lifestyle disorder, the prevalence is increasing globally. The prevalence among adults aged between 20 to70 years is expected to rise from 285 million in 2010 to 438 million by year 2030.[1] Asian countries contribute to more than 60% of the world's diabetic population as the prevalence of diabetes is increasing in these countries due to socio-economic growth and rapid industrialization occurring in many of these countries.The prevalence in urban-

rural divide is gradually narrowing as urbanization is spreading very rapidly, adversely affecting the lifestyle of respected populations. Asians have a strong ethnic and genetic predisposition for diabetes and also have lower thresholds for the environmental risk factors. As result, they develop diabetes at a younger age and a lower body mass index and waist circumference when compared with the western population. While type 2 diabetes poses huge economic burden to all nations, especially developing countries bear the highest burden since more than 80% cases occur in these countries. The prevalence estimates of diabetes and impaired glucose tolerance are high for all Asian countries and are expected to increase further in the next two decades [1] can be attributed mostly to the change in lifestyle as a result of rapid socio-economic growth.

The rise in prevalence, therefore, is a result of environmental and behavioral changes and cannot be attributed to altered gene frequencies since the increase has occurred within a few decades. It is estimated that the substantial increase in urbanization will occur in mostAsian countries, although the rates are variable among these countries. [2] The increase in urban population and aging are the main determinants of the global rise in prevalence of diabetes. Urbanization and internal rural to urban migration result in several adverse impacts, physical inactivity , change in dietary habits swift towards high-energy foods ,fatty foods and body mass index and upper body adiposity increase considerably.

Recent studies in India shown considerable changes have occurred in the living pattern of rural population leading to an increase in total prevalence of overweightness and diabetes. [3]. A large number of pre-diabetic subjects are prevailing in the rural India, as shown by the high prevalence of increased glucose tolerance. Indian studies showed that the conversion rate of increased glucose tolerance to diabetes is high, probable on account of the influence of lifestyle transitions.[3, 4]

Depression is the most common among psychiatric disorders and also common among the disorders with well documented impact on diabetes outcomes. The co-occurrence of depression in diabetes is attributed to a variety of factors, including the psychological and psycho-social impact of the disease, a potential common genetic susceptibility and common patho-physiological abnormalities involving neuro-immunological and neuro-endocrinal pathways, as well as micro-vascular brain lesions due to diabetes mellitus.

There are likely to be a bidirectional effects associated with depression due to negligence of self- care and the biological abnormalities such as increased cortisol and complications of diabetes may also lead to secondary depression. Depression can have alterations in the hypothalamic-pituitary axis, which lead to increased rates of cortisol production and other counter regulatory hormones leading to insulin resistance.[14]

II. Review Of Literature

Depression is a devastating disease that adversely affects all aspects of one's existence. It is a pervasive disorder that afflicts individuals of all ages, cultures and races. Nearly 340 million people worldwide suffer from depression.[5]

Depression was the fourth leading cause of disability in 1990 and was predicted to become the second leading cause of disability by 2020.In developed nations, major depression already was a primary cause of disease burden, exceeding all diseases except ischemic heart disease. The disability conferred by depression has been compared to functional impairment from blindness or paraplegia.[6]

Suicide was the 11thleading cause of death in United States in2000 and outnumbered homicides by ratio of five to three. [7]

Mortality from suicide can be conceptualized as an end stage of process of depressive disorders.The prevalence of suicide increases with age, and older adults,especially elderly white men, have a higher rate of suicide than any other age group.[8]

More than 90% of those who commit suicide have depression,substance use,or other medical disorder.[9] and 70% visit there primary care physician within 6 weeks of suicide.Some case control studies suggest correlation between burden and severity of comorbidmedical illness and suicide. [10]

Depression is linked with hyperglycemia in most studies of diabetic subjects, a relationship that is corroborated by meta-analyses of the literature in both type 1 and type 2 diabetes.[13]

Physiological features of depression, glucocorticoid dysfunction, increased sympathetic activity and alterations in inflammatory processes may contribute directly to hyperglycemia.[12]

The direct negative physiological effects of depression on glucose metabolism, increased counter regulatory hormone release and action, changes in glucose transport function, and increased immune-inflammatory activation [14] may also increase insulin resistance and reduce glucose uptake, increasing the risk for developing type 2 diabetes.[15]

