

## Depression and Diabetes in High-Risk Urban Population of Pakistan

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**Abstract:** *Objective:* To determine the prevalence of depressive symptoms among subjects with high-risk of diabetes as assessed by a pre-defined questionnaire in an urban city of Pakistan. Depressive symptoms were also assessed in people with newly diagnosed diabetes along with its determinants.

*Materials and Methods:* High risk subjects were identified by a pre-defined questionnaire which included positive family history of DM, age > 30 yrs, obese or over weight, decreased intake of fruit and vegetables in diet etc. Amongst them 1,825 subjects agreed for OGTT. 1,246 subjects gave consent for the assessment of depressive symptoms. Depressive symptoms were assessed by using the Montgomery Asberg Depression Rating Scale (MADRS).

*Results:* Depressive symptoms were present in 7.4% of the subjects at a rating of  $\geq 13$  on the MADRS. Mean age of all the subjects was  $42 \pm 9.4$  years while mean BMI was  $26.3 \pm 5.1$  kg/m<sup>2</sup>. The prevalence of depression was significantly higher in subjects with newly diagnosed diabetes compared to subjects without diabetes (13% vs 6%;  $p < 0.01$ ). Females were found to be more depressed than males (15.5% vs 3.6%;  $p < 0.001$ ). Female gender, being financially dependent, and having diabetes were found to be independent risk factors for depression controlling for potential confounding factors.

*Conclusion:* A significantly high percentage of depression, assessed by MADRS was found in subjects with newly diagnosed diabetes as compared to subjects without diabetes. It is of the essence that psychiatric attention may be necessary to be incorporated in diabetes care both for prevention and treatment.

**Keywords:** Depression, newly diagnosed diabetes, high risk population, Pakistan, MADRS.

### INTRODUCTION

Diabetes prevalence has been increasing worldwide and according to World Health Organization (WHO) estimates, the number of people with diabetes will rise from 246 million in 2007 to 380 million by 2025 [1].

Depression is a common public health issue which affects all aspects of a person's life and has been recognized as an important co-morbid condition in diabetes [2]. Studies

have identified depression as an independent risk factor for type 2 diabetes with relative risk of developing diabetes ranging from 1.3 to 3.0 [3-7].

It has been observed that depression frequently co-exists with diabetes and diabetes-related complications [8-10]. Evidence suggests that subjects with diabetes who have co morbid depression not only have poor glycemic control but also have higher rate of diabetes complications and disability [11]. Different trials have suggested that improvement in glycemic control is correlated with improvement in depression [12-14], while some studies have found association between glucose dysregulation and depression before the onset of type 2 diabetes [3, 4, 15].

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The combination of depression and diabetes has a detrimental effect on an individual's health and it adversely affects the chances of a healthy recovery from illness [16]. We know that depression not only decreases the quality of life in subjects with diabetes but may also worsen their glycemic control and this in turn may result in increased occurrence of complications resulting in higher health-care economic burden on individuals and the society at large [17, 18].

To the best of our knowledge the data on the prevalence of depression in subjects with high risk of diabetes in an urban population in Pakistan is limited. We investigated the prevalence of depression in subjects with high risk of diabetes as defined by being overweight, having positive family history, physically inactive and poor dietary habits in an urban population of Pakistan. Risk indicators for depression in relation to socio-economic state, education, marital status and diabetes were also assessed.

## MATERIAL AND METHODS

Screening camps were organized at various schools, union council offices and factories in and around the city of Karachi, Pakistan as part of a diabetes primary prevention program. On the first day of the program diabetes awareness lectures were delivered to the general public and employees by health professionals of the prevention team. On the second day, subjects identified as high risk on the basis of a questionnaire about weight, positive family history, physical inactivity and poor dietary habits etc were asked for an Oral Glucose Tolerance Test (OGTT). Individuals more than 30 years of age with no previous history of diabetes were included in the study. On the day of OGTT, subjects came with a fasting of 8-10 hrs. Fasting blood sample was taken and they were given a drink containing 75 gms of glucose with the time noted. Depression was assessed by MADRS after taking the fasting sample of blood. Second blood sample was taken two hrs after the glucose load. A total of 1,825 high risk subjects agreed for OGTT. Blood glucose was estimated by the oxidase method (GOD-PAP) [19]. Diabetes was defined according to WHO diagnostic criteria of RBS  $\geq 200$ mg/dl [20].

