



## **Outcome of COVID-19: Diabetes and Obesity**

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### **Author's contribution**

*The sole author designed, analysed, interpreted and prepared the manuscript.*

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## **ABSTRACT**

Today the world is facing one of the biggest crisis, due to a new beta-corona virus emerged from Wuhan in China, on December 2019. WHO declared 'acute respiratory syndrome COVID-19 (SARS Co-2)' as a pandemic on March 12, 2020. Corona viruses are enveloped positive single stranded RNA viruses, causing severe acute respiratory syndrome in the infected individuals. The risk of getting infected by covid-19 is similar in all the individuals across the nation. But the outcome of the infection varies from one individual to another, depending on the comorbidities present in them. The most vulnerable group of patients in respect to severity of outcome of the infection are the once with unbalanced health conditions like age (>65 years), immune-compromised, hypertension, type 2 diabetes, increased insulin resistance, cardiovascular diseases, chronic kidney disease, chronic liver disease, vasculitis (vascular inflammation) and obesity. It is now a public knowledge that diabetes and obesity are a risk factor for any individual as these conditions can exacerbate the manifestations of COVID-19 infections thus increasing the severity of the condition, that may require hospitalization of the patient, later may even require intensive care unit or/and mechanical ventilation, with increased risk of mortality rates. In diabetic patients it is mainly due to failure in controlling the glucose levels and the risk of ketoacidosis. In patients with obesity lipid peroxidase creates reactive lipid aldehydes leading to poor prognosis.

**Keywords:** COVID-19; pandemic; diabetes; obesity; outcome.

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## 1. INTRODUCTION

The spread of COVID-19 is still a nightmare for many of the governments and health associated faculties as it is spreading like the fire across the world, and the vaccine is yet to be formulated [1].

The number of confirmed cases around the world on 11 January 2021 was 90,879,255 and in India were 10,473,696 [2].

With a high prevalence of diabetes and obesity in the population of our nation, it is important to have the knowledge of how COVID-19 is effecting the individuals associated with these conditions. According to the International diabetes foundation, 463 million people are diagnosed with diabetes. Out of which India has reported 77 million diabetics. This makes us the second leading country for the diabetes and China leading the list with over 116 million diabetics. In the ninth addition of International diabetes foundation, the given estimation is that just over 134 million Indians will be diabetic in the next 25 years [3].

**Obesity:** Globally, more than 1.9 billion adults are overweight and 650 million are obese. Out of which India accounts for more than 135 million obese individuals. Approximately 2.8 million deaths are reported as a result of being overweight or obese:

- Today there are more children under the age of 5 years born with overweight in ratio to the once born with under-weight.
- According to recent studies in 2016, 39% of the children around the age of 18 years were overweight and 13% were obese. Diagnosis of overweight or obesity is done by using the simplest formula to calculate BMI is:  $\text{weight (in kg) / height}^2 \text{ (in m)}$ .

If the BMI is ranging between 18 to 25 – indicates average weight

If the BMI is greater than or equal to 25 and less than 30

If the BMI is greater than or equal to 30 – indicates obese.

Furthermore, obesity is susceptible to many viral infections. Most of the Researches have concluded that a lot of viruses utilize fatty tissue as a reservoir, this include adenovirus, influenza A virus, Human Immunodeficiency virus (HIV), and now COVID-19 is add to this list.

The Centers for Disease Control and Prevention (CDC), advise the elderly (above 65 years), as well as the individuals of any age who are suffering from serious underlying medical conditions, including obesity (BMI greater than or equal to 30 )and diabetes mellitus, to avoid public gathering and far more better if they don't go out of their houses or not to come in contact with the individuals at risk of transmitting the infection to them, as this will reduce the chances of exposure to the least. These precautions are to be taken with at most care as this category of individuals is at a higher risk for complications and increased severity of the COVID-19 infection and its manifestations. There is also suggestive information from the researches that risk of mortality rate in this category of patients is observed to be increased by ten folds when infected by the Corona virus. When infected by COVID-19, Mortality rate in young patients with severe respiratory manifestations was approximately 2%, but in patients with the obesity and diabetes and metabolic syndromes have increased to 14% [4].

