Correlation between Risk of Diabetes and Stress and Cortisone Regimen among Patients with COVID 19

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Abstract

Background: One of the most significant epidemics of the century, the COVID-19 virus disease is brought on by severe respiratory syndrome and poses a threat to human health globally. **Study aim:** to investigate the correlation between risk of diabetes and stress and cortisone regimen among patients with COVID 19**. Design**: It made use of a descriptive correlational design. **Setting**: this study was carried out at Minia Cardiothoracic University Hospital **Subjects**: convenient sample of 802 hospitalized patients typical COVID-19. **Data collection tools**: Tool (1) **structured interview questionnaire, it include** (socio-demographic data, medical information, laboratory investigation record and cortisone therapy monitoring). Ordinal Scale for Clinical Improvement**,** Type 2 diabetes risk form and Perceived Stress Scale**. Results** 31.3% of COVID-19 patients have low risk for type 2 diabetes, 7.5% of sample have high risk, and 52.2% of study sample use cortisone therapy < 7 days and 47% of patients suffer from severe stress. There was a high positive significant correlation among diabetes risk assessment and duration of cortisone use and level of stress. **Conclusions**: The data suggest that the correlation between diabetes occurrence following COVID-19 infection and diabetes risk, stress level, duration of cortisone use, and severity of the COVID-19 infection. **Recommendation** All COVID-19 patients should be acquire continuous glucose monitoring or to self-monitor their blood sugar levels frequently. The goal of continued monitoring is to identify pre-diabetic patients early and reduce their risk of acquiring diabetes.

Keywords: Risk of diabetes, stress, cortisone regimen, COVID 19.

Introduction

Infection with the COVID-19 virus in 2019 that results in severe acute respiratory syndrome. One of the most significant epidemics of the century, SARS-CoV-2, also known as COVID-19 virus 2, has been putting human health at jeopardy all over the world. More than 2.8 million individuals have perished as a result of the COVID-19, which has infected more over 130 million patients **(WHO, 2021 & World meter COVID-19 virus Pandemic, 2021).**

A novel viral infection that first appeared in China in late 2019 was named COVID-19 virus disease 2019 (COVID-19) by the World Health Organization (WHO) in February 2020 after it had expanded to infect individuals all over the world and met the requirements for pandemic status. Because of the epidemic, death and morbidity rates have significantly increased globally **(Lu et al., 2020; Wang et al., 2020)**

High rates of COVID-19 disease mortality and morbidity are found in males, the elderly, and patients with coexisting illnesses. Type 2 diabetes mellitus (T2DM), which has significantly higher death and morbidity rates, is one of the most prevalent comorbidities among COVID-19 patients. **(Roncon et al., 2020 & Fadini et al., 2020).** Furthermore, current research indicates that new-onset hyperglycemia occurs often in hospitalised COVID-19 patients without a history of diabetes. Hyperglycemia at hospital admission is another significant predictor of COVID-19 individuals without diabetes mellitus **(Bode et al., 2020; Sardu et al., 2020).**

A Chinese expert panel advised treating severely ill COVID-19 patients over the near term with low- to moderate doses of cortisone based on their experience. (**Shang et al., 2019**). Even while long-term use of cortisone may raise the risk of glaucoma, hypertension, cataracts, infection, and fluid retention, short-term cortisone therapy is normally safe, despite the possibility of secondary hyperglycemia (**Mattos-Silva et al., 2020**). Blood glucose levels that are above normal but below the established diabetes threshold are referred to as having prediabetes. Because there is a high possibility of developing diabetes, it is thought to be a dangerous condition **(Ali & Maysaa, 2020).**

Stress is defined as any uncomfortable psychological reaction followed by biochemical, physiological, cognitive, and behavioral responses **(Bakioğlu et al., 2020).** The numerous stressors that people are currently coping with as a result of the pandemic are reflected in the COVID-19 stress **(Ahuja, 2021).** The ongoing pandemic has the potential to pose a serious risk to physical and mental health **(Qiu et al., (2020).** The risk of prediabetes appears to be significantly influenced by stress. In many animals, the zone fasciculate of the adrenal cortex in the adrenal gland produces cortisol, a glucocorticoid that is created by a drawn-out and complex endocrine reaction chain as a result of stress. Less frequently, cortisol forms in other tissues **(Ali & Maysaa, 2020).**

The second most prevalent comorbidity of COVID-19, after hypertension, has been reported to be diabetes, more specifically type 2 diabetes mellitus (T2DM). A growing body of evidence indicates that comorbidities raise the risk of morbidity and mortality in SARS-CoV-2 infections, and DM patients frequently get severe infections. Information on results broken down by glycemic control, however, is scarce. Studies show that people with poorly managed diabetes experienced worse outcomes **(Gerganova et al., 2022).**

The global community is still at risk from the COVID-19 pandemic. Despite improvements in management, steroids remain the drug of choice for treating severe illness, even though they have hazards such immunosuppression and hyperglycemia. To hasten the recovery from acute infection and reduce mortality in both critically ill and non-critically unwell individuals, acute hyperglycemia must be managed (**Aravind et al., 2021**).

The COVID-19 pandemic places a heavy burden on nurses in terms of duties and responsibilities. They still handle the majority of patient care at hospitals and play a significant role in evaluation and monitoring of the local area. Nurses are responsible for ensuring that patients receive individualized, superior care, regardless of whether they are contagious. They also prepare for potential COVID-19 outbreaks, which might overwhelm the system by raising the demand for nursing and medical services. Nurses must also ensure that personal protective equipment and sanitation supplies are available and being used effectively, and they must give screening data, confinement criteria, and triage protocols based on the most recent instructions. (**Jackson et al**., **2020).**

Significant of the study

In Egypt, COVID-19 cases were 284,024 in July 2021, with 16,487 fatalities, placing it sixth internationally in terms of fatality rate. The age group of 65 and older had the highest mortality rate among infected individuals in Egypt, accounting for 48.9% of all fatalities. Egypt also came in 68th place internationally in terms of the number of cases of the virus, as well as 186th in terms of how quickly patients recovered from the illness (**Abdelhafiz et al., 2020).**