Depression was assessed by Montgomery Asberg Depression Rating Scale (MADRS) developed by Montgomery and Asberg in 1979 [21]. MADRS is a 10 items questionnaire. The sum of each item is from 0 to 6 and total sum of the questionnaire ranges from 0-60. Normally, MADRS scores are categorized into 4 groups, Healthy (0-12), Mild depression (13-19), Moderate depression (20-34), and severe depression (35-60) [22]. 1,246 subjects gave consent for the assessment of depressive symptoms. To ensure standardization, a single health professional did the MADRS scoring of all the individuals.

Demographic and socioeconomic information was also collected through a structured questionnaire. Subjects were categorized according to age into two groups,  $< 40$  and  $\geq 40$  yrs. Height was measured in centimeters and weight was measured in kilogram BMI was calculated by dividing weight to height in meter square. According to WHO and IDF definition, obesity in Asians is defined as BMI  $25\text{kg}/\text{m}^2$

and above [23]. BMI values were categorized into obese ( $\geq 25$ ) and non obese ( $<25\text{ kg}/\text{m}^2$ ). Waist and hip girth was measured and blood pressure was recorded by using a mercury sphygmomanometer. Waist circumference was measured with non stretchable measuring tape at the midpoint between bottom rib and tip of hip bone. Hip circumference was measured at the fullest part of the hips.

We divided our subjects into two groups, 0-12 as healthy subjects and above 13 as depressed subjects as defined in a study done in a rural area of Pakistan [22]. The term depression is used in terms of an epidemiological definition based on symptoms scale [24].

The ethical approval for this study was given both by the Norwegian Ethical Committee for Medical Research and by the Institutional Review Board of Baqai Institute of Diabetology and Endocrinology (BIDE).

## Statistical Analysis

The data was entered and analyzed on SPSS version 13.0. Continuous variables are shown as Mean  $\pm$  SD and categorical variables are in frequencies and percentages.

T-test was used for the mean difference of two groups and compared with p value  $< 0.05$  for the statistical significance. Z-test for proportion is used for the prevalence with the same criteria of significance. Logistic regression is used to get the adjusted odds ratio and 95% CI for sex, age, diabetes, BMI, marital status, occupation, education, socio-economic status and hypertension.

## RESULTS

Out of the 1,246 subjects, 853 (68.4%) were males and 393 (31.5%) were females. One hundred and seven (8.5%) had diabetes but no depression, 76 (6%) were depressed without diabetes, 16 (1.28%) had both diabetes and depression, while 1047 (84%) were free from both diabetes and depression. Depression with diabetes was relatively common in the older age group having a mean age of  $44.6 \pm 10.5$  years. Depressed subjects and subjects with diabetes had significantly high BMI as compared to healthy subjects with a p value of  $<0.05$  as shown in Table 1. Systolic and diastolic blood pressure was also high amongst those having both diabetes and depression. Mean age of all the subjects was  $42 \pm 9.4$  years while mean BMI was  $26.3 \pm 5.1\text{ kg}/\text{m}^2$  (data not shown in Table 1).

Prevalence of depression was found to be 7.4% in this population (Table 2). The prevalence of symptoms of depression was significantly higher 13% (95% CI; 8.03 - 18.95) in subjects with diabetes as compared to subjects without diabetes 6.8 % (95% CI; 5.53 - 8.23) as shown in Table 2 (p value = 0.01, Odds ratio 2.1, 95% CI; 1.1 - 3.6). Depression was more common in subjects whose BMI was  $> 25\text{ kg}/\text{m}^2$  i.e. 9.1% with a OR 1.4 (95% CI 0.92- 2.35) compared to non obese. Looking at the gender distribution females were more depressed as compared to males (15.5% vs 3.6 %; p  $<0.005$ ) as shown in Table 2.

