

# Obesity as a Risk of Serious Illness in COVID-19: A Sitematic Review

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**Abstract:- Obesity is a pathological condition for the human being, it is characterized by the accumulation of fatty tissue in the body, affecting the health of the population worldwide, weakening its immune system in this way the organism becomes more vulnerable to the COVID -19. There are several implications of the pandemic on people with obesity, producing serious symptoms that require admission to intensive care areas. Objective: To carry out a systemic review on obesity as a risk of serious disease in COVID-19. Methodology: the study is developed through the bibliographic review considered as a database the main journals that have published articles related to the subject, such as: New England Journal of Medicine (NEJM), Nature, The Lancet, Scielo, Redalyc, Elsevier, PubMed, the same ones that are consulted through academic search engines. Using the following keywords: obesity / obesity, COVID-19, complications / complications, serious illness Results: The intended results are related to recognizing obesity as a risk of serious disease for COVID-19, in such a way that that the relationship that exists between this described fact can be identified by identifying the role of the weight condition against the virus, the existing risks and the complications that are mostly reported. Conclusion: people with obesity because they are a population at high risk of severe disease for covid-19 should promote protective measures to avoid contagion.**

**Keywords:- Obesity, COVID-19, Complications, Severe Disease.**

## I. INTRODUCTION

According to the World Health Organization (WHO), obesity is defined as "the abnormal or excessive accumulation of fat that can be detrimental to a person's health" (1). Considered by the WHO as the epidemic of the 21st century, obesity and overweight have reached human beings in their different stages of life, regardless of sex, ethnicity, social status and geographical location.

Statistics from the main world health governing body show a worrying increase in the number of people considered overweight or obese, since in the period between 1975 and 2016 the number of people considered obese tripled. These figures detail that around 1900 million cases correspond to adults over 18 years of age and 340 million cases to children and adolescents aged between 5 and under 18 years (1).

Risk factors are classified as primary and secondary. Major risk factors are those that have been proven to play a role in the risk of a disease, while secondary risk factors are those that increase the risk of a disease. The American Heart Association (A.H.A.) and the American College of Cardiology (A.C.C.) have identified obesity as one of the main cardiovascular and metabolic risk factors with a direct impact on the life expectancy of affected individuals (2).

Obesity as a risk in people with arterial hypertension, dyslipidemias, type II diabetes mellitus, cardiovascular diseases, stroke, sleep apnea, add up to a worldwide problem due to a higher risk of morbimortality due to coronavirus (3).

Currently, an association between obesity and the COVID-19 pandemic has been observed. The studies developed at the beginning of the pandemic had among their objectives the identification of risk factors that could lead to more severe forms of Sars-Cov2 disease, the focus was centered on factors such as age, sex and the presence or absence of chronic diseases such as hypertension and diabetes without considering the body mass index in patients (4).

Among other mechanisms implicated in the genesis of severe disease in obese patients with COVID-19, the weakening of the intestinal microbiota has been postulated as it would be responsible for attenuating the damage resulting from infection (5) (6). In addition, recent studies try to establish the relationship between adipose tissue as a reservoir for Sars-Cov2, since the adipocyte expresses

ACE2 type receptors which are transmembrane proteins that are used by the virus as a gateway to infect cells (5,7).

The information described is of great relevance for the study, because it allows identifying that people who have received a positive COVID-19 diagnosis or have died from the disease are surely those who have presented some type of pre-existing disease and are even part of the obese population.

The main reason that promoted the development of the present study is related to obesity as a serious disease risk in patients with COVID-19, which is of great relevance and importance for the nursing discipline. The research seeks to identify some aspects of relevance such as the role of obesity against the coronavirus or SARS-CoV-2 extracting information from knowledgeable authors on the subject, also the identification of the risks to which they are exposed and the complications that have been mostly reported on obese people linked to the virus (8).

This study event is related to the search of several studies that indicate relevant information about obesity, identifying it as a broad risk factor for the presence of different chronic diseases, as is the case of diabetes, cardiovascular diseases, arterial hypertension and even different types of cancer and that at present it has demonstrated great influence in the increase of mortality in patients diagnosed with COVID - 19, due to the complications that it attracts in the process of entry of the virus in the body and the limitations that the obese patient can go through such as the dysfunction of the immune system and the decrease of the pulmonary ventilation capacity due to the excess of body fat (9).