The High risk Category for severe complications due to COVID-19 infection:

- of age  $\geq 75$  years
- body mass index (BMI) more than or equal to 30
- heart failure

Knowing about these risk factors associations has become more important, as the people of our country have a high ratio of diabetic and obese individual and many are unaware of the fact that it could be a very serious comorbid condition not only for COVID-19 but also predisposing factor for many other complication. As of now ratio of number of people getting infected by COVID-19 to the number of beds available for admissions in the hospitals all over the nation is very less this makes it more important to educate ourselves about the vulnerability we are living in [5].

## 2. SYMPTOMATOLOGY OF COVID-19

The symptoms caused by this virus are usually mild and begin gradually. The following are common manifestations seen in the population:

- fever,
- dry cough,
- tiredness
- include aches and pains,

- difficulty in breathing
- headache
- sore throat,
- loss of taste or smell [6]

According to the researchers of Wuhan 90% of the population who were affected previously, months later after the recovery still show damaged state of lung. This suggests that the perfusion and ventilation rate of the patients is damaged; therefore their gas exchange mechanism is also deteriorated. Examinations done on the recovered patients – show a decrease in efficiency of lung in comparison to healthy individuals.

### 3. PATHOPHYSIOLOGY

Role of ACE-2 in Diabetes and Obesity:

- Corona virus: utilizes ACE-2 as receptor to gain entry into macrophages and small percent of other cells. (ACE-2 is seen in large number of cells in our body)
- Corona virus consists of S-glycoprotein on its outer surface which binds to ACE-2. This leads to configuration changes

causing proteolysis by host cell proteases (TMPRSS2 and Furin). This allows the virus to enter the host cell.

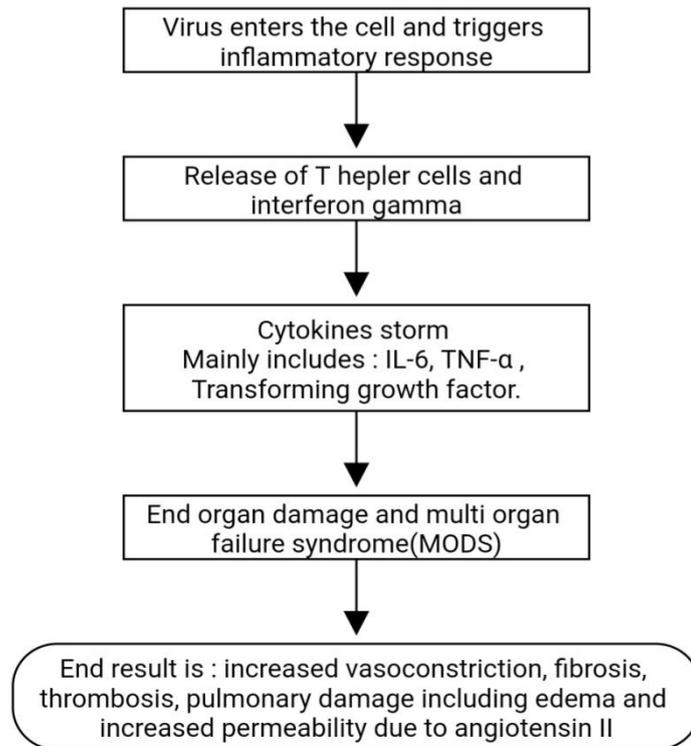
#### 3.1 Diabetes

It has been observed that the diabetic patients who are infected with Corona virus have increased levels of furin (type-1 membrane-bound protease). The function of furin is to cleave the inactive proteins released in our body, this leads to activation of the protein.

#### 3.2 Obesity

Some researchers suggest that adipokines are cytokines secreted by the adipose tissue. One such adipokine is Serum amyloid-A, this can act directly on macrophages and lead to cytokine storm. If the release of these substances persist for long it causes increased severity of the infection. The ratio of these adipokine produced when increased, shows evidences of increased insulin resistance in type 2 diabetic patients.

After the entry of the virus into the cell the following occurs:



This leads to POOR PROGNOSIS of the infection [7].

