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Clinical screening on nondiabetic vaccinated against COVID-19 patients and blood glucose dysregulation levels associated with sars-cov-2 in the post-pandemic period

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Abstract

Glucose dysregulation in COVID-19 disease has been described in several. Genetic recombination in the viral genome during their replication may be the key role for evolution of viral diseases not yet known. Comparisons between comorbidity patient group and the non-comorbidity patient groups was evaluate to diabetes mellitus (DM) through blood glucose levels collected. This is a retrospective epidemiology study involving patients categorized into three groups according to admission Blood Glucose (BG) levels: < 70 mg/dL; 77 – 90 mg/dL; < 99 mg/dL collected in 2022y. New insulin therapy or increased dosing from baseline had not been considered. The main of this study is to detect the presence of glucose levels in the post-pandemic period, as diabetic people have a higher risk of develop severe illness from COVID-19. From January 2022 to December 2022, 11.019 patients without severe COVID-19 pneumonia were documented. Of these patients, 10004 (90.78 %) were male and 1015 (9.21%) were female. Other predictors factors to comorbidity were not analyzed as pulmonary disease, hypertension, chronic kidney disease, heart failure, and liver cirrhosis. About 11.019 patients who had blood glucose samples collected, 10.004 samples were male gender corresponding to 90.78% while only 1.015 samples corresponding to 9.21% female. However, 89.69% had values within the expected range and 10.25% values above the expected, demonstrating a hyperglycemia index and only 0.054% hypoglycemia was detected in patients collected at the laboratory unit. It has been demonstrated that hyperglycemia in patients with COVID-19 is associated with a higher risk of mortality. So, our study focused on the possibility of vaccinated patients against COVID-19 showed controlled glucose blood levels. In conclusion, our study dataset was a backward-looking study which the glucose parameter listed in the electronic medical records could be analyzed as focuses the predictor factor on vaccinated patients against SARS-CoV-2

Keywords: SARS-CoV-2; COVID-19; Diabetes; Blood glucose; Risk factor

1. Introduction

The emergence and reemergence of viral diseases are complex occurring throughout novel viruses or a new variant isolated virus after the adaptation of the virus in others hosts or by the introduction of infections between several species [1]. Coronavirus disease 2019 (COVID-19) is a highly infectious illness caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) named based on phylogeny and the viral taxonomy among clusters to the prototype human and bat which started in China in late 2019 [2,3,4]. High glucose levels and glycolysis promote SARS-CoV-2 (CoV-2) replication. Thus, the enzyme mitochondrial ROS/hypoxia-inducible factor-1a dependent pathway

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(mtROS/HIF-1a) is necessary for CoV-2 replication and cytokine production in monocytes [5]. And diabetes are among the main risk factors for severe COVID-19 symptoms [6]. The virus infects peripheral blood monocytes and enhances the expression of angiotensin-converting enzyme 2 (ACE2) [5].

It has been reported that hyperglycemia in COVID-19 patients is associated with a higher risk of in-hospital mortality regardless prior history or presence of diabetes [8]. Elevated glucose levels resulted in increased viral load for CoV2, IAV, and RSV [5]. Glucose dysregulation or dysglycaemia in COVID-19 disease involves both hyperglycemia and hypoglycemia and has been described in studies primarily from China and Europe [7]. Hyperglycaemia may contribute to development of cytokine storm by promoting proinflammatory glycosylation [8]. SARS-CoV-2-Induced Metabolic Reprogramming of Monocytes Directly Affects T Cell Response and Lung Epithelial Cell Death. Retrospective cohort study involved 16 scientific papers at China was applied to Meta-analysis showing demographics data prevalence of various comorbidity associated with hospitalized COVID-19 patients [9].

Prevalence and association of hyperglycaemia and diabetes with the risk of death h in hospitalized COVID-19 patients [9], and hyperglycaemia as a predictor of mortality in patients hospitalized with COVID-19 regardless of diabetes status [10]. Our objective was to identify prevalence of hyperglycaemia and hypoglycemia in COVID-19 vaccinated patients according glucose blood levels in the post-pandemic period.

2. Material and method

This was a retrospective observational study conducted at All Lab. We obtained clinical and outcome data were obtained from electronic medical records of the lab. The data set was divided into control glucose and uncontrolled groups according references values. The hexokinase enzymatic method is the reference method for determining blood glucose in serum or plasma. Sample involves the separation of the fluid part (serum) from the formed elements (red blood cells, leukocytes and other cells) and is carried out immediately, so that there is no consumption of this analyte. Adenosine triphosphate promotes the phosphorylation of glucose in a reaction catalyzed by hexokinase (HK), according to the following chemical reaction:

$$\text{Glucose} + \text{ATP} \xrightarrow{\text{HK}} \text{Glucose-6-phosphate} + \text{ADP}$$

$$\text{Glucose-6-Phosphate} + \text{ADP} \xrightarrow{\text{G-6-PDH}} \text{6-phosphoglucanato} + \text{NADH}$$

Hexokinase is an enzyme that catalyzes the transfer of phosphate from ATP to glucose. The chemical reaction catalyzed by the enzyme glucose 6-phosphate dehydrogenase (G-6-PDH) has high specificity for glucose 6 phosphate and therefore other hexoses or phosphorylated pentose esters do not participate in the reaction.