Being female, having diabetes and being socio-economically dependent (non earners and not included as income generating members of the family) were significant

**Table 1. Characteristics of Sample Population**

Characteristics	Healthy (No Diabetes and No Depression)	Depressed but No Diabetes	Diabetes but No Depression	Both Diabetes and Depression
n=1246	1047	76	107	16
<b>Demographic Parameters</b>				
Age in years	41.4 ± 9.3	41.9 ± 8.9	43.7 ± 9.5 *	44.6 ± 10.5
Males %	754 (72%)	27 (35.5%)	68 (63.6%)	4 (25%)
Females %	293 (27.9%)	49 (64.5%)	39 (36.4%)	12 (75%)
High Physical activity	441(42.12%)	25(32.89%)	44(41.12%)	7(43.75%)
Low Physical activity	606(57.9%)	51(67.1%)	63(58.9%)	9(56.3%)
<b>Anthropometric Parameters</b>				
Body mass index (kg/m <sup>2</sup> )	26.1 ± 4.9	27.9 ± 5.8 *	27.8 ± 6.5 *	26.4 ± 5.2
Waist-hip ratio	1.07 ± 3.8	0.84 ± 0.2	0.88 ± 0.2	0.86 ± 0.1
Systolic blood pressure (mm/Hg)	120 ± 17	120 ± 17	121 ± 18	127 ± 16
Diastolic blood pressure (mm/Hg)	84 ± 11	84 ± 11	84 ± 14	89 ± 10

\* p-value <0.05 was observed when compared with healthy subjects.  
Values Present as Mean ± SD and n (%).

independent risk indicators for depression in this population (Table 3). It appears that low income was a modifier in the multivariate model (OR 2.2, 95% CI 0.86- 5.62; p-value =0.097).

## DISCUSSION

Prevalence of depression in this population was found to be 7.4%, which is relatively low when compared with other studies done in different areas of Pakistan that reported 34% and 48.8% cases of depression in their respective populations [25, 26]. This difference in the prevalence is likely due to the different assessment tools used for the symptoms of depression. In the Primary Prevention Program, a high risk group for diabetes was initially identified on the basis of a structured questionnaire and these were further

screened by Oral Glucose Tolerance Test. Those who were identified as having diabetes according to OGTT were labeled as newly diagnosed subjects with diabetes. Assessment of depression by MADRS was done at baseline before the second sample was taken as a component of the diabetes primary prevention program.

The reported prevalence rate of depression from rural area of Pakistan by using MADRS was 5.4%, which is comparable to our results [22]. A possible reason for the low prevalence of depression could be under reporting of subjects with depression because people were reluctant to tell about depressive symptoms as they did not want to accept themselves as a patient of depression. Both in Bangladesh and Pakistan depression was associated with low income.

**Table 2. Prevalence of Depression with 95% CI**

	Over All			Male			Female*		
	n	Depression	(95% CI)	n	Depressed	(95% CI)	n	Depressed	(95% CI)
All	1246	92	7.38 (6.16-8.83)	853	31	3.63 (2.58-4.89)	393	61	15.52 (12.52-19.1)
Age < 40 years	577	39	6.75 (5.04-8.8)	403	15	3.72 (2.17-5.57)	174	24	13.79 (9.5-18.9)
Age > 40 years	669	53	7.92 (6.2-9.96)	450	16	3.55 (2.12-5.26)	219	37	16.89 (12.74-21.85)
Without DM	1123	76	6.76 (5.53-8.23)	781	27	3.45 (2.38-4.73)	342	49	14.32 (11.22-18.04)
With DM	123	16	13 (8.03-18.95)	72	4	5.55 (1.12- 0.84)	51	12	23.52 (13.78-35.17)
BMI ≥25 kg/m <sup>2</sup>	645	59	9.14 (7.28-11.37)	380	14	3.68 (2.09-5.57)	265	45	16.98 (13.19-21.5)
BMI <25 kg/m <sup>2</sup>	438	28	6.39 (4.47-8.68)	336	14	4.16 (2.37-6.3)	102	14	13.72 (8.13-20.4)
WHR ≥cut off	794	63	7.93 (6.36-9.81)	597	23	3.85 (2.56- 5.39)	197	40	20.3 (15.6-25.92)
WHR < cutoff	452	29	6.42 (4.52-8.67)	256	8	3.12 (1.34- 5.25)	196	21	10.7 (7.09-15)