The general objective was to perform a systemic review on obesity as a risk factor for complications to covid-19.

## II. METHODOLOGY

### Type of research

A systematic review of different bibliographies was carried out for the development of the article, to find direct relation with the described problem, and through the presentation of theoretical findings to support the main idea of the study.

### Search strategy

Since the study is developed through literature review, the main journals that have published articles related to the topic under study in both Spanish and English language have been considered as a database: New England Journal of Medicine (NEJM), The Lancet, Scielo, Redalyc, Elsevier,

and PubMed, the same that are consulted through academic search engines, for the search keywords were used according to the Decs, MESH, Boolean type connections such as AND and OR were used.

### Inclusion criteria:

The selection of articles will be carried out as follows:

- Languages: Spanish and English.
- Year of publication: 1990-2021.
- Open access original research articles.

### Exclusion criteria:

- Articles that are not from the year of publication sought will be excluded from the study.
- Bibliographic reviews that do not present a direct contribution to the development of the study.

### Procedure

In the first stage, the topic will be identified and the research questions will be formulated: "What is the role of obesity in relation to COVID-19?", "What are the risks in the evolution of patients with COVID-19 associated with obesity?", "What are the most reported complications in the evolution of obese people who develop COVID-19?".

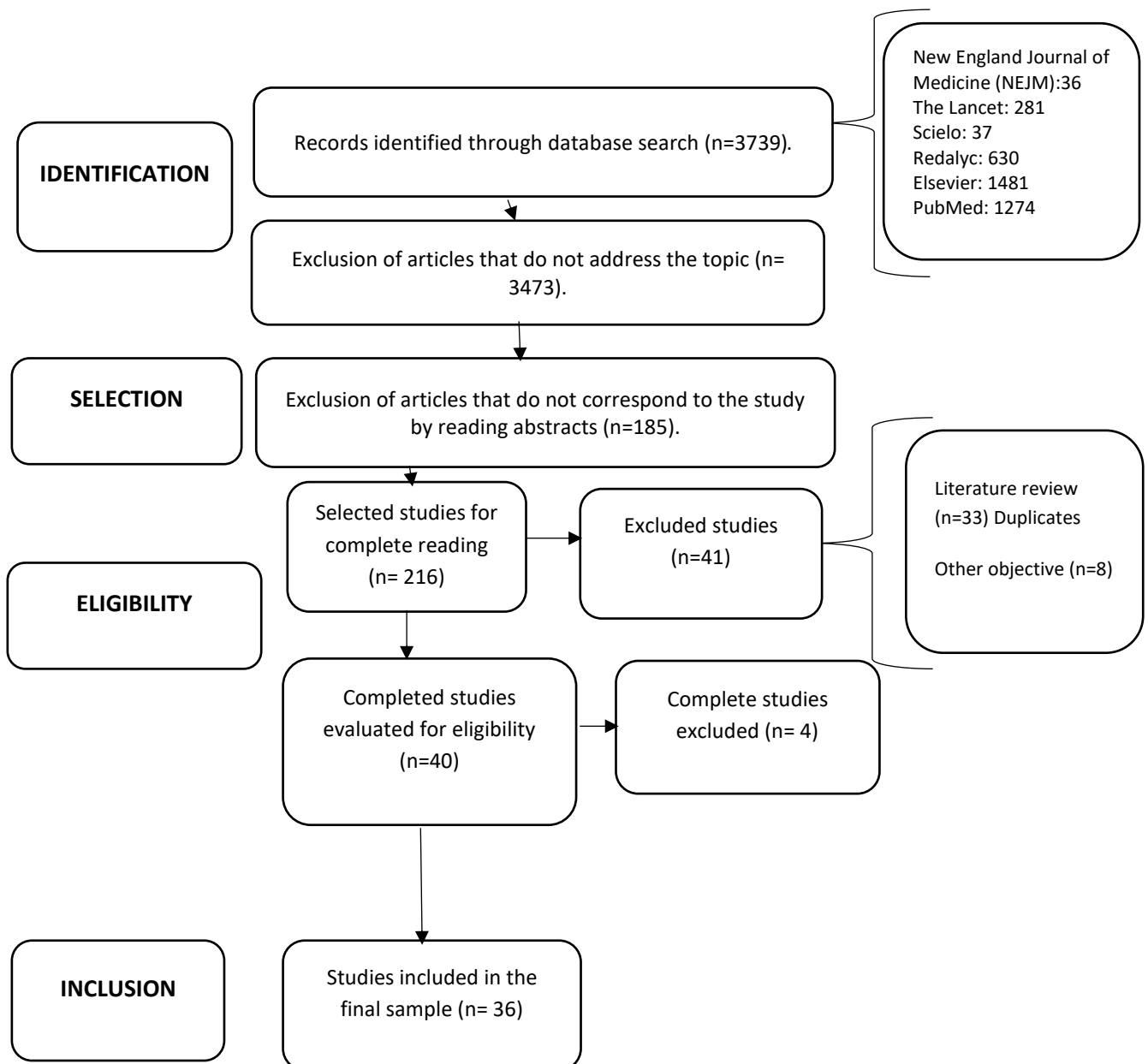
In the second stage, the inclusion criteria will be considered as articles in English, Spanish, that the year of publication is from 2018 to 2020, and that they are open access research articles; articles that are not of the year of publication sought, bibliographic reviews that do not present contribution to the development of the study will be excluded.