Depressive symptoms are associated decreased glycemic control and increased diabetic complications, [11]conversely; poor metabolic control and functional impairment due to increasing complications may cause or worsen depression and lessen response to antidepressant treatment. [16]

A hospital based study shows that overall 84% of the subjects with diabetes had depression, while moderate to severe depression was found in females (71.43%) and males (54.55%).[39]A meta-analysis of 27 studies demonstrated depression was significant with a variety of diabetes complications showing consistent association of complications and depressive symptoms.[41]

In addition to the effects of depression on the onset, course of diabetes, the chronic nature of diabetes mellitus itself and its required treatment also constitute the stressors that the individuals

must confront. There are wide variations seen in how persons handle these diabetes-specific stressors as well as the stress of chronic illness. The concept of coping "person or individual difference" factors that influence an individual's adaptation to the stressors of chronic illness. [45]

The pathways epidemiological study reported that every half-point decrease in the HbA1C level there was 19.5% reduction in risk of diabetes related complications.(46)

A general hospital study shows that total health service costs of subjects with diabetes and depression are significantly higher than those with diabetes alone.[47]Another study it was found that the mean age of 54.66+11.22 and prevalence of depression is 16.9% in type 2 diabetes subjects.[48,49] A largest population based study in 2009 shows 15.1% prevalence of depression in 300 diabetic subjects.[50]

III. Illness Related Factors

Asians have a strong ethnic and genetic predisposition for diabetes and have lower thresholds for the environmental risk factors, as a result Asian population develop diabetes at a younger age than their Western counterparts.[17]It may also be related to an interplay of higher rates of central obesity, insulin resistance, genetic predisposition and / or influence of adverse intrauterine influences present among the Asian Indian population.

The ethnic differences in the prevalence of diabetes and impaired glucose tolerance may not be completely explained by the living environment and geographical locations, suggesting a major role for genetic factors.[18]

In southern India, the prevalence of diabetes in persons under 44 years has increased from 25% of the total prevalence in 2000 to 36% in 2006. [3]Asian people with young onset of diabetes have substantial phenotypic heterogeneity, many with a positive family history, impaired beta cell function, no islet cell autoantibodies and with clustering of cardio metabolic disorders. [19,20]

The prevalence ofobesityand overweight are relatively lower in Asia compared to with Western population, the recent socio-economic transition in Asia is resulting in a parallel increase in its prevalence. Among Asians, diabetes occurs at lower Basal Metabolic Index level than in Western populations and small increments in weight triggers glucose intolerance in susceptible subjects.[18,21,22]

Several studies in Asian populations, particularly in Asian Indians, have highlighted the "metabolically obese" phenotype among normal weight individuals.[21,25] This phenotype, characterized by greater abdominal obesity despite a normal BMI, less muscle mass, higher percentage of body fat and increased propensity for insulin resistance compared with the Western populations, render higher susceptibility for diabetes in Asian populations.[23,24]

The risk of diabetes is shown to be higher by 45% in smokers than non-smokers.[26] Smoking increases risk of central obesity and insulin resistance.[27]

The relation between Alcohol consumption and Diabetes remains controversial.While consumption in higher amounts is associated with an increased risk of type 2 diabetes, consumption in low to moderate amounts has been found to be protective in some studies.[28]

The increasing use of alcohol in Asian countries, especially among middle class and rural population, also increases the risk for diabetes and other metabolic diseases.[26]

A U shaped relationship was found between Alcohol consumption and Glycemic control among patients with diabetes.[29]In some circumstances Alcohol ingestion may cause or worsen depression, whereas in other circumstances the direction of causal effect may be reserved.[30]

Both Alcohol and Major depression pose a significant risk for the development of the other disorder at one year. [31]The prevalence of depressive symptoms is strongly related to alcohol dependency,the strongest association was between major depressive symptoms and alcohol dependency in women. [32]

In Asian populations the prevalence of type 2 diabetes is high, particularly so in Asian Indians, by virtue of a high genetic susceptibility and enhanced interaction with triggers. Consuming a high fat diet and lower levels of physical activity are the common factors which trigger the gene-environment interaction. Rapid weight gain occurring in childhood due to a nutritionally rich environment enhances the risk of these adult diseases. A recent collaborative study of prospective data from large numbers of individuals in five low and middle income countries, including India, showed that lower birth weight is a risk factor for glucose intolerance.[33]Higher than expected weight gain between 48 months and adolescent/ adult is also risk for glucose intolerance.

