

# Evaluation of compliance and adherence to medications in diabetic and/or hypertensive patients during the lockdown period and the effect of COVID-19 lockdown on blood glucose levels and blood pressure levels



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## ABSTRACT

**Background:** To contain the COVID-19 pandemic, a nationwide lockdown was imposed, which affected the lives of people with diabetes and hypertension as the patients were not able to regularly follow up with the doctor. **Aims and Objectives:** This prospective observational study was conducted to find out the compliance and adherence to oral hypoglycemic agents and antihypertensives during lockdown, to consult with doctors during lockdown, and also to analyze the effect of lockdown on blood glucose levels and blood pressure control by comparing the pre- and post-lockdown blood pressure and blood glucose levels. **Materials and Methods:** A prospective observational study was conducted on 100 participants aged between 35 and 85 years. They were studied by a questionnaire for a period of 3 months. The majority belonged to the 55–65 years of age group, and a male predominance was seen across all age groups. The changes in lifestyle habits of the participants during lockdown and complications due to diabetes and hypertension were also studied. **Results:** There was a statistically significant decrease in the adherence to prescribed medications during lockdown due to various reasons, the most important of which was the lack of access to personal consultation with the doctor during lockdown. Patients also could not follow their diet and physical exercises due to lockdown. All these factors led to poor control of blood pressure and blood glucose levels, as evidenced by comparing the pre- and post-lockdown blood glucose levels and blood pressure. **Conclusion:** This study concludes that there was a significant decrease in adherence to medications during the COVID-19 lockdown and there was poor control of blood pressure and blood glucose levels due to the lockdown period.

**Key words:** Diabetes mellitus; Hypertension; Blood glucose levels; Blood pressure levels; Lockdown

## INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease of inadequate control of blood glucose levels. Type 1 DM is due to reduced insulin production, and type 2 DM is due to insulin resistance, which leads to inappropriately raised blood

glucose levels. Hypertension is a major non-communicable disease and a major cause of mortality and morbidity.<sup>1-4</sup> Hypertension and diabetes are the most common causes of non-communicable diseases. Along with strict adherence to the medications and regular monitoring of blood glucose levels and blood pressure, the management of diabetes and

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hypertension also includes non-pharmacological methods like lifestyle modification in the form of regular exercise and diet control.<sup>5-7</sup>

COVID-19 is a disease caused by the SARS-CoV-2 virus, and it spreads via respiratory droplets. It is a highly communicable disease. After an incubation period of 6–8 days, there is a phase of symptomatic illness in the form of cough, fever, sore throat, breathlessness, and myalgia, which lasts for 1–2 weeks. The infection can be asymptomatic, but it can remain infectious in these asymptomatic patients. In vulnerable populations such as children and the elderly, and in people with comorbidities such as hypertension and diabetes, it can progress to viral pneumonia, which can cause death due to respiratory failure. In a study involving 173 patients with severe COVID-19 pneumonia, 16.2% had diabetes, and in another study of 140 hospitalized patients, 12% had diabetes.<sup>8-18</sup>

As a measure to contain COVID 19, the government of India had ordered for a nationwide lockdown from March 25, 2020, to May 31, 2020, in four phases. It was hypothesized that the diabetic and hypertensive patients would have poor adherence to the medications during lockdown due to the inability of personal consultation with doctors to alter the medications according to the patient's blood glucose levels and blood pressure. The non-availability of drugs during lockdown was also thought to be one of the reasons for poor adherence to the medications. The non-availability of space for regular exercise and maintenance of a healthy lifestyle during lockdown was also considered to be an additional factor in the poor control of blood glucose levels and blood pressure.<sup>19</sup>This would lead to poor blood glucose and blood pressure monitoring and control, which in itself is a risk factor for the worsening of symptoms and an increase in complications.<sup>20</sup>

### Aims and objectives

This prospective observational study was conducted to find out the compliance and adherence to oral hypoglycemic agents and antihypertensives during lockdown, to consult with doctors during lockdown, and also to analyze the effect of lockdown on blood glucose levels and blood pressure control by comparing the pre- and post-lockdown blood pressure and blood glucose levels.

## MATERIALS AND METHODS

### Participants

A total of 100 participants, including 73 males and 27 females, between the ages of 35–85 years participated in the study. The majority of the participants belonged to

the 55–65 years of age group. A male predominance was present across all age groups.

### Inclusion criteria

Participants who were more than 35 years of age and who had been diagnosed to have either diabetes, hypertension, or both for a minimum duration of 1 year were included in the study.