COVID-19 has been reported to be accompanied by hyperglycemia in persons without diabetes as well. Here, we emphasize careful analysis of the already available clinical data in order to comprehend the intricate mechanisms behind hyperglycemia in COVID-19. Assessing the causal link between COVID-19 and type 2 diabetes was the secondary goal **(Bode et al., 2020 & Smith et al., 2021).** Numerous research on the COVID-19 demonstrate that it causes numerous problems in virtually every human system. It appears that COVID-19 is the reason why many people get diabetes **(Samir et al., 2021).** The acute stress of the COVID-19 infection may be connected to the recently discovered diabetes. Additionally, cortisone treatment is one COVID-19 management strategy that may cause a lot of patient issues. Based on the results of the previous investigation, this study was carried out to assess the prevalence of newly found diabetes mellitus among COVID-19 patients and the connections between newly discovered diabetes mellitus and cortisone use, stress, and pre-diabetic risks.

Aim of the study:

The aim of the present study is to investigate correlation between risk of diabetes, stress and cortisone regimen among patients with COVID 19.

To determine percentage of diabetes mellitus disease occurred after COVID-19 infection**.**

To determine that COVID-19 patients have risk of type 2 diabetes mellitus before infection or exposure to stress and cortisone regimen enhance occurrence of this disease.

To investigate the correlation between severity of COVID-19 infection and occurrence of diabetes mellitus.

Research question:

1-What is severity of disease condition among patients?

2-What are stress levels among patients?

3-What are types & duration of cortisone regimen among patients?

4-1What are type 2 diabetes risk percentage among patients?

5-Is there correlation between stress and cortisone regimen and risk of diabetes among patients with COVID 19?

Subjects and Methods

Research design:

A descriptive correlational study design. It emphasizes an explanation of the relationship between and among variables. The researchers uses a correlational research design to measure two or more variables to investigate the extent to which the variables are related (**Seeram**, **2019**).

Operational definitions:

Nursing assessment; selected nursing assessment used to investigate causes of diabetes after COVID-19 infection include exposure to stress, cortisone regimen and risk of diabetes.

Study setting:

This research was done at chest department and intensive care unit at Minia Cardiothoracic University Hospital which is located in new Minia city includes three departments, the cardiac department, chest department, and cardiothoracic surgery, consists of four clinics (Chest Clinic, Open Heart Clinic, Heart Clinic, and Respiratory Function Clinic).

Subjects of study:

A purposive sampling method for data collection was used. This formula was used to determine the sample size: $n=z^2 P (1-P)/d^2$ **(Daniel, 1999).** With a 95% confidence interval (CI), 50% response distribution, and 0.05 margin of error, a sample of 401 patients was considered. But because convenience sampling has its limitations, we strengthened our sample by adding a design effect (DE) factor to the equation. Previous research have shown that a DE of 2 is the minimum acceptable DE for purposive sampled studies. Consequently, a minimum sample size adjustment of 802 (401×2) participants was taken **(Wejnert et al., 2012).**

Inclusion criteria:

1. Adult male and female.
2. Hospitalized patients' typical COVID-19 symptoms and diagnosed by at least one of the following features like polymerase chain reaction (PCR) and typical lung CT-scan lesions.

Exclusion criteria:

1. Patient receive cortisone medication for long time before COVID -19.
2. Patient suffer from diabetes mellitus before COVID -19.

Data collection tools

Two scales and two tools were used to collect data for this current study.

Tool 1: Structured interview questionnaire. It was developed by the researchers after revising extensive literature review to assess the bio socio-demographic and medical characteristics. It was gathered during the initial interview and is divided into three parts:

Part one: The patient's bio sociodemographic information, including their age, gender, place of residence, and marital status etc. …...

Part two: The medical information data such as (frequency of occurrence COVID-19 infection, when does blood sugar level rise, BMI).

Part three: Laboratory investigation record and cortisone therapy assessment

1- Hemoglobin (HbA1c test) It determines the blood sugar average over the last three months. It is one of the often used tests to identify if patient risk of diabetes when a patient is admitted, measured one time in this study.

Fasting blood glucose testing All COVID-19 patients are required to undergo daily monitoring for these items by hospital regulation. Calculate the mean of the results for each weak after daily measurements for three weak

2- **Cortisone therapy assessment** frequency of different medication prescribed by doctors (Methylprednisolone, prednisone, dexamethasone and hydrocortisone therapy**).** Measured patients' duration using of cortisone medication and classified into less than 7 day, from 8 day to 14 days and more than 14 days.

Scale 1: Ordinal Scale for Clinical Improvement.

This scale adopted from World Health Organization **(WHO, 2019).** This classification is used to measure severity of clinical outcomes for COVID -19 patients. It contain five category (uninfected, ambulatory, and hospitalized with mild disease, hospitalized with severe disease and dead).

Scoring system

Scale categorized from 0 (No clinical or virological evidence of infection) to 8 (Death). When patient assessment indicates zero scores meant there is uninfected, while if patient is ambulatory will take 1 score if no limitation of activities and 2 score if there is limitation of activities, hospitalized patients with mild disease have score 3 that indicates a patient need hospitalization without oxygen therapy while score 4 refers to mild disease and need oxygen mask or nasal. prongs while hospitalized with severe disease take score 5 and this means that patient with Non-invasive ventilation or high-flow oxygen but if patient condition worsted he need Intubation and mechanical ventilation and take score 6 if this not enough for patient he need ventilation + additional organ support- vasopressors, Renal Replacement Therapy, Extracorporeal membrane oxygenation in this case take score 7 but when eight scores this mean there is patient have is dead.

Tool II: Type 2 diabetes risk form

The Finnish Diabetes Risk Score (FINDRISC score form) adoption of these questionnaire by **(Tuomilehto & Lindstrom, 2003).** is an eight-item questionnaire that may be completed in one page without the need for any invasive diagnostic test Age, body mass index (BMI), waist circumference, physical activity, daily fruit and vegetable consumption, usage of antihypertensive medication, history of high blood glucose, and family history of diabetes were all taken into account in the FINDRISC model.