In the third stage, articles will be selected by reading the title and abstract.

In the fourth and fifth stages, the evaluation will be carried out according to the proposed objectives, since the sixth stage, in which the discussion has been formed, depends on this. The present systematic review will have scientific information, identifying theories and concepts of quality providing inconclusive information.

The scientific contribution of the results is focused on making known the negative influence of obesity in people in general and much more in those patients who present diagnosis of COVID -19, with the purpose of contributing with scientific evidence that allows recognizing the relationship of these conditions and the outcome to which the population with overweight and pre-existing diseases associated to this health condition is exposed, so that it is possible to promote the knowledge about this particular and adopt measures that reduce the possibility of aggravating the current condition.

**Figure 1.** Flow chart of study selection.



A systemic review of scientific articles was carried out in a total of 3739 from the different search engines in relation to obesity in COVID-19 patients, from which 3702 were excluded and 36 studies were obtained with which the present study was carried out, see Figure 1.

**III. DISCUSSION**

Obesity and coronavirus are two major diseases that are affecting the world not only in terms of health but also economically. Several studies indicate that people with obesity who contract covid-19 disease are more likely to require intensive care where the challenge for nurses is becoming increasingly greater, due to the difficulty in obtaining diagnostic images, mobilization, intubation, where obesity is a serious complication for covid-19(36) .

In a study conducted in New York involving 4,103 patients who developed COVID-19 the prevalence of obesity in hospitalized patients was 40% while in the group of non-hospitalized patients this figure was at 15%. British studies involving a population of 16,749 patients confirmed that obesity is associated with an elevated risk of dying from COVID-19 (10).

It revealed that the prevalence of obesity was higher in younger hospitalized patients. The results obtained were a prevalence of obesity of 59% in the age group 18 - 49 years, 49% in the group 50 - 64 years, 41% in the group >65 years (10).

In this regard, the Pan American Health Organization has also presented some statistics on the participation of COVID-19 related to obesity, indicating that "this risk is

particularly relevant in the United States because the prevalence of this condition is about 40%, versus a prevalence of 6.2% in China, 20% in Italy and 24% in Spain", this data can be directly related to the increase in deaths in the United States (10).

Currently, the most recent studies suggest that obese patients showed an elevated tendency to develop severe forms of coronavirus disease, which resulted in a greater need for hospitalization, admission to intensive care units (ICU), requirement of invasive mechanical ventilation and severe complications leading to death independently of other comorbidities (11).

It is important to mention that, within the present research project, it is related to certain pathologies, which nowadays, are considered as a huge problem that is directly affecting the health of human beings, in this case, reference is made to the role of obesity in front of Covid-19. In view of the above, a more concrete research will be carried out by means of theoretical literature, investigating in key sources such as books, articles and scientific journals, with the objective of obtaining more outstanding information and knowing each one of the contexts about the proposed topic.

### **Obesity**

Obesity, as has been described, is a disease of great complexity due to the intervention of multiple factors: physiological, metabolic, psychological, genetic; with profound effects on the health-disease relationship, which would favor the appearance and development of acute and chronic diseases.

The participation of obesity in acute infectious diseases would be related to alterations of the immune system that affect humoral immunity (secretion of antibodies) and cellular immunity (alteration of the leukocyte count, especially excessive proliferation of the lymphocyte line) conditioning a sustained pro-inflammatory situation that is deleterious at the moment of facing an infection (12).