### Exclusion criteria

Participants who were <35 years of age and participants who had complications other than diabetes and hypertension were excluded from the study.

### Procedure

It is a prospective observational study based on the questionnaire method. A sample of 100 patients was selected using a simple random sampling technique.

The study was done after obtaining ethical clearance from the institute ethics committee on a sample of 100 patients who were following up in Chigateri hospital in the city of Davangere, Karnataka, for 3 months after obtaining informed consent from patients. Patients diagnosed with either DM or hypertension or both were identified, and their compliance and adherence to the prescribed medications, blood pressure, and blood glucose levels pre- and post-lockdown were compared based on the records available with the patients. The means of consultation with the doctors during lockdown, complications due to diabetes and hypertension faced by the patients during lockdown, and adherence to lifestyle modifications during the lockdown period were also studied using a questionnaire. Patient's aged more than 35 years of age who were diagnosed to have either diabetes or hypertension or both for a minimum duration of 1 year were included in the study. Patient's aged <35 years of age and those having complications other than DM or hypertension were excluded from the study. The data collected were entered into MS Excel and analyzed using descriptive statistics. The results were expressed as percentages.

## RESULTS

A total of 100 patients with either DM, hypertension, or both were enrolled in the present study. The majority of them had the disease for a minimum duration of 10 years or longer. The maximum number of patients were in the age group of 55–65 years (44). There was a male preponderance in all the age groups<sup>21</sup> (Table 1).

Before lockdown, 87% of patients were adherent to the medication, and 13% were not adherent. Comparing the adherence to medication before and after lockdown,

the percentage of people adherent to medication during lockdown fell to 70%, but the percentage of people not adherent to medication regularly increased to 30% (Table 2).

Statistical analysis was done using the Chi-square test, and medication compliance and adherence have reduced and were found to be significant with a  $P=0.0034$ . The causes of non-adherence were due to various reasons, among which the non-availability of medications during lockdown stands first (40%), some people chose to control their diet (30%), and some people had variations in symptoms (27%), due to which non-adherence was seen.

38% of the study population were in consultation with the physician, out of which the majority were on-call consultations and very few had direct consultations. 62% of the population were not in consultation, the major cause being the non-availability of transportation services, followed by the non-availability of doctors, followed by the patient not visiting the hospital due to fear of risk of acquiring COVID-19.

44% of the participants did not get their blood glucose levels and blood pressure checked for 3 months of lockdown owing to the restriction on outdoor traveling, and a few of them did not have a glucometer or blood pressure measuring apparatus at home. This led to poor scrutiny of blood pressure and blood glucose levels and the inability of changing of the medication by the doctor at the proper time.

26% of the study population developed complications due to diabetes or hypertension during lockdown, with the majority being increased frequency of urination, followed by headaches, palpitations, giddiness or syncopal attacks, and hypoglycemia.

The majority of population was following the dietary instructions given by their doctor, but a significant fraction

(38%) was unable to do so because of the restrictions due to lockdown.

Before lockdown, most of the patients were regularly exercising, of which the majority preferred outdoor exercise. Due to restrictions on outdoor movement and the gathering of crowds in outdoor exercise spots during lockdown, the fraction of people not exercising increased from 22% to 36%. The patients who continued to exercise did more indoor exercises than outdoor.

Finally, the pre- and post-lockdown blood pressure and blood glucose levels were compared. 63% of patients had Blood pressure  $<140/90$  before lockdown, which reduced to 32% post lockdown (Figure 1). Only 37% of the total population had their blood pressure above 140/90 before lockdown, which increased to 68% post lockdown (Table 3).

Statistical analysis was done by using the chi square test, and the percentage of people having blood pressure more than 140/90 after lockdown was found to be statistically significant with a  $P<0.0001$ , thus signifying the effect of lockdown on poor control of blood pressure.

The percentage of patients maintaining a blood glucose level of  $<110$  mg/dL decrease from 71% pre-lockdown to 54% post lockdown (Figure 2). The percentage of people having blood glucose levels more than 110 mg/dL was 29% pre-lockdown, which increased to 46% post-lockdown (Table 4).

Statistical analysis was done using the Chi-square test, and the increase in the percentage of people with blood glucose levels more than 110 mg/dL post-lockdown was found to be statistically significant with a  $P=0.013028$ , thus signifying the effect of lockdown on the poor control of blood glucose levels.