The score values were assigned to each response, and the overall FINDRISC was calculated as the total of those values. Age (4 items) scored as zero if patient is (less than 45yrs) to four (over 64yrs). Body Mass Index (BMI) (3 items) scored as zero (less than25 Kg/m^2) to 3 (higher than 30Kg/ m^2), waist circumference (3 items) scored as zero (men less than 94cm / women less than 80cm) to 4 (men less than 102cm / women less than 88cm), degree of physical activity (2 items) scored zero (no) to 2 (yes), consumption of fruits and vegetables (2 items) scored as zero (every day) to 1 (not every day), use of blood pressure medication (2 items) scored zero (no) to 2 (yes), high blood glucose during disease or pregnancy (2 items) scored 0 (No) to 5 (yes), family history of diabetes (2 items) scored zero (no) to 5 (yes parent, sister, brother and own child) were all questioned in the survey. The questionnaire was filled in by the researchers, there are multiple answer choice scales for each item, followed by the measurement of participants' Fasting blood glucose, height, weight and waist circumference.

Scoring system

Respondents could receive 0 to 26 points on the questionnaire. Diabetes risk is indicated by a score between 0 and 6, with scores between 7 and 11 indicating a slightly elevated risk, 12 to 14 indicating a moderate risk, 15-20 indicating a high risk, and >20 indicating a very high risk..

Scale 2: Perceived Stress Scale (PSS) This scale measured to all patient at admission to hospital. The scale was first created by **Cohen et al. in 1983**. It was developed to assess the degree of stress people felt in unpredictable, out-of-control, and overloaded situations. The original version of the PPS had 14 items (PSS-14). The positivity subscale (items renumber 1, 2, 3, 8, 11, 12, and 14) and the negativity subscale are both included in the full 14-item Perceived Stress Scale (includes items number items 4, 5, 6, 7, 9, 10, and 13).

Scoring system: On a five-point scale, from 0 (never) to 4, participants are asked to rate how frequently they encountered stressful events in the previous month (very often). The positive items are reverse-coded, and the scores for each item are added to determine the PSS overall score.

The range of total scores is 0 to 40. A higher score suggests that you are under more stress.

- ► Scores between 0 and 13 are regarded as low stress.
- ► Scores ranging from 14-26 it considered moderate stress.
- ► Scores between 14 and 26 are regarded as moderate stress..

Study Procedure (Field work)

Field work or procedure included three phases' preparatory, implementation, and evaluation

Preparatory phase

Books, periodicals, and the internet were combed through to find the latest, most relevant research on the study problem from around the world. COVID-19 patients were utilized to evaluate the infrastructure of the proposed study. Prototype test. Additionally, the pilot study's purpose is to assess the feasibility and usefulness of implementing research instruments into hospital practice in order to include patients who were initially excluded from the study population. It was completed in March 2021 to assess the tools' utility, clarity, and comprehensiveness. After getting ethical approval and permission to access the setting zones, a pilot study was conducted on 10%, or 8 patients, of all participating participants in order to test and evaluate the applicability of the instruments that were used in the study. These subjects were included in the research sample without any modifications being made. The nursing faculty's ethics committee gave its approval. Patients provided oral consent, the investigator secured approval from the head of the chest department at Minia University and the intensive care unit should patients' condition worsen to transfer to it, and participants were informed of their right to withdraw at any time and the confidentiality of their data.

Constant validity, the tools were evaluated for content validity by a jury of three experts from Minia University in the fields of medical surgical, community health nursing, and psychiatric nursing. The jury looked at the tools' content coverage, clarity, wording length, format, and overall appearance. All jury members concur that the existing study tools were legitimate and pertinent to the study's objectives based on their recommendation.

Reliability of tools

The internal consistency of the questionnaire was assessed using the Cronbach's alpha coefficient. A Cronbach's alpha score of 0.00 indicates there is no dependability, whereas a coefficient of 1.00 indicates perfect reliability. However, a reliability coefficient of 0.70 is acceptable. Cronbach's alpha was used to examine the dependability of each tool, and the results are displayed in the table (A).

Table (A): Cronbach's alpha for each Scale:

Tool title	Cronbach's Alpha
Scale 1: Ordinal Scale for Clinical Improvement.	0.90
Scale 2: Perceived Stress Scale (PSS)	0.85
Questionnaire1: Type 2 diabetes risk form	0.77

Implementation phase

Researchers started assembling study proposals. The study was carried out after patients were admitted to the chest department and, if necessary, transferred to the intensive care unit if their condition worsened. The researcher described the study's objectives to the participant groups, outlining any potential advantages and drawbacks of participating. Data collection was completed over a period of 6 months starting from April 2021 to October 2021. Data collection by the researchers has begun utilizing two tools, two scales, and one questionnaire. (Bio socio-demographic characteristics. Lab through face-to-face interview, first, a routine hospital patient who had at least one of the following traits and typical COVID-19 symptoms (RT-PCR, typical lung CT-scan lesions).

The researchers assess fasting blood glucose daily by Oncall Plus apparatus for all patient as hospital routine with continuous monitoring and consultation from hospital doctors, the first measurement at patients admission, the researchers calculate means of fasting blood glucose three times at admission as base data, through first weak and before discharge for all patients a mostly stay in hospital from 3 to4 weeks.

The researchers assess cortisone medication (types and duration) prescribed by doctors (Methylprednisolone, prednisone, and dexamethasone and hydrocortisone therapy) and duration of uses of this medication prescribed from less than 7 day and more than 14 day as variable can effect on diabetes occurrence

Identifying that patient's high risk to diabetes mellitus by tool II, the data collected by researchers and followed by measuring patient fasting blood glucose, height, weight and waist circumference. The standing height and weight were calculated to the nearest 0.1 cm and 0.1 kg, respectively. Weight per square meter (kg/m2) was used to compute the body mass index (BMI). To the nearest 0.1 cm, the waist circumference (WC) was measured using a non-stretchable tape measure at the point where the lowest rib and iliac crest, meet the final score was the sum of the weighted values given to the answers to all eight questions, which ranged in value from 0 to 26.. All patients had their hemoglobin A1C levels checked right away upon admission to determine whether or not they had prediabetes, in order to confirm that they did. Ask the patients if they can afford the expense of the hemoglobin A1C investigation, and if not, the researchers should cover it.