\*All p values were <0.005 while compared with male to female.

T2DM= Type 2 Diabetes Mellitus.

BMI= Body Mass Index.

WHR= Waist-hip ratio.

Cut off values of WHR =0.9 cm for male and 0.8 cm for female.

**Table 3. OR with 95% CI for Depression**

Variables	Adjusted Odds Ratio*	95% CI	p-Value
Female	6.48	3.43-12.26	<b>0.000</b>
Age above 40 years	1.09	0.60-1.98	0.767
Subjects with diabetes	3.81	1.7-8.53	<b>0.001</b>
Obese Subjects	1.05	0.55-2.02	0.861
Unmarried	2.15	0.79-5.81	0.13
Low income status	2.2	0.86-5.62	0.097
Under graduate	0.51	0.22-1.17	0.111
Financially dependent	7.75	4.17-14.41	<b>0.000</b>
Hypertension	1.31	0.74-2.33	0.345

\*Adjusted for all variables present in the model.

We found significantly high percentage of depression in our diabetic population, a trend that was also seen in other studies from this region [3, 24]. Our results showed high percentage of depression in females as compared to males, this has also been observed in other studies [24].

This higher prevalence of depression in females may be due to women bearing more stress in our social and cultural set up along with the added responsibility of the role of caretaker of the whole family [26]. Furthermore, as women are more economically dependent in our society this could be a cause of high percentage of depression.

Result shows depression was common in group of subjects who were non-earners, less educated and belonging to low income group. Along with these factors, diabetes and increasing age were also positively associated with depression; similar trend was also observed in a study from rural community of Pakistan [22]. We also observed that dependent persons (non-earners) were more depressed than earners, as they were not contributing as income generating members of the family and might have a feeling of worthlessness leading to depression. Thus poor access to monetary resources and feeling of uncertainty due to poverty might be possible reasons of high rate of depression in low income population [27]. We also found obesity to be positively associated with depression. Depressed people usually adopt sedentary life style that in turn leads to weight gain and result in obesity [28].

To minimize the biases in the assessment of depression scoring and to ensure standardization, MADRS of all the subjects was done by a single health professional. Since, only subjects with high risk for diabetes as assessed by questionnaire were included in the study, our sample is not representative of the prevalence of depression in the general population.

## CONCLUSION

A higher level of depression was found among subjects with newly diagnosed diabetes as opposed to subjects without diabetes but still at risk for diabetes and CVD. This is likely to be crucial for policy making. Previous studies have also largely documented higher levels of depression in those with diabetes as opposed to subjects without diabetes.

Although, our data suggests a dose-response impact of depression for diabetes, this is probably due to recruitment of subjects who already are at risk of developing diabetes as done in our diabetes prevention program. Along with diabetes, female gender and financial dependence were important factors associated with depression. Further studies are needed to determine whether psychiatric management together with lifestyle improvement may be beneficial in primary prevention of diabetes and improving glycemic control.

## ACKNOWLEDGEMENTS

We acknowledge the hard work and dedicated commitment of the diabetes primary prevention team and Norwegian Research Council for financing this project. We would like to thank the Research Department of Baqai Institute of Diabetology & Endocrinology for their valuable support.

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Received: December 8, 2009

Revised: January 28, 2010

Accepted: March 4, 2010

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