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# A REVIEW ON CRP ANALYSIS AND OBESITY INFLUENCE IN THE DISPARITY OF COVID-19 PANDEMIC

**Moussa Mohammed Elamin[1*]**

1. ***Department of Exact Sciences, Faculty of Chemistry, University of Tahri Mohamed, Bechar, Algeria.***

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**ABSTRACT**

At the current time, obesity itself can be a pandemic for many risk factors such as what is occurring in western countries were quickly comforted by the increase in the frequency of obesity, whose effects on health were soon manifested by a significant increase in cardiovascular disease in the general population. Inflammatory proteins can be classified according to their functions into different categories, although they are mainly involved in the response of the acute phase of inflammation, among which is the C-reactive protein (CRP). This study aimed to provide the effects of obesity according to the inflammatory analysis with CRP test on obese patients having a high-frequency inflammation which is one of several causes lead toward the infection and catching by Coronavirus COVID-19 disease because the influence of the obesity on the immunity system, according to sex, ethnicity, and age. We focused that obese patients must avoid any high-level CRP concentration to prevent them from any risk factors of contamination by COVID-19 pandemic.



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## Introduction

Regionally, the economic development and industrialization of Western countries were accompanied by an intense rise in the occurrence of obesity. The effects of obesity on health manifested as a significant increase in cardiovascular disease, which has become the leading cause of death in these countries [1, 2]. Some studies have even concluded that the duration of obesity is more important than its severity; several surveys indicate that excessive dietary fat intake is associated with a qualitative dietary imbalance (excess of saturated fatty acids and cholesterol, ratio of n-6 and n-3 polyunsaturated fatty acids too high) contributes to the increase in the prevalence of obesity [3, 4]. Currently, it is recognized that obesity is associated with a chronic inflammatory state characterized by abnormal production of pro-inflammatory cytokines (TNF-α and IL-6) and increased circulating levels of markers of systemic inflammation such as CRP [5]. Some authors suggest that this chronic inflammatory state could be at the root of cardiometabolic alterations such as endothelial dysfunction or insulin resistance observed in obese individuals [6]. A basic repertoire of responses to taste stimuli is in place from birth in higher mammals [7, 8].

This repertory evolves and is developed over the course of life mainly due to an automatic and unconscious mechanism of Pavlovian learning of food tastes. Through this mechanism, the sensory characteristics of the food become a complex conditional stimulus associated with the unconditioned physiological signals that are the nutritional consequences of ingesting that food. In this way, the sensory characteristics of the food act as signals that announce and predict nutritional effects. Consumer can regulate their consumption based on this prediction. In obese people, these mechanisms do not seem to be disturbed. Only a marked taste for dietary fat appears in the obese subject [9, 10].

The current coronavirus pandemic (COVID-19) is a public health crisis that has resulted in widespread pneumonia infection. CT scans are crucial in determining the severity of the condition. Other indicators of the entry of lungs disorder disease in the severity of the current pandemic include other sensitive elements. C-reactive protein (CRP) levels can be used to diagnose pneumonia early on, and patients with severe pneumonia have elevated CRP levels **(Figure 1)** [11-14].

C reactive protein (CRP) overexpression was found during the SARS outbreak in 2002, and it was linked to respiratory dysfunctions and patient death. However, the papers' findings remained conflicting [15, 16].

**Corresponding Author:** Moussa Mohammed Elamin; Department of Exact Sciences, Faculty of Chemistry, University of Tahri Mohamed, Bechar, Algeria. E-mail: moussa.mohammed@univ-bechar.dz.

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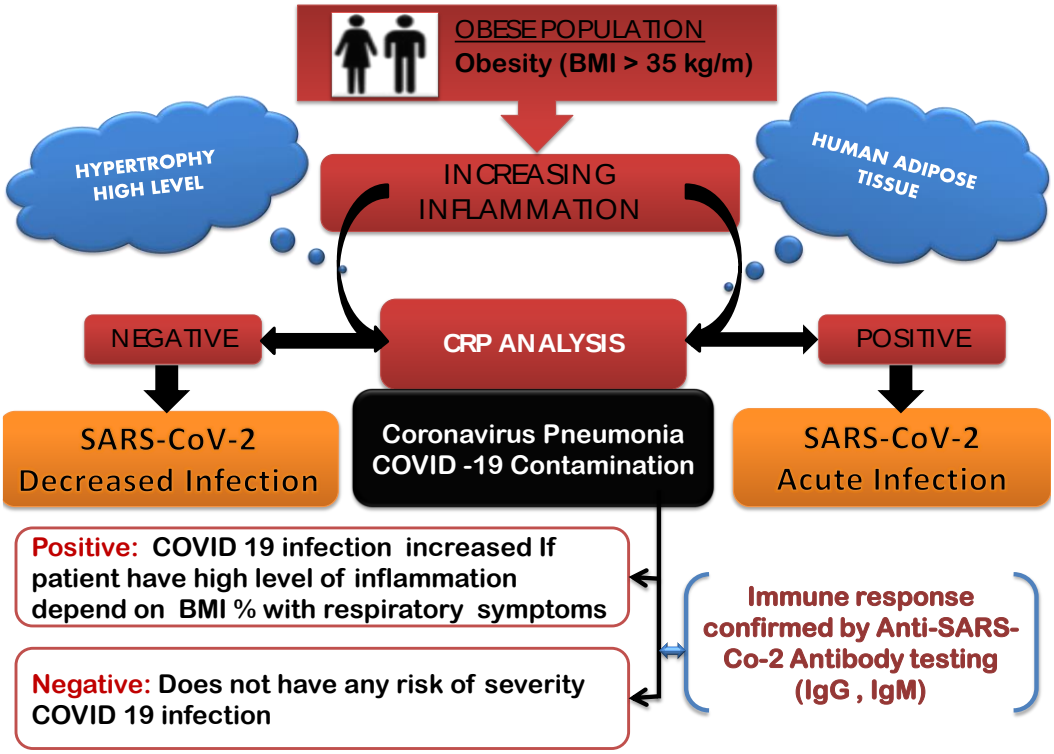