Classify severity degree of COVID 19 infection by scale 1. The 1st measurement occurs immediately on admission, the 2nd after one weak and 3 $^{rd.}$ measurement after 3 or 4 weeks at discharge. The last scale measured stress degree for all patient immediately at admission

All researchers who interface directly with patients start their work by washing their hands. After making contact with patients, they put on personal protection clothing, such as masks, work caps, shoe covers, and long sleeved work gear. Masks should be replaced every four hours, and work clothes, such as shirts and caps, should be changed daily. Remember to replace them as soon as possible if there is pollution or humidity.

Evaluation phase

The researchers used two scale and two tool to assess the cause of diabetes after COVID -19 infection.

Statistical analysis of data

Descriptive statistics, including frequency distribution, percentages, averages, and standard deviations as a measure of dispersion, were used to summarize, tabulate, and present the data. For the statistical analysis of the data, a statistical package for the social sciences (SPSS), version (20), which includes the test of significance described in traditional statistical texts, was employed. The mean and SD were used to express numerical data. To determine whether there was a relationship between two qualitative variables or a difference between two or more proportions, the chi square test was utilized. The interrelationships between the quantitative variables were evaluated using Pearson correlation analysis. Statistical significance was defined as a p value of 0.05 or less.

Result

Table (1) shows that, 68.1% of study sample are male and 40.0% of study sample their age ranged from 31-<50 years with mean age 37.1±12.1 years, 68.3% among them are married, additionally 48.6% of the study sample cannot read and write. Moreover, 58.3% of study sample are live in urban areas.

Table (2) illustrates that 67.7 of sample have first time of infection with COVID-19 and 39.9% of the sample their blood sugar rise within 48 to 72 hours of infection with COVID-19, but 8.3% of sample their blood sugar rise after one month. Regarding their body mass index reveals that 40.5% of study sample are overweight, and 23.4% of sample are suffer from obesity.

Table (3) indicates on admission 31.4%, of study sample are hospitalized with mild disease and take oxygen by mask while 29.3% of patients are intubated. While after one week of hospitalization 28.3% of patients have mild disease and take oxygen by mask, and 12.4% of sample are hospitalized with severe disease and are ventilated also use additional support. Compared to after three weeks after hospitalization 30.1% of study sample are take oxygen by mask, and 12.4% of sample are hospitalized with severe disease and are ventilated also use additional support.

Figure 1 shows that 31.3% of study sample have low risk for type 2 diabetes mellitus, 34.0% of study sample have moderate risk, 7.5% of sample have high risk and 13.9% of study sample have very high risk for type 2 diabetes.

Figure 2 shows that 47% of sample suffer from severe stress, 30.1% suffer from moderate stress and 22.9% of sample suffer from low stress.

Table (4) indicates on admission 87.5 %, of study sample are normal blood sugar level, but 12.5% of them suffer from prediabetes. While 50.6% of sample suffer from diabetes after one week from admission and 55.8 become diabetic after three week. the mean scores of fasting blood sugar is 83.9±13.5 on admission, 163.3±89.4 and after one week and 212.1±153.7 after three week that there are statistically significance differences among blood sugar level, on admission, follow up and after recovery

Table (5) indicates on admission 87.4 %, of study sample are normal HBA1c but 12.6% of sample are pre diabetes HBA1c with mean 5.27±0.314.

Figure 3 shows that 87.4% of study sample are normal blood sugar level, but 12.6% of study sample are prediabetes. Mean±SD is 5.27±0.314

Figure 4 shows that 47% of study sample take methylprednisolone therapy, 24.6% of sample use prednisone, 13.5% of sample take dexamethasone and 12.9% of study sample take hydrocortisone therapy.

Figure 5 shows that 52.2% of study sample use cortisone therapy < 7 days, 30.3% of sample use cortisone therapy > 14 days but 22.5% of study sample use cortisone therapy ≤8 to ≤14 days.

Table 6 shows there are highly statistically significant relationship between diabetes incidence after COVID 19 infection and risk of diabetes, stress level, duration of cortisone use, and severity of COVID 19 Infection at P value=.001 and 0.002.

Table (1): Frequency and percentage Distribution of study sample's Demographic characteristic, (n=802).

Variables	N	%
Gender		
-Male	546	68.1
-Female	256	31.9
Age		
-18-<30	250	31.1
-31-<50	321	40.0
-51-64	231	28.9
Mean ± SD	37.1±12.1	
Marital status		
-Married	542	68.3
-Divorced	7	8.2
-Single	253	31.5
Education		
- cannot read and write	390	48.6
- Read and write	244	30.4
- Diploma	102	12.7
- University	66	8.3
Residence		
-Rural	335	41.7
-Urban	467	58.3

Table (2): Frequency and percentage Distribution of Study Sample's Current Health Status about COVID 19 (n=802).

Variables	N	%
Frequency of occurrence COVID-19 infection		
- First time of infection	543	67.7
- Second time of infection	233	29
- More than 2 time of infection	26	3.2
Time of rising blood sugar level		
- Within 48 to 72 hours of infection with COVID-19	317	39.5
- From 7-day to15 days after infection with COVID-19	299	37.4
- From 15 day to 21 day	119	14.8
- More than month	67	8.3
-Body mass index		
- Normal BMI = 18.5-24.9 kg/M	289	36.0
- Overweight BMI = 25.0-29.9 kg/M	325	40.5
- Obesity BMI = 30.0-39.9 kg/M	188	23.4
- **Mean ± SD: 24.25 ± 3.1**		

Table (3): Frequency and percentage Distribution of study Sample according to Severity of COVID-19 virus level (n=802).