The molecule responsible for this alteration in the immune response is leptin, a hormone secreted by the adipose tissue which belongs to the cytosine family (IL5, IL-6, IL-15) and which exerts its effect on specific receptors at the level of the central nervous system which are structurally similar to the receptors of the hematopoietic cytosines, which explains its immune-modulating function when the hormone-receptor interaction takes place (12).

The proposed mechanism of action of the effect of leptin on the cells of the immune system begins when this hormone exerts its effect on the receptors on the surfaces of monocytes and T-lymphocytes which induces their activation and expression of a greater number of leptin receptors (13).

As a consequence, monocytes initiate the release of pro-inflammatory cytokines (IL-1, IL-6, TNF alpha) which initiates a positive feedback loop by generating an additional

activating stimulus towards T-lymphocytes which respond by releasing new cytokines (IL-2, Interferon gamma), the latter known as Th1 response. This response known as Th1 is both immune-protective and pro-inflammatory. At this point the positive feedback loop closes when the Th1 response becomes an activating stimulus for a greater number of macrophages, perpetuating a situation that generates chronic low-grade inflammation in the obese patient (13).

At the respiratory level, obesity causes increased respiratory work due to fatty infiltration of the inspiratory muscles, increased elastic resistance of the lung and thoracic cage, possibly due to the greater thickness of the thoracic wall in the obese patient. As well as a decrease in the caliber of the airways and in the pulmonary capacity that limits the volume of air that enters the respiratory apparatus (14) (16).

All this conditions to develop a fast and superficial breathing as an adaptation mechanism to the alterations of the pulmonary physiology known as hypoventilation-obesity syndrome (14) (16).

The cardiovascular system has overweight as the main independent risk factor favoring the development of arterial hypertension, coronary disease, heart failure, arrhythmias, atrial fibrillation and sudden death. The pathophysiological mechanism involved is atherosclerosis that develops in obese patients after combining a series of alterations such as dyslipidemia, insulin resistance, endothelial dysfunction, increased sympathetic tone, chronic pro-inflammatory - prothrombotic state (15).

Obesity causes alterations in pulmonary physiology, cardiovascular and immune response that play a critical role in the course of COVID-19 infection in addition to the fact that both pathologies predispose to a pro-inflammatory state. Among the pathophysiological mechanisms involved in the progression of COVID-19 to severe disease is the vitamin D deficiency present in the obese patient which predisposes to an elevated risk of systemic infections and is detrimental to the immune system (5) (17).

Pharmacological vitamin D supplementation helps prevent respiratory infections by acting as an immune regulator by decreasing the production of pro-inflammatory cytokines by the innate immune system, reducing the risk of triggering a cytokine storm during the course of pneumonia (5) (18). Therefore, studies suggest that vitamin D deficiency may be the link between obesity and increased morbidity and mortality from COVID-19 (5) (18).

### **COVID-19**

The current Covid-19 pandemic, produced by a mutant strain of coronavirus SARS-CoV-2, has challenged humanity, generating a worldwide economic, social, and health crisis. It began in China at the end of 2019, in the city of Wuhan, where a group of 27 cases suffering from pneumonia of unknown etiology were reported, 7 of which were severe patients (19).

This virus was spreading, by January 24 in China 835 cases were reported, in Thailand on January 13 a case was reported, in South Korea on January 19 and then worldwide, declaring the World Health Organization (WHO), as a new pandemic (19).

Coronaviruses are encapsulated viruses with a diameter between 60- to 140nm, have a long-segmented RNA and belong to the family of the Coronaviridae, and the subfamily of the Coronavirinae, this is classified into four genera alpha coronavirus, beta coronavirus, delta coronavirus and gamma coronavirus (20).

#### Transmissibility.

The SARS-CoV-2 virus is highly contagious, it is rapidly transmitted from person to person through coughing by respiratory droplets, which are capable of being transmitted at a distance of 2 meters, and by close contact, mainly through the hands that carry the virus, due to the contact we maintain with the mucous membranes of the mouth, nose or eyes (21). The dissemination of the virus in the air in the form of aerosols increases the permanence affecting people at higher risk, or those who have had direct contact with infected individuals.