**Table 1: Distribution of patients according to the age**

Age (in years)	Male	Female	Total
35-45	11	0	11
45-55	22	4	26
55-65	30	14	44
65-75	8	6	14
75-85	2	3	5

**Table 2: Medication adherence**

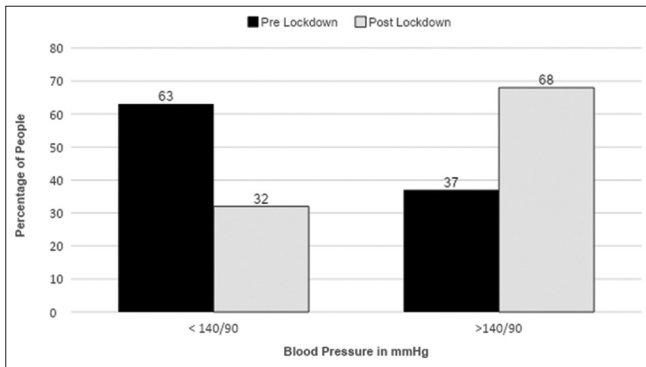
Medication adherence	Before lockdown	During lockdown
Adherent	87	70
Non-adherent	13	30

**Table 3: Comparing pre and post lockdown blood pressure**

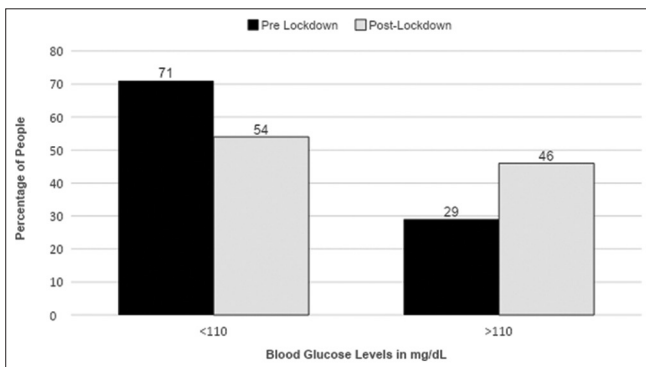
Blood pressure in mmHg	Pre lockdown (%)	Post lockdown (%)
$<140/90$	63	32
$>140/90$	37	68

**Table 4: Comparing pre and post lockdown blood glucose levels**

Blood glucose levels in mg/dL	Pre lockdown (%)	Post lockdown (%)
$<110$	71	54
$>110$	29	46



**Figure 1:** Pre and post lockdown blood pressure levels



**Figure 2:** Pre and post lockdown blood glucose levels

## DISCUSSION

The government imposed a lockdown to contain the COVID-19 pandemic, due to which there were restrictions on outdoor movement. Among the total participants in this study, the majority could not consult physicians regularly in person due to lockdown restrictions, and the patients were not able to get their prescriptions for anti-hypertensive and anti-diabetic medications regularly, leading to poor compliance and adherence to the medications. These findings are consistent with the study conducted by Alshareef et al.,<sup>22</sup> The results of the present study further confirmed this by showing that there was a statistically significant reduction in adherence to the medications during the lockdown.

Among the few who consulted, online consultations were much more expensive as compared to direct consultations; hence, the patients did not get their blood glucose and blood pressure checked every month. Due to lockdown restrictions, the patients were not able to adhere to healthy lifestyle habits like outdoor workouts and a healthy diet. All these factors led to poor control of diabetes and hypertension. This is consistent with studies conducted by Banerjee et al., and Pal et al.,<sup>22-24</sup> This study shows a statistically significant increase in the percentage of people who had poor control of blood pressure and blood glucose when the pre- and post-lockdown levels were compared.

In the study conducted by Richardson et al., they have highlighted the importance of regular blood sugar and blood pressure monitoring as hypertensives and diabetics are at higher risk for complications of COVID-19.<sup>25</sup>

Few participants in the present study had various complications because of the disease and medications, which is similar to the study by Ghosal et al., where they found a linear relationship between the duration of lockdown and complications.<sup>19</sup>

## Limitations of the study

The study was done on a small sample of population and was done for a short duration of time. Hence the patients could not be followed up further to know the long term complications due to non compliance and non adherence of oral hypoglycemic agents and anti- hypertensives

## CONCLUSION

The results of the present study emphasize that the COVID-19 lockdown has adversely affected the lifestyle habits, compliance and adherence to the medications. This has led to poor control of blood pressure and blood glucose levels. This in turn had a detrimental effect on COVID-19 outcome in this subset of population and also caused complications specific to deranged blood pressure and blood glucose level.

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