Severity Level	On admission	After one week	After four weeks	Chi (P-value)
	N (%)	N (%)	N (%)	
-Uninfected	0	0	0	
-Ambulatory	0	0	0	
Hospitalized mild disease				
-No O_2	252 (31.4)	242(30.1)	242(30.1)	36.657 (0.001)**
-O_2 by mask	217 (27.0)	227(28.3)	218 (27.1)	
Hospitalized sever disease				
-No invasive ventilation	99 (12.3)	119(14.3)	111(13.8)	
-Intubation-or mechanical ventilation	234 (29.3)	150(18.7)	158(19.7)	
-Ventilation and additional organ support	0(00.0)	100 (12.4)	100(12.4)	
Dead	0	00	0	

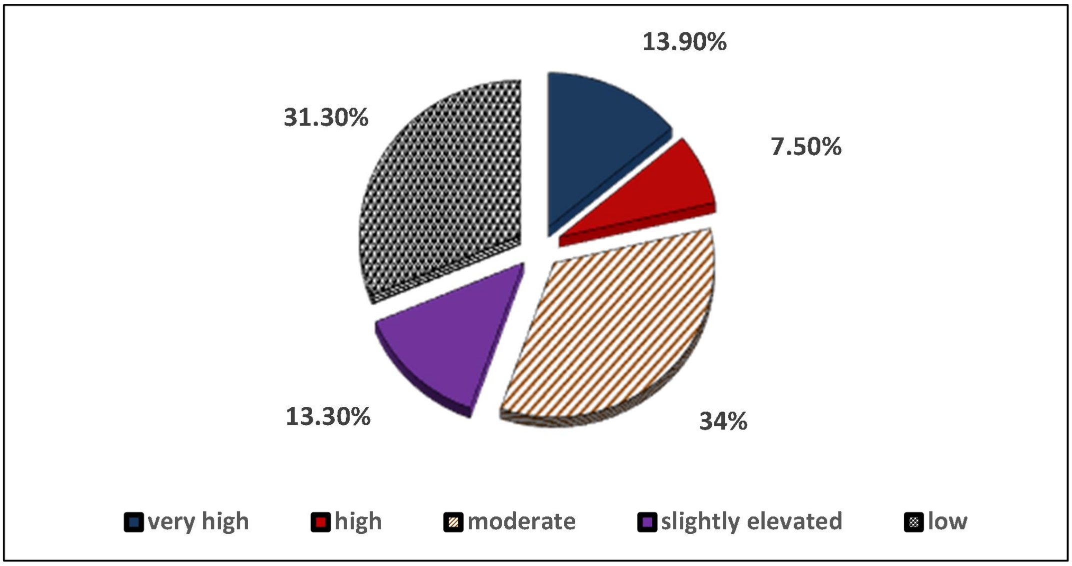

Figure (1): Frequency and Percentage Distribution of Study Sample according to Type 2 Diabetes Risk (n=802).

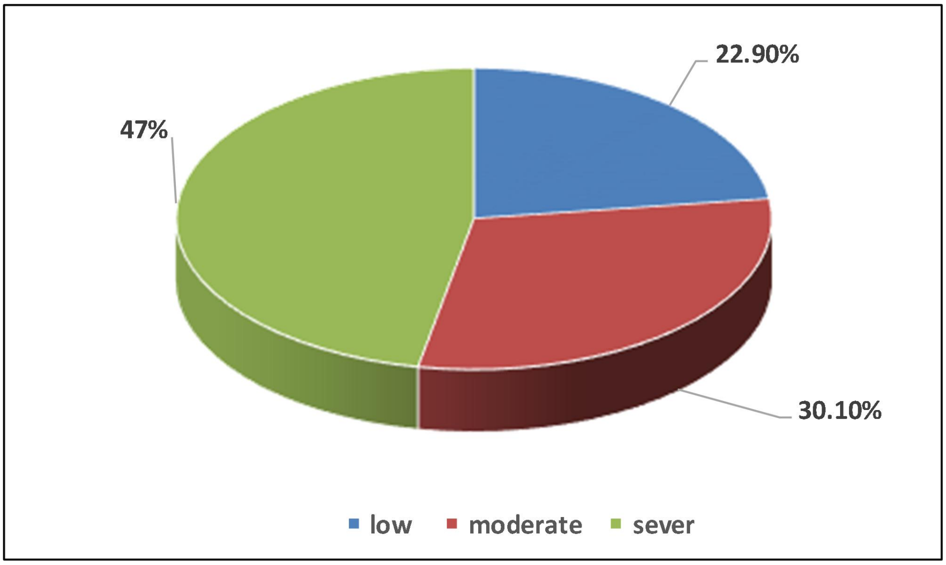

Figure (2): Frequency and Percentage Distribution of Study Sample according to Perceived Stress Level (n=802)

Table (4): Frequency and Percentage Distribution of Study Sample according to Blood analysis Fasting Blood Glucose (n=802)

	On admission		One week from admission		Before discharge		Chi	P value
	N	%	N	%	N	%		
Fasting blood glucose(mg/dl)							132.088	0.000**
Normal less than 100 mg/dl	702	87.5	296	36.9	255	31.7		
Prediabetes from 100 to 125 mg/dL	100	12.5	100	12.5	100	12.5		
Diabetic 126 mg/dL (7 mmol/L) or higher	0	00.0	406	50.6	447	55.8		
Mean ± SD Fasting blood glucose(mg/dl	83.9±13.5		163.3±89.4		212.1±153.7			

Table (5): Frequency and percentage Distribution of study Sample according to Blood analysis (HBa1c) (n=802)

HBA1c	On admission	
	N	%
-Normal (less than 5.7%)	702	87.4
-Prediabetes (5.7%-6.4)	100	12.6
-Diabetes (6.5% and more)	0	00.0
Mean ± SD	5.27±0.314	