Measures in Patients of diabetes with COVID 19 infection:

- a) In case a person with diabetes exhibits any of the above given symptoms, and then they must be taken for a COVID-19 (RT-PCR) test immediately.
- b) The person with positive COVID test reports are to be isolated for 14 days or till the symptoms resolve (whichever is longer) and the guidelines issued by governments of one's own country should be followed.
- c) Majority of patients have a mild disease and can be managed at home (HOME QUARANTINE). Hydration should be maintained and symptomatic treatment with acetaminophen, steam inhalation etc. can be given.
- d) Patients with type 1 diabetes should measure blood glucose and urinary ketones regularly. This is to prevent further complications and helps in treating the condition in earlier stages.
- e) Oral anti-diabetic drugs can be taken but Hypoglycemia should be avoided along with frequent monitoring of blood glucose [8].

How does COVID-19 affect the blood glucose level?:

- In the patients with infection of COVID-19 has been observed that there is hyperglycemia without pre-existing diabetes. This is explained as a possibility due to expression of ACE-2 on the pancreatic islets.
- Role of anti-diabetic drugs: Some studies show that Thiazolidinediones (TZD), anti-hypertensives and statins: increasing the ACE-2 expression in liver tissues. Therefore. Many of the researches have suggested to stop the use of these drugs.
- Role of Dipeptidyl peptidase-4 (DPP4) enzyme and its inhibitors: DPP4 is involved in many functions such as: control of the activity of growth factors, chemokines, bioactive peptides and T-cell activation. One of its main functions is regulating glucose metabolism. Some of the experimental studies have suggested that certain polymorphisms of DPP-4 are associated with reduced chance of MERS-CoV infection. This might explain the

absence of MERS-CoV cases in Africa, despite the presence of virus in camels [9].

Obese pregnancy in Relation to COVID-19

Women who were overweight or obese before pregnancy (pre pregnancy) and pregnant women who are obese when infected with COVID-19 have increased risk of severity of the disease progression and the rate of death. The present data shows that the category of pregnant women who are at highest mortality risk are the once in second and third trimester with an underlying co-morbid condition such as cardiopulmonary involvement, therefore COVID-19 can be dangerous both to the mother as well as the babies health. These conditions can even lead to preterm birth or fetal death. It has been noted that there is been a drastic fall in the CD4<sup>+</sup> T-cell count in the maternal mother when infected with the virus. The fetus of the infected mother can also suffer from a negative impact on the innate immunity in early part of life, this occurs due to the release of pro inflammatory cytokines from placental cells during the pregnancy. Placenta secretes leptin in large amounts when the mother is infected this interferes with the uterine contractility which leads to prolonged labor, therefore leading to high incidence of cesarean sections. In the early stages of pregnancy COVID-19 is not permeable and therefore no risk of transmission to the fetus, but in the later stages of pregnancy leads to immune-suppression – with increased phagocytes, increased activity of NK and T cells, inhibition of TH1 responses, this causes destruction of immune complex which results in increased membrane permeability to COVID-19 making the fetus vulnerable to the infection [10].

### 3.3 Controlling Glucose Levels

Controlling the blood glucose levels if not only important for the patients who are infected by COVID-19 but also for an individual who is suffering from diabetes mellitus or have risk for developing diabetes in the future:

- Sodium-glucose co-transporter-2 (SGLT2) inhibitors are suggested to be stopped due to its properties that can lead to increased changes dehydration and ketosis.
- METFORMIN: Patients presenting with vomiting or poor oral intake are suggested to stop the use of Metformin.

- INSULIN is the ideal drug in many of the cases. Given intravenously with frequent monitoring of blood glucose levels.
- Insulin analogues such as subcutaneous short acting insulin can be used in mild to moderate ill patients.
- ACE (Angiotensin converting enzyme) inhibitors and ARB (Angiotensin receptor blockers) were suggested to be helpful in reduction of the risk of endotracheal incubators and death. Where as a research from the Wuhan have suggested that using Ace inhibitors and ARBs for treating the patients with diabetes leads to complications and worsens the patient's condition. But due to the lack of evidence in favor of benefit or harm, some associations suggested that patients can continue to use these drugs [11].
- Calcium Channel Blockers (CCB): There were researches done on the effect of CCBs in pneumonia patients which suggests that it decreases the severity of the courses of the disease. But there are not many clear researches on the effect of CCB in COVID patients. On the other hand some researcher says that it is a preferable drug to use as it does not increase the ACE2 expression (mainly in the patients with hypertension).
- Statins: Till date researches have suggested that statins are protective against pneumonia. Statins have been recognized to increase the levels of ACE-2, but it role in the susceptibility to COVID-19 infection is still unclear. Nevertheless, these drugs are to inhibit the cytokines storm which will prevent the worsening of the disease [12].