From an evolutionary perspective, humans were designed to move – to loco mote and engage in all manner of manual labor throughout the day. This was essential to our survival as species.The recent shift from a physically demanding life to one with few physical challenges has been sudden, occurring during a tiny fraction of human existence. We are spending increasing amounts of time in environments that not only limit physical activity but require prolonged sitting-at work, at home and in our cars and communities. Scientist studying the ill effects of this decrease in physical activity have revealed a complex multifaceted relationship among physical work, energy expenditure, and health.[34]

Sedentary life style, especially time spent watching television has been linked to obesity, metabolic syndrome and diabetes, all conditions characterized by some degree of hyperinsulinemia and insulin resistance.[35] Reported time spent using a computer was significantly associated with long-transformed concentrations of insulin before but not after accounting for waist circumference and body mass index. Sedentary behavior,particularly the amount of time spent watching television, may be an important modifiable determinant of concentrations of insulin. There is significant relationship between physical activity, sedentary life and depression. [36]

A new study published in BMJ Sports Medicine demonstrated that there was a clear link between sedentary lifestyle and depression. The study involved searching throughout a variety of research vaults for studies related to sedentary behavior and depression risk. For the meta-analysis, researchers used 13 cross-

sectional studies were used with 110,000 total participants and 11 longitudinal studies with over 83,000 participants. The researchers then summarized relative risks (RRs) using a random effects model. The results were not very surprising: sedentary behaviors were found to increase risk of depression by up to 25%.

The rise in dietary intake of carbohydrate especially highly refined carbohydrate is a likely cause in promoting weight gain and obesity.[37] A significant reductions in postprandial plasma glucose and plasma insulin levels with low carbohydrate diet (LoCHO) have been demonstrated in many studies.[38]

Aims of the Study:

1) To study the prevalence of depression among diabetes subjects.
2) To study illness related factors influencing depression and diabetes.

IV. Materials And Methods

After obtaining appropriate permission from hospital authorities to conduct this study,this cross sectional study was conducted in department of medicine at Osmania General Hospital, Hyderabad. The subjects included in the study were previously screened by physician /Endocrinologist and diagnosed as having diabetes mellitus, were taken as sample. The sample population comprised of subjects suffering from diabetes mellitus of all types and also suffering from one or more complications of diabetes. These subjects were also attending the medical as well as departments of neurology,nephrology,ophthalmology and endocrinology for the care and patients were selected on consecutive sampling basis.

Based on the signs and symptoms of diabetes as well as complications due to diabetes the complications, the inclusion criteria was subjects with diabetes with or without complications as per international criteria, who consented for study, aged between 18 to 65 years. Exclusion criteria were impaired glucose tolerance and gestational diabetes, head injury, epilepsy, subjects using steroids, immunoglobulin's, interferon, cancerous patients, intracranial tumors and other endocrinal disorders. A semi-structured intake proforma was prepared to collect data and illness details. The data collected was subjected for statistical analysis and result was compiled. The level of significance was set at 0.001

Tools used:

1. Semi-structured intake proforma
2. Hamilton Depression Rating Scale(24)

Statistical Methods: For the purpose of analysis means and standard deviation have been used, comparison between groups was made by 't' test and chi-square.

V. Results

The present study was done in department of medicine at Osmania General Hospital, based on signs and symptoms and as well as complications due to diabetes, were divided in to two groupsi.e., complicated and uncomplicated group.

Table 1: Prevalence of depression in diabetes

In total sample	40%
In uncomplicated group	15%
Complicated group	72.5%

The above Table1 is depicting the prevalence rates of depression among complicated (72.5%) and uncomplicated group(15%).The prevalence rate of depression in complicated group is higher than uncomplicated group.