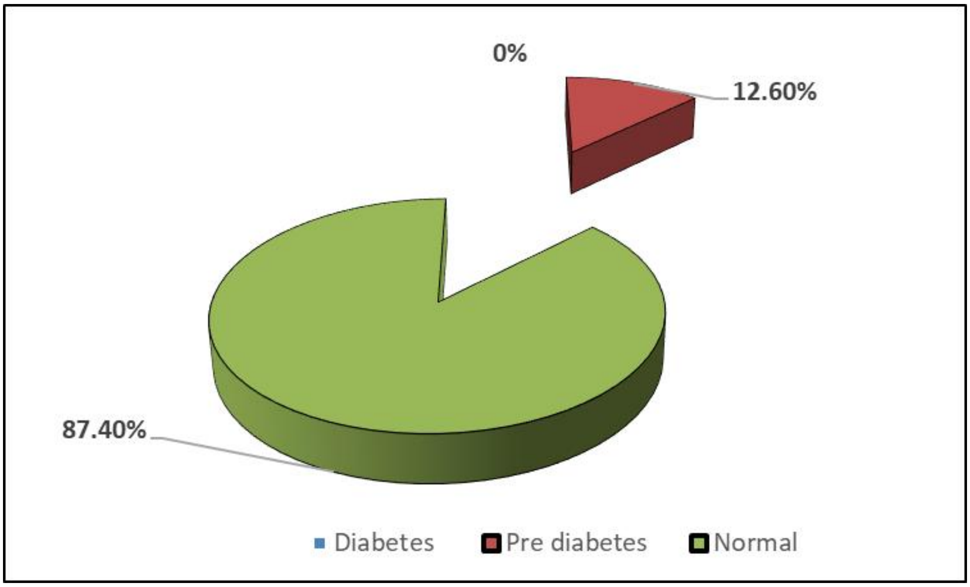

Figure (3): Frequency and Percentage Distribution of study Sample according to Blood analysis (HBa1c) on admission (n=802).

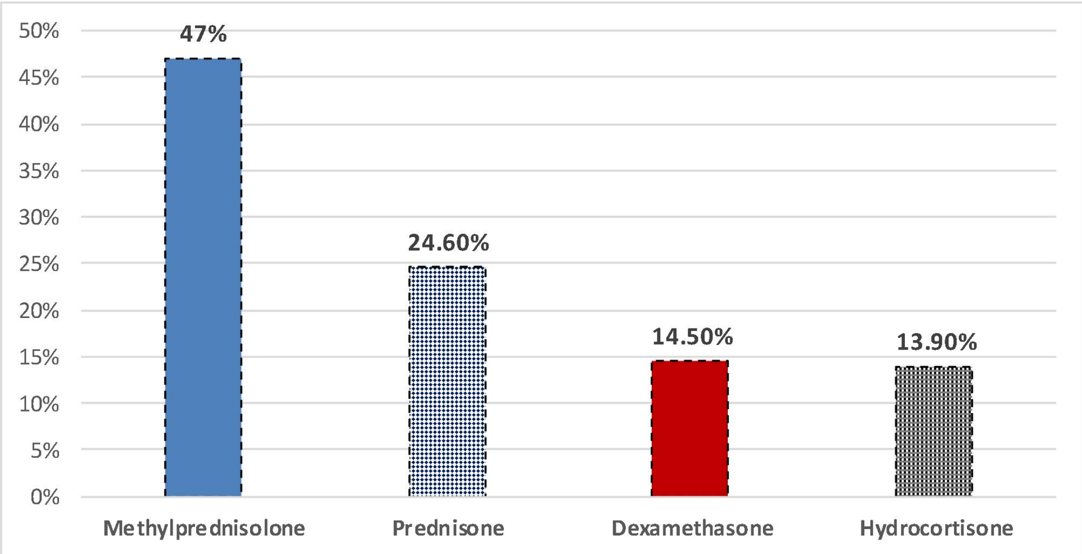

Figure (4): Frequency and Percentage Distribution of Study Sample According to Types of Initial Cortisone therapy 19 (n=802).

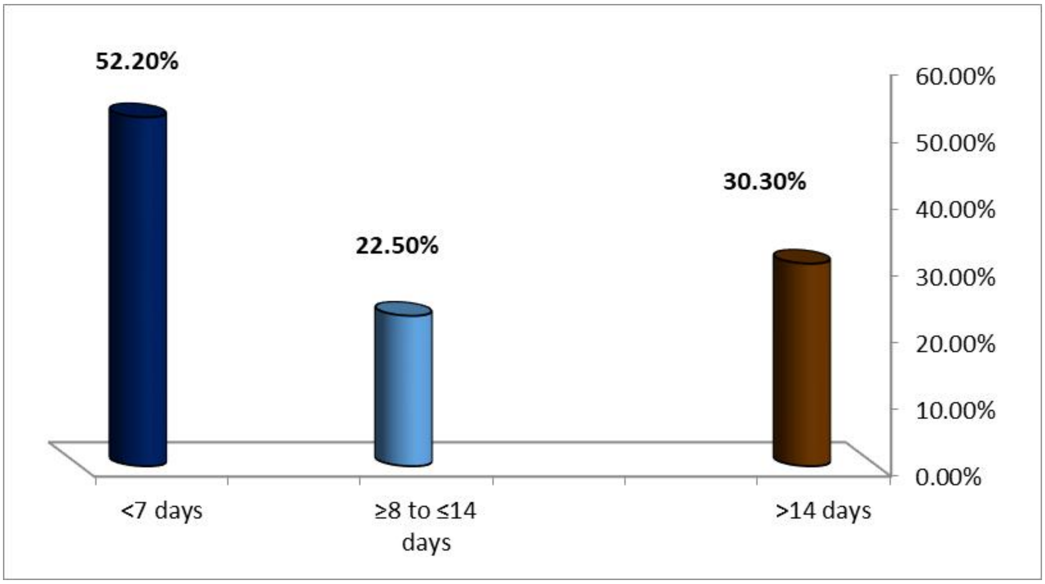

Figure (5): Frequency and Percentage Distribution of Study Sample According to Duration of Initial Cortisone therapy (n=802).

Table (6): Correlations between Diabetes Incidences after COVID 19 Infection and Risk of diabetes, Stress level, Duration of Cortisone use and Severity of infection (n=802).