The pandemic has effected different population in different aspects; out of this the most neglected is the mental health of the population. Even though there are lot of medical practitioner trying to warn the people about COVI-19 in such a manner that is knowledgeable of the dangerous aspects of it but also assuring the people that it is not that hard to combat the pandemic. Even after these efforts of the government through news media and other flat forms in the country people are still undergoing a mental breakdown – due to fear of contamination and social distancing and on the other hand a lot of them are affected by the down fall of the economy. Disasters like these traumatize the society, even more when the outcome is

destructive. The pandemic is more a danger and a reason for panic to the most governments and the people all around the world as the date to the end of it is still uncertain. Another reason is that the communities/countries which used to support each other in the past are now competing for the resources to cope with their own crisis. [13]. Studies on different aspects of comorbidities like diabetes mellitus were reported [14-17]. Afaque reported on association and treatment of diabetes in patients affected by COVID-19 [18]. Similar studies on Covid and diabetes were reported [19-21].

It has been noticed in history that human beings are very bad in coping up with sudden changes in their life, and this pandemic has turned everyone's life's upside down - unemployment, home-schooling for children, and staying isolated and not getting in contact with friends and colleagues.

It has been a great deal of change for the government and the world health organization itself, they have done their best in giving their end of support to the healthcare workers, COVID positive isolated patients , and the general public. The commonest psychiatric diseases that are seen in the nation well as all over the world are: substance abuse, depression, anxiety and sleep disorders. These problems are observed to be exacerbated during the time of pandemics [22-24], and there are studies saying that these are going to worsen in the Post-Pandemic period. The most important thing every person has to remember is that the infected individuals are not to be marginalized. They need us the most at this stage of their life. Many of the patients get depressed due to the fact that their own family and friends are treating them in an unacceptable manner. Now many researches are suggesting that the psychiatric facilities should be increased to meet the needs of the out numbering population affected by this pandemic [25-26].

As a clinician in the time of pandemics you should be available to a patient to talk the patients about their mental health and assure them there going to be taken care of, when you feel like your patients is suffering from some kind of depression or problems always contact a psychiatrist as there are the only ones who could diagnose there condition and treat them adequately. This will decrease the burden on the patient himself and the clinician; this could even lead a better outcome of recover due to the reduced mental stress [27-28].

#### 4. CONCLUSION

It very important to maintain a healthy and a balanced life for better future and to reduce the risk of comorbidities, this is not only for diabetic or an obese patient but for every individual aspiring for a healthy lifestyle. Physical exercise is the most important step to take not only to keep the physical health on track but to keep your mental peace from the stress caused by staying home all day. It also helps in keeping the blood pressure and the glucose levels controlled. Keep yourself hydrated. Monitor blood pressure and decrease consumption of excessive salt, this has to be continued on long-term basis especially in hypertensive patients maintaining their blood pressure. Reduce consumption of high energy food: as this is most important causes of obesity followed by the lack of physical activity. Obesity is a serious problem faced by many and it is mainly due to the increase intake of the food that has very high energy levels. Avoiding eating food with high carbohydrates no nutritional value at all: mainly the junk food and the fast food and it is increasing the risk of obesity to about more that 20 folds. Unhealthy and uncontrolled eating ultimately leads to immune deficiency, therefore increases the chances of more infections. Uncontrolled eating has also shown the increased insulin resistance in maximum population. Increase intake of food contains Vitamin C. This Pandemic gives you more a reason to take care of our health and strive for a better lifestyle.

#### CONSENT

It is not applicable.

#### ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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