Table 2: Hamilton depression rating scale-24

Variables	Uncomplicated	Complicated	Chi-square	P value
Depressed Mood	0.23(0.485)	1.15(0.864)	5.813	0.001
Feeling of Guilt	0.21(0.469)	1.38(1.030)	6.469	0.001
Suicide	0.23(0.469)	0.80(0.992)	3.098	0.003
Insomnia Early	0.41(0.549)	1.13(0.853)	4.417	0.001
Insomnia Middle	0.05(0.320)	0.85(0.802)	5.784	0.001
Insomnia Late	0.08(0.354)	1.08(0.859)	6.720	0.001
Work and Activity	0.21(0.57)	1.88(1.137)	8.221	0.001
Retardation	0.05(0.320)	1.15(1.027	6.389	0.001
Gen Somatic Symptoms	0.36(0.537)	1.03(0.733)	4.595	0.001

Table 3:Hamilton depression rating scale-24

Variables	Uncomplicated	Complicated	Chi-Square	P-Value
Genital Symptoms	0.00(0.000)	0.98(0.733)	7.859	0.001
Hypochondriasis	0.26(0.595)	1.58(1.152)	6.367	0.001
Loss of Weight	0.03(0.160)	0.75(0.840)	5.293	0.001
Agitation	0.03(0.160)	0.50(0.784)	3.745	0.001
Anxiety Psychic	0.70(1.137)	0.70(1.137)	2.884	0.006
Anxiety Somatic	0.23(0.485)	1.00(0.906)	4.689	0.001
Somatic GI Symptoms	0.08(0.270)	0.75(0.670)	5.884	0.001
Insight	0.00(0.000)	0.15(0.533)	1.78	0.083
Diurnal Variation	0.00(0.000)	1.00(0.847)	7.46	0.001
Depersonalization and Derealization	0.03(0.160)	0.00(0.000)	-1.0	0.324
Paranoid symptoms	0.03(0.160)	0.00(0.000)	1.0	0.324
OCD Symptoms	0.00(0.000)	0.00(0.000)	-	-
Helplessness	0.33(0.701)	1.95(1.061)	8.010	0.001
Hopelessness	0.56(0.780)	1.93(0.997)	6.277	0.001
Worthlessness	0.44(0.788)	1.50(0.716)	6.277	0.001
HDRS TOTAL	3.95(7.518)	23.2(14.449)	7.40	0.001

The above Tables 2 and 3 displaying the individual variables of HAMD -24 scale. The majority of symptom variables of depression show statistically significance in complicated group with p value <0.01 than the uncomplicated group, suggesting increased prevalence of depression in complicated group

Table 4: Hamilton depression rating scale (24):

Group	Nil	Mild	Moderate	Severe	Chi-square	P value
Complicated (n=40)	16(40%)	14(35.5%)	5(12.5%)	5(12.5%)	30.622	.001
Uncomplicated (n=40)	39(97.4%)	0(0%)	1(2.61%)	0(0%)		
Total	55(68.4%)	14(17.7%)	6(7.6%)	5(6.3%)		

The above Table 4 shows that clinical depression was found in 31.6% of subjects and 68.4% were not suffering from depression. Among 60% of subjects in complicated group the severity of depression was mild in 35%, moderate in 12.5% and severe in 12.5% whereas, only 2.6% of subjectsuncomplicated group has shown moderate depression with significant 'p' value of 0.001. Depression was found in 60% of subjects in complicated group when compared to 2.6% of subjects in uncomplicated group and no evidence of depression was found in 97.4% in uncomplicated and in 40% of complicated group.

Illness related factors:

Table 5 : Age

Age	Uncomplicated	Complicated	T test	Significance
18-65 years	53.54±6.89	47.53±12.61	-2.64	P=0.001*

The mean age in complicated group is 47.53±12.61 which is significantly lower than uncomplicated group with a mean of 53.54±6.89. The reason could be due to onset of complications in type 1 diabetes is earlier than type 2 diabetes.

In this study, Smoking and Alcohol abuse is found in 37.5% in complicated subjects whereas no abuse found in uncomplicated group with significant p value as can be seen in Table 6.

TheTable 7 shows family history diabetes found in 15% of complicated group, while 40% in uncomplicated group and no family history in 85% of complicated group and 10% of uncomplicated group with no statistical significance.

TheTable 8 shows that sedentary lifestyle found in 47.5% of complicated group and 12.5% in uncomplicated group with significant p value, suggesting increased incidence of sedentary life style in complicated group.

