

## EFFECT OF STRESS ON CONTROL OF TYPE 2 DIABETES MELLITUS

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### ABSTRACT

#### BACKGROUND

There is significant evidence that stress, whether physical or mental, might have metabolic consequences in individuals suffering from diabetes mellitus, in terms of both its onset and exacerbation.

The aim of the study was to study the effect of stress on the control of type 2 diabetes mellitus.

#### MATERIALS AND METHODS

The research was a cross-sectional study on patients who were diagnosed with type-2 DM. The stress levels of the patients were assessed with Perceived Stress Scale (PSS) and their HbA1c levels were measured using appropriate lab methods. Based on the data obtained, a statistical relationship was framed between the stress levels of the patients and the degree of control of diabetes mellitus.

#### RESULTS

A total of 94 patients were enrolled in the study. After checking HbA1c levels at regular intervals, it was found that a total of 32 (34.04%) of 94 patients had poor glycaemic control. Also, after administering PSS, total 18 (19.14%) of 94 patients were found to have high stress. It seemed that HbA1c levels were a direct reflection of the stress levels.

#### CONCLUSION

Stress plays a key role in the causation as well as outcome of type-2 DM. Stress management along with education, dietary and lifestyle changes, and pharmacotherapy should be taken as holistic treatment approach for full control of diabetes mellitus.

#### KEYWORDS

Diabetes Mellitus, Stress, Glycaemic Control.

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#### BACKGROUND

Diabetes mellitus (DM) is a metabolic disease characterized by an inability to maintain normal glucose,<sup>1,2</sup> Type 2 DM is the most common type of diabetes mellitus. Type 2 DM is characterized by insulin resistance, which may be combined with relatively reduced insulin secretion.<sup>3</sup> The defective responsiveness of body tissues to insulin is believed to involve the insulin receptor. Type 2 DM is primarily due to lifestyle factors and genetics.<sup>4</sup> A number of lifestyle factors are known to be important to the development of type 2 DM, including obesity (defined by a body mass index of greater than 30), lack of physical activity, poor diet, stress, and urbanization. However, there are significant evidences that show the possibilities of stressful experiences influencing diabetes control.<sup>5</sup> The haemoglobin A1C (HbA1c) test is frequently used in people with type 2 diabetes as a measure of how their blood sugar is controlled. This potential influence is important in not only causing diabetes

onset or exacerbation<sup>6</sup> but also the development of diabetes complications due to chronically high (uncontrolled) blood glucose levels. Therefore, the present study was conducted to assess the effect of stress on glucose control in patients with Type-2 diabetes mellitus (T2DM).

#### Aim of the Study

To evaluate the effect of stress on the control of type-2 diabetes mellitus.

#### MATERIALS AND METHODS

##### Inclusion Criteria

- All the patients diagnosed as T2DM, willing to participate in the study and giving informed consent.
- Included were patients on any oral glucose-lowering treatment with or without once-daily injection of a long-acting insulin.
- Patients on any oral hypoglycaemic drugs with or without once-daily injection of a long-acting insulin.

##### Exclusion Criteria

- Patients suffering from any known psychiatric illness
- Patients with other medical, neurological or endocrinal illnesses likely to affect blood glucose levels.

##### Procedure

A total of 94 patients, diagnosed with T2DM and who were on oral or injectable hypoglycaemic drugs, attending the

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Medicine OPD in the hospital were chosen for the study. The stress levels of the patients were assessed with the Perceived Stress Scale (PSS) which a classic stress assessment instrument that gives the idea about one's feelings and thoughts during the last month. Also, the measurement of HbA1c level, which serves as a biomarker for monitoring glycaemic control, was done using appropriate lab technique. All the collected data was tabulated and analysed using appropriate statistical methods. Based on the data obtained, a statistical relationship was framed between the stress levels of the patients and the degree of control of diabetes mellitus.

**RESULTS**

All 94 patients who followed within 12 months were enrolled in the study. After checking HbA1c levels at regular intervals, it was found that total 32 (34.04%) of 94 patients showed HbA1c levels in the range of (>8) which depicted that these patients had high glucose levels for most of the time in a period of 12 months. These patients had poor glycaemic control even when on hypoglycaemic drugs. Among those patients who had poor glycaemic control, 13 (40.63%) had high stress (range 27-40) on PSS, whereas 16(50%) had moderate stress (range 14-26) and 3 (9.37%) had low stress (range 0-13) on PSS. It was also seen that the patients who had good glycaemic control showed contrast results with only 5 (8.06%) out of 62 patients having high stress. Also, about 18 of 94 patients had high stress, of which 13 (72.22%) had poor glycaemic control.