This new virus is stronger than other coronaviruses, since it can survive in the environment for up to 3 hours, in feces for 48 hours, but if these are diarrheic it lasts 4 days, in urine for more than 24 hours, in plastic material for 48 hours (22).

#### Pathophysiology

COVID-19 is a viral infection produced by SARS-CoV-2, which mainly affects the lower respiratory tract; in severe cases it could produce a massive systemic inflammatory response and thrombocytic phenomena in different organs (23).

SARS-CoV-2 contains about 30 000 RNA bases. It uses the densely glycosylated spike (S) protein to enter host cells and binds with high affinity to the angiotensin-converting enzyme receptor 2 (ACE2), this enzyme is expressed in alveolar type II cells. The RNA of the virus passes to the cells of the upper and lower respiratory tract, and is translated into viral proteins (23). This causes mild and asymptomatic symptoms, moderate symptoms such as dyspnea producing alveolar damage, cough, temperature of 38 degrees, severe symptoms such as hypoxia, renal failure, respiratory failure where there is the need for a mechanical ventilator that in many cases leads to death (23).

The pathophysiological mechanisms in obese patients with Covid-19 progress to negative results associated to inflammatory processes and immune response. Obesity accentuates the synthesis of pro-inflammatory cytokines such as interferon gamma (IFN-gamma) and interleukins (IL) and their reaction cascades and functionally affects the innate and humoral immune system (24). The overload of cytokines produced by viral infection added to the cytokine synthesis arising from obesity is detrimental to the lungs and

bronchi, and leads to different cardiac, renal and respiratory complications (24).

#### Incubation time

The estimated average incubation time is 3 to 6 days after contact, the appearance of dyspnea is 5 to 6 days, but the virus develops and the symptoms become more complicated until the patient needs hospitalization at 7-8 days, at the beginning the symptoms are mild, but these worsen with the appearance of hypoxia causing irreversible damage that many of them reach death (24).

For this reason, there are certain preventive measures to avoid becoming infected with Covid-19 and thus bring the pandemic to an end. The direct intervention of those international organizations and entities in charge of health, have been in charge of raising awareness worldwide to follow biosecurity and hygiene measures, mainly the correct washing of hands, the use of masks and alcohol, and the important ones, to be cautious in not touching eyes, nose and mouth with the hands without first being washed and to maintain social distancing (25).

Similarly, when treating a patient with Covid-19, health professionals or teams should enter the isolation room under the respective biosafety standards, i.e., with the use of protective goggles, biosafety suit, gloves, masks, and other supplies.

#### The role of obesity against COVID- 19

First of all, it is mentioned that there are different scientific studies that have been elaborated until nowadays, where it is mentioned that obesity plays a negative role against Covid-19 being a risk factor for the severity and mortality of patients during the disease (26).

Obesity in vulnerable patients suffering from certain chronic diseases that are not reversible, such as hypertension, renal insufficiency, diabetes could play an important role in the immune system of the host infected by SARS-CoV-2 (26). That is why, in the face of the current pandemic, health professionals have mentioned that obese patients are the most likely to reach a higher hospital risk in their health in the face of this virus.

#### Risks and complications of obese patients with Covid-19.

Obesity is associated with a low-grade pro-inflammatory state, with increased cytokines that generate a decrease in the innate and adaptive immune response. This immune condition, in people with obesity, there is greater susceptibility to infections, favoring a worsening of pulmonary involvement, and the presence of macrophages contributes to a rapid release of inflammatory cytokines that play a prominent role in the multiorgan failure associated with COVID-19 infection (27).

It is established that an obese patient basically suffers from highly respiratory alterations, due to airflow resistance, less expansion of pulmonary volume, difficulties in mobilizing the thoracic cage to such an extent that they are admitted to the ICU and become dependent on mechanical



respiratory support. However, it is emphasized that this type of patient undergoes a much more complex intubation process (27).

However, it also affects their immunity, this is due to the accumulation of adipose tissue that affects some of their micronutrient reserves. This type of affectations in their nutrients, is considered to the lack of vitamins (C, E), minerals (Zinc, Selenium) and trace elements, which would help to prevent diseases.

#### IV. CONCLUSION

In conclusion, obesity is a risk factor for serious disease in COVID-19, because it acts by decreasing the capacity of lung function and decreasing the strength of the respiratory muscles, causing major complications and often even death, for this reason people with obesity should be treated as a vulnerable population group and high risk, prevention measures should be intensified to reduce the contagion.

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