3. Results

3.1 Baseline characteristics

From January 2022 to December 2022, 11.019 patients without severe COVID-19 pneumonia were documented. Of these patients, 10.004 (90.78 %) were male and 1015 (9.21%) were female. Other predictors factors to comorbidity were not analyzed as pulmonary disease, hypertension, chronic kidney disease, heart failure, and liver cirrhosis.

Normal glucose values follow reference standards between 70 and 99 mg/dL. All changed results are confirmed by repetition sample, as reference internal quality control. Therefore, lower values are suggestive of hypoglycemia and higher values are indicative of pre-diabetes. Results are shown as means (standard deviation, SD) or medians.

The samples collected from female and male investigated to glucose blood serum showed for all patients with an average proportional of 0.2264±0.3053 (CV = 0.2904) detected in the 2022 years. The findings are displayed in table 1 and figure 1 below.

Table 1 Analysis of means, standard deviation and coefficient of variation of glucose blood serum in patients collected in the 2022 y

Months	Female	Male	Patients
Medium	84.58333333	833.6666667	918.25
SD	19.15230028	254.576773	266.7184845
CV	0.226431136	0.30536998	0.290463909

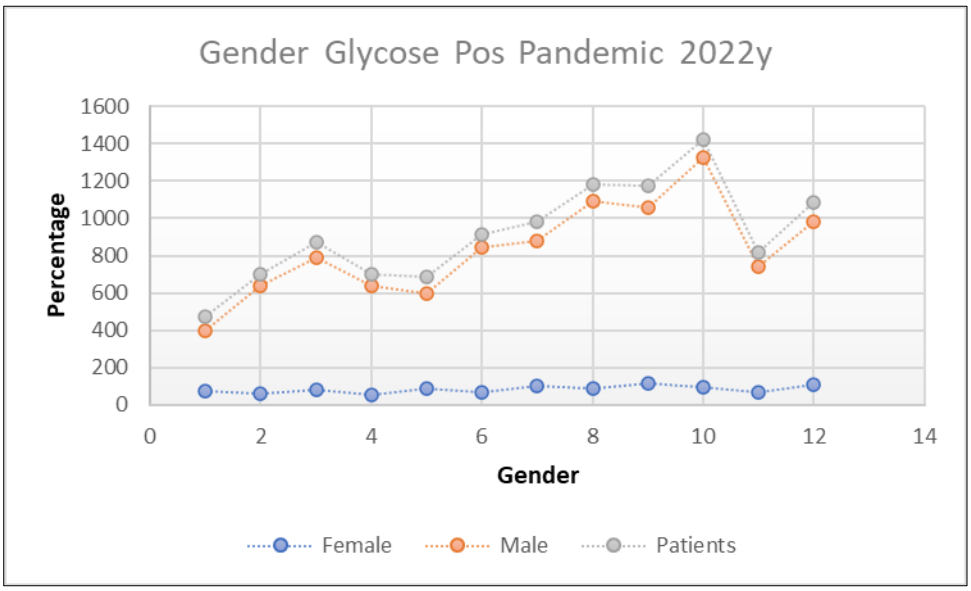

Figure 1 Glucose blood serum samples collected pos pandemic period among female and male investigated in the 2022 year

Table 2 Percentage of glucose collected from patients' gender among months/ 2022 year

Months	Female (%)	Male (%)	Patients
January	15.25	84.74	472
February	8.94	91.05	704
March	9.58	90.41	876
April	8.15	91.84	699
May	13.04	86.95	690
June	7.34	92.65	912
July	10.39	89.60	981
August	7.37	92.62	1.179
September	10.11	89.88	1.177
October	6.73	93.26	1425
November	8.71	91.28	815
December	9.82	90.17	1089
Total	9.21	90.78	11.019

About 11.019 patients who had blood glucose samples collected, 10.004 samples were male gender corresponding to 90.78% while only 1.015 samples corresponding to 9.21% female. The findings are displayed in table 2.

Table 3 Percentage of expected range for glucose blood samples collected from patients among months/2022 year

Months	values below the expected range (%)	values within the expected range (%)	values above the expected range (%)	Patients
January	0	86.86	13.13	472
February	0	85.93	14.06	704
March	0	90.63	7.18	876
April	0	89.98	10.01	699
May	0	87.53	12.46	690
June	0.10	92.10	7.78	912
July	0.10	92.04	7.84	981
August	0.16	84.05	15.77	1.179
September	0	93.79	6.20	1.177
October	0	95.01	4.98	1.425
November	0	86.74	13.25	815
December	0.18	86.50	13.31	1.089
Total	0.054	89.69	10.25	11.019

About 11.019 patients were analyzed in 2022y, in which the most prevalent month was October with 1.425 collection visits followed by 1.177 in September for post-pandemic glucose research. However, 89.69% had values within the expected range and 10.25% values above the expected, demonstrating a hyperglycemia index and only 0.054% hypoglycemia was detected in patients collected at the laboratory unit (table 3).