Items	Diabetes incidences after COVID 19 Infection	
	R	P
Risk of Diabetes	**0.920****	**0.001**
Stress level	**0.740****	**0.001**
Duration of Cortisone	**0.874****	**0.001**
Severity of COVID 19 Infection	**0.913****	**0.002**

NS= not significant * p = ≤.05 (statistical significance) ** p = ≤.01 (highly statistical significance).

Discussion

Diabetes mellitus and COVID-19 are intricately intertwined. On the one hand, COVID-19 with a severe course is thought to be most likely to develop in people with diabetes mellitus as one of the major risk factors. The use of steroids to treat a severe COVID-19 infection can have a particularly harmful impact on diabetes, aggravating hyperglycemia by lowering b-cell secretory activity and increasing insulin resistance (**Landstra and de Koning**, **2021**). The current study therefore sought to explore the association between risk of diabetes mellitus, stress, and cortisone regimen among patients suffering from COVID-19.

Present study sample with COVID -19 revealed that more than half of them are male and just one-third are female. This is because women in Upper Egypt tend to stay at home. More than half of them live in urban and are married but near half of them are illiterate with a mean age of 37.1 ± 12.1 years. The results of **Getu Melesie et al.,(2020)**, were consistent with the demographics of the current study. They reported that the mean age of the study respondents was 44.6± 9.84 years and that 235 (55.6%) of them were male.

This finding is compatible with **Almalki., (2021),** who found that the average age was 35.35 years. The majority of participants (n = 408) were married (408; 68.3%), male (414; 69.3%), Saudi (534; 89.4%), and from urban regions (350; 58.6%). In addition, According to **Kasemy et al. (2020)**, stated that 52.2% of the study's participants were female and 47.8% were men. Participants who lived in rural areas made up 48.8%. Basic education made up 36.9% of the total educational level, while postgraduate education made up 2.3%. The participants who were not employed made up the majority of the population (61.1%), and around 41.1% of them said their income was insufficient**.**

This contradicts the findings of **Schilling et al study's from 2021**, which discovered that women made up 52% of the population and that the median age of the 2.4 million patients with COVID -19 in Germany from January 2020 to February 2021 was 44 years old, 10% of these 2.4 million persons were hospitalized, which is higher than the DA's figure and most likely results from emergency hospitalizations not being recorded in practices, the most common reason for missing data.

Finally, the present study corresponding in point and opposed of another with result of **Hussein, (2021).** The socio-demographic characteristics of the respondents, almost two-thirds (61.6%) were females and married (68.8%). Approximately half of the participants (41.7%) were of age 30–39 years old and (46.6%) were working. More than half of the participants were of middle socioeconomic status (57.5%), (58.9%) urban residents and (71%) had university graduates.

As regards to the increasing in blood glucose level after being infected with COVID -19 the findings revealed that more than one third of the sample their blood glucose rises within 48 to 72 hours of infection with COVID-19. This elevation in blood sugar level in COVID-19 patient may be due to administered high dose of cortisone medications beside the COVID-19 evoke stress related disease. The non-diabetic COVID-19 patients who had raised blood glucose levels at the time of diagnosis had a higher chance of dying, longer hospital stays, and a need for mechanical ventilation, according to **Haymana et al. (2021).** On the other hand, there was no direct connection between diagnosis-related glucose levels and hospitalization.

In this regard, **Rathmann et al. (2022)** established that people with COVID-19 demonstrated a higher risk of type 2 diabetes compared to acute upper respiratory infection (15.8 vs 12.3 per 1000 person-years). The findings of **Xie and Al-Aly (2022),** who proposed that COVID-19 individuals may experience a range of post-acute sequelae, including diabetes, following exposure to the SARS-CoV-2 virus, were supported by their findings. The post-acute phase of diabetes, however, still lacks a comprehensive description of the risks and costs involved.

According to severity of COVID 19 the current study result found that the one third of patients are hospitalized with mild disease and take oxygen by mask at admission while another third of them was intubated and ventilated. after one and two week of hospitalization, near one third of patients was taken oxygen by mask, and less than one third of sample are hospitalized with severe disease and are ventilated, also use additional support. In my opinion the percent of severity lead to increase period of cortisone medication and stress exposure, all of this factors increase incidence of diabetes.

According to this systematic review, 4.9% of all COVID cases in China were rated as serious and 17.8% were classified as severe. According to study conducted in Europe from 22 March to 3 June 2020, 10.4% (269/2579 cases) of the study sample were categorized as severe-to-critical patients **(Lechien et al,.2021)**. In the Silicon Valley region of the United States, a total of 41 individuals (4.9%) had severe or critical illnesses, according to **Vaughan et al 2021. Additionally**, COVID-19 severity in Egypt was discovered to be 51.6%, according to **Azab et al 2021**. **Huh et al**. reported 11.96% of cases in South Korea to be serious (2020).

The current study demonstrated that nearly to half of patients suffer from severe stress, less than third of studied patients suffer from moderate stress and the remaining of sample had low stress. This result could be attributed to fear from disease deterioration, isolation to treat pandemic disease, high mortality rates among COVID -19 patients and may be related to the finding that almost of studied sample lived in urban areas where life is filled with multiple stressors. Another justification is the strong link between respiratory virus infections and subsequent mood problems such depression and post-traumatic stress disorders. PTSD is a stress-related psychological ailment that develops right away after a trauma, therefore that is another factor. Another multifactor is included, too. Age, comorbidities, the worry that family members will become infected, a lack of access to social media, and inaccurate information about COVID-19 may all contribute to the development of psychiatric illnesses in patients. Clinicians should be aware of the elevated likelihood of PTSD among COVID-19 patients as a result. Mental health interventions protocol should be provided to support the mental health problems of patients.

The present study finding was in harmony with previous research which reported that among the study participants, more than half of sample suffer from stress during the pandemic and it seems to be increasing day by day **(Lakhan et al., 2020).** In a further study, **Zandifar, et al. (2020)** examined the prevalence and severity of depression, anxiety, stress, and perceived stress in hospitalized COVID-19 patients. The results showed that the majority of patients (97.1%) experienced some level of stress, 84.9% of patients fell into the category of having severe and very severe stress. Only one-quarter of patients reported moderate levels of stress, while nearly three-quarters reported high levels of perceived stress. **Arafa**, **et al**., **study's** (**2021**) indicated a high prevalence of stress, with scores of 48.8%, mild to moderate 33.8%, and severe to very severe 15.0% among their respondents.