Table 6: Smoking and alcohol abuse

Smoking and Alcohol Abuse	Uncomplicated (n=40)	Complicated (n=40)	Chi-square	Significance
Yes	0 (0%)	15(37.5)	18.462	P=0.001*
No	40(100%)	25(62.5%)		

Table 7: Family history of diabetes

Family history of diabetes	Uncomplicated (n=40)	Complicated (n=40)	Chi-square	Significance
Yes	16(40%)	6(15%)		
No	24(60%)	34(85%)	6.270	P=0.12

Table 8: Sedentary life style

Sedentary Lifestyle	Uncomplicated (n=40)	Complicated (n=40)	Chi-square	Significance
Yes	5(12.5%)	19(47.5%)		
No	35(87.5%)	21(52.5%)	72.381	P=0.001*

Table 9: High carbohydrate diet

High Carbohydrate Diet	Uncomplicated (n=40)	Complicated (n=40)	Chi-square	Significance
Yes	4(10.0%)	9(22.5%)		
No	36(90%)	31(77.5)	2.296	P=0.13

The above Table 9 shows high carbohydrate consumption in 22.5% subjects of complicated group and 10% of uncomplicated group with no statistical significance.

Table 10: Reaction to illness

Reaction to illness	Uncomplicated (n=40)	Complicated (n=40)	Chi-square	Significance
Mild	39(97.5%)	38(95%)		
Severe	0(0%)	2(5%)	3.013	0.222
Very Severe	1(2.5%)	0(0%)		

The above Table 10 shows subjects reaction to illness found to be mild in 95% of subjects and severe in 2% in complicated group whereas mild reaction to illness found 97.5% and very severe in 2.5% of subjects in uncomplicated group with no statistical significance.

Table 11: Admission status

Admission Status	Uncomplicated (n=40)	Complicated (n=40)	Chi-square	Significance
OP	40(100%)	2(5%)		
IP	0(0%)	38(95%)	30.622	P=0.001*

The above table illustrates admission status among both groups, it was found that 95% wereinpatient admissions and 5% were on OP basis in complicated group whereas all subjects of uncomplicated group were on OP care with significant p value.

VI. Discussion

Diabetes mellitus comprises a group of common disorders that share the phenotype of hyperglycemia. Several distinct types of diabetes mellitus exist and are caused by a complex interaction of genetics, environmental factors and lifestyle changes. Diabetes is the 3rd leading cause of death and with an increasing incidence worldwide, and will be a leading cause of morbidity and mortality in the foreseeable future.

In this study prevalence of depression was 15% in uncomplicated group and 72.5% in complicated group suggesting depression associated with diabetes and its complications. Our study results correlating with previous study by RupeshChaudary*et al.* [39]Among the subjects of complicated group, 35% were suffering from mild depression, 12.5% of moderate and 12.5% with severe form of depression. This study results were replicating earlier meta-analysis study by Anderson RJ *et al*.[41]The mean age of subjects in complicated group (47.53±12.61) is lower than uncomplicated group(53.54±6.89) with significant p value, correlating previous study by Yatanpal Singh *et al*[48] and Parikh RM *et al*[49]

Recent studies in India showsalarmingly increasing number of people with diabetes and its complications. The younger age at which the disease develops (especially type 2 diabetes) in children and adolescents are of significance concern. Rapid rates of urbanization, modernization,readily available fast foods,smoking and alcohol abuse and sedentary habits have altered the lifestyle of the population, more so young population. In this study, influence of the illness related factors such as Age, Smoking and Alcohol Abuse, Sedentary lifestyles shows statistically significant 'p' value and results were correlating with previous studies by Katikireddi*et al*[17]Nunes*et al*[42] Willi C *et al*[26] Haskell WL *et al*[34] and Ford *et al*[35]

Limitations

The generalization of the findings is limited because of the sample size. This is a hospital based study; the sample may not be representative of community population. It was a cross sectional study and the subjects were not followed up.

VII. Conclusion

The health care and social burden of diabetes is alarming in many Asian countries, particularly India. The health consequences are devastating in Asian populations due to a strong genetic predisposition to metabolic diseases like diabetes. Current lifestyle parameters perhaps accelerate the clinical expression of the disease at a very young age itself.

Primary prevention of diabetes is possible by modifying risk factors such as obesity and insulin resistance[43,44] National programs promoting healthy lifestyle among the population, starting from a young age, should be given priority in the health care agenda.Collaborative care interventions should include the psychiatric care.

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