Table 4 Analysis of means, standard deviation and coefficient of variation of glucose blood serum collected from patients in the 2022y

Months	values below the expected range	values within the expected range	values above the expected range	Patients
Medium	0.5	823.5833333	94.16666667	918.25
SD	0.797724035	257.2545462	36.78150062	266.7184845
CV	1.59544807	0.312400482	0.390940928	0.290463909

In the 2022y, glucose blood samples were collected with an average proportional of 0.5± 0.79 (CV = 1.59) for values below the expected range characterized as hypoglycemia; an average proportional of 823.58±257.25 (CV = 0.31) for values within the expected range characterized as normal glucose index and an average proportional of 94.16±36.78 (CV = 0.39) for values above the expected range characterized as hyperglycemia. These findings had been demonstrated in table 4 and figure 2 below indicating the references values.

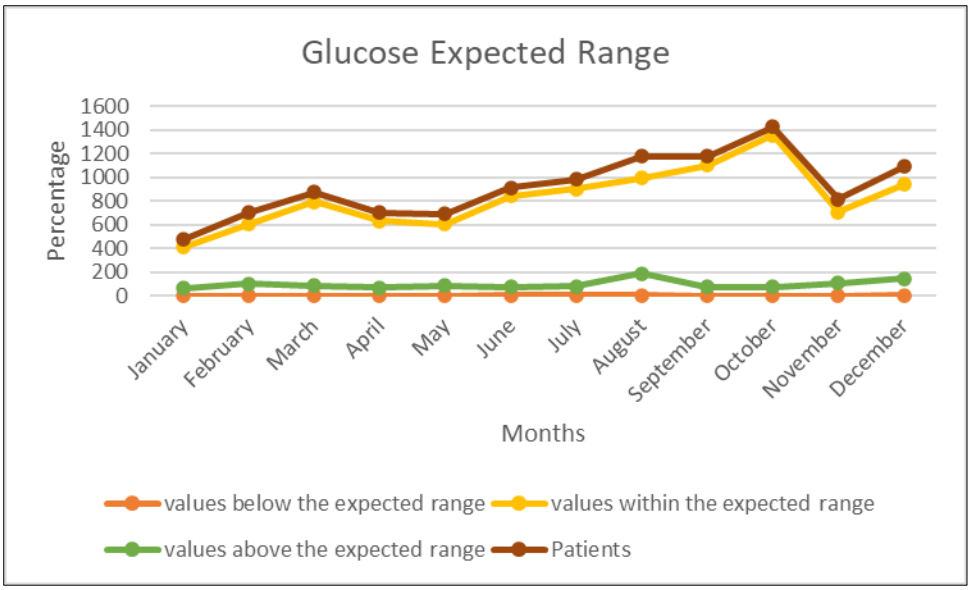

Figure 2 Reference values of glucose blood samples collected from patients in the 2022 y

4. Discussion

It has been demonstrated that hyperglycemia in patients with COVID-19 is associated with a higher risk of mortality. So, our study focused on the possibility of vaccinated patients against COVID-19 showed controlled glucose blood levels. This is a retrospective epidemiology study involving patients categorized into three groups according to admission Blood Glucose (BG) levels: < 70 mg/dL; 77 – 90 mg/dL; < 99 mg/dL collected in 2022y. Therefore, lower values are suggestive of hypoglycemia and higher values are indicative of pre-diabetes. According Nandy et al., 2020, the presence of Diabetes mellitus (DM) has a significant impact on mortality rate in COVID-19 patients. Some studies had demonstrated that COVID-19 affects endocrine system causing glucose dysregulation mainly in approximately 50% of those who are hospitalized with COVID-19 [7]. And the emergence and reemergence of viral diseases may be accompanied for the genomic and epidemiology surveillance to mitigate any risk of propagation of the novel possible variant viral [11].

5. Conclusions

In conclusion, our study dataset was a backward-looking study which the glucose parameter listed in the electronic medical records could be analyzed as focuses the predictor factor on vaccinated patients against SARS-CoV-2. Therefore, further studies are needed to better be understanding of measurement in diabetic patients at high risk for COVID-19. New insulin therapy or increased dosing from baseline had not been considered. Genomic tools as Next Generation Sequencing (NGS) for the characterization of viral samples and in genetic engineering for the development of vaccines had been advanced molecular studies during SARS-CoV-2 pandemic.

Ethical considerations

All research was performed in accordance with the relevant guidelines and regulations. This study had no risk/negative consequence on those who participated in the blood collection. Data was accessed from January, 2022, to December, 2022, and access to the collected information was limited to the principal investigator and confidentiality was maintained throughout the project.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

Ethical clearance was obtained from the ethical review committee of Department of Sciences Medicine University in accordance with ethical principles for the guidance of physicians in medical research.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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