Despite the fact that this might be explained by differences in the length of the epidemic and the assessment of the existence of PTSD, it is also possible that the lower death rate (2–5%) in COVID-19 patients may have had an effect on the prevalence of PTSD in COVID-19 patients **(Pormohammad et al., 2020). Ettman et al. 2020** recruited 1441 participants to study patients with COVID-19 and discovered that 27.8% of them showed symptoms of depression, compared to 8.5% prior to COVID-19.

Related to duration of administration of cortisone therapy the finding shows that half of study sample use cortisone therapy < 7 days, one third of sample use cortisone therapy > 14 days but near third of study sample use cortisone therapy ≤8 to ≤14 days. According to **Haymana et al. (2021)**, this result can be linked to inflammation that may occur throughout the course of COVID-19 disease or hyperglycemia that might develop as a result of therapeutic use, such as steroid therapy. Additionally, the first analysis of the effect of hyperglycemia on hospitalization rates was made possible by the use of glucose levels at the time of diagnosis.

According to blood glucose investigation the mean scores of fasting blood sugar was 83.9±13.5 on admission while in follow up it was 163.3 ± 89.4 and after recovery it was 212.1±153.7 with highly statistical difference among them. This confirms the fact that one of the side effect for cortisone medication was elevation of blood sugar especially with high dose. Numerous studies have demonstrated that diabetes mellitus, especially type 2 diabetes mellitus, is one of the most prevalent comorbidities among COVID-19 patients (**Sonmez et al ., 2021; Satman, et al ., 2021; Sun et al ., 2021**). According to some recent studies, the glycaemia levels at the time of hospital admission had a detrimental impact on the prognosis of COVID-19 disease in non-diabetic patients **(Bode et al., 2020; Zhang et al., 2020; Carrasco et al., 2021; Wang et al., 2020; Sardu et al., (2020).** However, these results were unaffected by glucose levels between 100 and 139 mg/dl **(Haymana et al., 2021)**.

As regard pre diabetic risks of COVID-19 patients, the current result showed that one third of study sample had low risk for type 2 diabetes, and another one third had moderate risk while less than one quarter of study sample had very high risk for type 2 diabetes. Our result might resulting from dose of cortisone and the stress evokes form disease beside social isolation and economic burden. This finding was supported by **Xie & Al-Aly (2022),** who said that the influence of risk factors such age, race, cardiovascular diseases, hypertension, hyperlipidemia, and prediabetes status might be estimated (HbA1c >5•6% and 6•4%), and BMI categories on diabetes outcomes within 30-day survivors of COVID-19.

Numerous studies showed that there were a significant difference between the incidence of diabetes following COVID 19 infection and the risk of diabetes, stress level, and duration of cortisone treatment (P value =.001). According to research from the United States, Italy, Spain, and China, patients who had on-admission hyperglycemia but no prior diagnosis of diabetes mellitus were more likely to need to be admitted to the intensive care unit (ICU) and required mechanical ventilation **(Bode et al., 2020 & Carrasco-Sánchez et al., 2021).**

Ahmed et al. (2016) provided evidence that stressful situations might have an impact on diabetes. Many medical specialists think that stress-related hormonal changes or increases are the cause of diabetes. Stressors that last a long time have a negative impact on blood sugar levels. According to scientific research, physical or mental stress can increase blood glucose levels or lead to the formation of type 2 diabetes.

The primary care findings are consistent with a retrospective cohort examination of COVID-19 hospitalized patients in the UK, which included individuals with more serious illnesses, greater viral loads, and higher immune activation. The incidence of new-onset diabetes was 29 (95% CI 26, 32) per 1000 person-years in the 47,780, COVID -19 patients (mean age 65; 55% men), giving them a rate ratio of 1.5 (95% CI 1.4, 1.6) as compared to matched controls from the general population **(Ayoubkhani et al., 2021).**

Conclusion:

Based on the results of the present study we can concluded that:

After one week of infection with COVID-19, half of the patients developed type 2 diabetes mellitus, with their patients experiencing extreme stress and requiring seven days of methylprednisolone medication. One-third of the patients had a severe COVID-19 infection at the start of the study but this infection subsided to a mild illness. The development of diabetes after COVID-19 infection was found to be correlated with diabetes risk, stress level, length of cortisone administration, and severity of the COVID-19 infection.

Recommendations:

The researchers come up with the following recommendations for Patients :

- To raise public knowledge of COVID-19 and protect COVID-19 patients from hyperglycemia complications caused by COVID, educational programs should be designed and implemented in various care settings. These materials should include books, brochures, and films.
- All COVID-19 patients should be recommended to acquire continuous glucose monitoring or to self-monitor their blood sugar levels frequently. The goal of continued monitoring is to identify pre-diabetic patients early and reduce their risk of acquiring diabetes.

For chest department and nurses :

- Nurses and department supervisors must use advanced guidelines for caring for COVID-19 through monitoring and prevent complications that occurred from pandemic infection based on evidence-based practices.
- Create programmed that department supervisors will teach about the significance of patient safety precautions and other cutting-edge concerns for COVID-19 patients' complications.

For further researches :

- It is the need of the hour to preserve the mental health of individuals and develop appropriate psychological strategies, techniques and interventions that can improve the mental health of vulnerable groups during the pandemic. In addition to using psycho-social coping techniques, these techniques can improve a person's quality of life, overall health, and well-being.
- Follow-up studies will be required to explore hyperglycemia observed in COVID-19 and determine the possible development of new-onset diabetes.

Limitation of study

- The potentiality for infection when working with COVID-19 patients puts researchers under more strain.
- The cost of providing hemoglobin A1C to patients who are unable to afford it, in addition to the protective clothing that researchers must wear while gathering data and providing care for patients, places a financial strain on the researchers.
- Gathering data in severe cases and the largest sample needs more effort from researchers and patients.

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