Summarizes all the patients falling into different categories of diabetes control according to HbA1c scores showing about 62 (65.95%) having good control and 32 (34.04%) having poor diabetes control. (Table 1)

HbA1c Score	Diabetic Control	Total
6-8	Good	62
>8	Poor	32
	Total	94

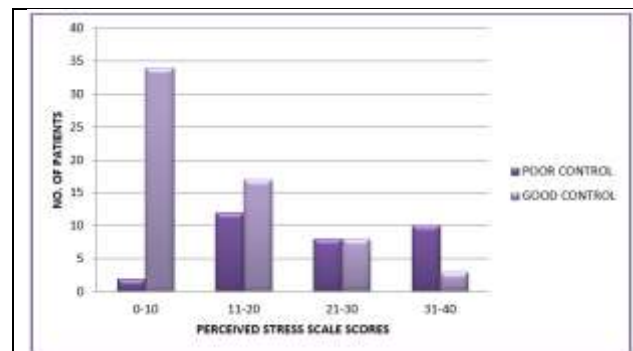
**Table 1. HbA1c and Diabetic Control**

Summarizes all the patients who were distributed according to their glycaemic control status and their corresponding levels of stress as calculated from perceived stress scale. It shows that about 32 (34.04%) had poor and 62 (65.95%) had good glycaemic control whereas, about 40 (42.55%) had low stress, 36 (38.29%) had moderate and 18 (19.14%) had high stress levels. (Table 2)

PSS	Poor Control	Good Control	Total
Low (0-13)	3	37	40
Moderate (14-26)	16	20	36
High (27-40)	13	5	18
Total	32	62	94

**Table 2. Perceived Stress Scale and Diabetes Control**

Establishes the relationship between stress and glycaemic control, wherein it shows that towards the lower side of stress scores, the no. of patients with good glycaemic control are significantly higher compared to that with poor glycaemic control. But as the stress increases, no. of patients with poor glycaemic control also increases with corresponding decrease in no. of patients with good control. Also, towards the highest limit of the PSS, there is reversal of the ratio of glycaemic control as seen towards the lower side. (Figure 1)



**Figure 1. Relationship Between Stress and Glycaemic Control**

Summarizes all the patients who were on oral hypoglycaemic drugs and those who required add-on insulin for glycaemic control with their corresponding levels of stress as per perceived stress scale. It depicts that about 60 (63.82%) patients were on only oral hypoglycaemic drugs whereas 34 (36.17%) had to be given insulin along with OHD for better glycaemic control. It was also seen that among those who received insulin, about 15 (44.11%) had high stress. (Figure 3)

PSS	OHD	Insulin	Total
Low	33	7	40
Moderate	24	12	36
High	3	15	18
Total	60	34	94

**Table 3. Perceived Stress Scale and Hypoglycaemic Drugs**

**DISCUSSION**

Previous studies strongly suggest that stressful experiences have an impact on diabetes mellitus. A number of laboratory studies have been conducted to demonstrate the effects of specific stressful situations (for example, arithmetic problem solving, unpleasant interviews) on blood glucose levels. Many of these studies have demonstrated that these types of stressors can destabilize blood glucose levels, at least for hours at a time.<sup>7</sup>

In a study of 30 patients which investigated the effect of acute psychological stress on glucose concentrations in patients with Type 2 diabetes, glucose levels were monitored on two days called a control day and a stress day when all participants were exposed to moderate psychological stress. The study showed that on the stress-test day, the glucose

concentrations were significantly higher compared with the control day (mean difference 1.5 mmol/l, 95% CI 0.5-2.4,  $P = 0.003$ ).<sup>8</sup>

In a recent study conducted on 400 diabetic patients, results showed that the fasting blood glucose levels were a direct reflection of the stress levels ( $P < 0.05$ ) whereas the glycaemic index (HbA1c level) was found to be linked to both treatment adherence and stress.<sup>6</sup>

Results found in our study are in congruence with these previous studies in this respect. We found that more than 30% of the patients had poor glycaemic control of which about 40% had significantly high stress. We came to know that there is a direct correlation between stress and glycaemic control as when stress increases the possibility of having poor glycaemic control also increases. Also, more than 30% patients were given add-on insulin with OHD for better glycaemic control, of which about 44% had significantly high stress. Although there could be many other factors that may be affecting blood glucose, the study showed that the stress was a potential contributor to it.<sup>9</sup>

It seems clear that there is a range of responses to stressful experiences, both physiological and behavioural or emotional, which is mediated through "fight/flight" response (stress response) when stress occurs. It activates neuroendocrine processes that influence the blood glucose level through the release of cortisol, growth hormone and endorphins.<sup>9,10,11</sup> This reaction has an adaptive importance for a healthy organism, but, in diabetic patients, the stress-induced hyperglycaemia may aggravate the disease since the hypoglycaemic agents cannot counterbalance it.

## CONCLUSION

Stress is an important factor both in causing diabetes onset and exacerbation. Hence, it becomes important for physicians to acquaint themselves with the effects of stress on T2DM in order to ensure proper treatment of the latter.<sup>6</sup> Stress management must be incorporated in the holistic treatment approach along with other measures like dietary plans, lifestyle modifications and pharmacotherapy for full control of diabetes mellitus.

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