**Figure 1.** Relationship between high-level BMI and Coronavirus COVID-19 contamination risk.

*Obesity*

*Definition*

Previously, obesity has been recognized as one of the world's major health problems. In adults, it is defined as an excess of fat mass leading to health problems. It results from an imbalance between energy intake and expenditure. It is also defined as a disorder whereby the body lipid mass is amplified compared to the available norms, which are correlated with age, sex, size, and muscle mass. The increase in lipid mass occurs by hypertrophy (increase in the average size and lipid content of each fat cell), or by hyperplasia (increase in the total number of fat cells), or a combination of these two abnormalities in the most severely obese individuals. This increased lipid mass distribution may be generalized or localized in certain regions of the body [17-19].

*Epidemiology and Classification*

In terms of nomenclature, several classifications of obesity have been proposed:

*Classifications of Obesity According to Adult Body Mass Index*

According to the World Health Organization WHO this is an epidemic of the century and should be considered as one of the major public health problems **(Table 1)** [20].

**Table 1.** Classification of adults according to BMI [21].

| Classification (Adults) | BMI category (Kg/m²) |
|---|---|
| **Insufficient weight** | < 18.5 |
| **Normal weight** | 18.5 – 24.9 |
| **Overweight** | 25.0 – 29.9 |
| **Obesity** | 30.0 – 34.9 |
| **Class I (moderate)** | 35.0 – 39.9 |
| **Class II (severe)** | 40 and more |
| **Class III (morbid)** | 40 and more |

The waist circumference (TT) and hip circumference (TH) are measured with a tape measure on a standing subject when the TT/TH ratio was less than 0.9 in women and 1 in men, while obesity is defined as a Gyonoid and Android in the opposite case [22]. While BMI is a good tool for screening for obesity, it does not provide information on body composition

(proportions of fat and lean body mass) or fat distribution, which can be highly variable among individuals [23]. It is now accepted that regardless of BMI, excess fat in the abdominal cavity (android obesity) is much more harmful to health than fat in the thighs and hips gynoid obesity). Android obesity, linked to the commonness of metabolic signs, is the most harmful form of obesity. In this regard, it has been demonstrated that within each BMI category, a surge in the ratio of the waist-to-thigh (index for estimating abdominal fat accumulation) is linked to a subsequent escalation in the possibility of myocardial infarction [24]. In addition, it has been observed that obese subjects with a low amount of visceral adipose tissue have a glucose tolerance similar to those of normal weight. Recently, the cross-sectional International Day for the Evaluation of Abdominal Obesity (IDEA) study also demonstrated the importance of waist circumference as a variable associated with the risk of cardiovascular disease and type 2 diabetes [25, 26]. The prevalence of obesity increases steadily with age in adults, peaking in the age group 65-69. Epidemiological and physiological analyses have shown that high-fat diets associated with a tendency to be sedentary are the causes of the progression of obesity which accompanies the development of countries and the transition from poverty to wealth [27].

*In the United States*

61% of people are overweight; over the past 20 years, in all age groups and sexes, the rate has been gradually escalating. The greatest increase is seen in Teenagers where it has tripled in the 2 decades [28].

*In Europe*

The southern European countries commonly have greater obesity levels than in northern European countries because the traditional Mediterranean diet has been replaced by foods rich in fat, sugar, and salt [29].

*In French*

According to the Nutritional Surveillance and Epidemiology Unit [USEN, 2007], the various studies in France (SOFRES, Institute, and INSERM) provide identical information on the increase in the prevalence of obesity. From 8.2% in 1997 to 12.4% in 2006, 5.9 million French people were obese, and this has increased in two years [30].

*In Spain*

Several countries in the southern region of Europe have focused their efforts primarily on food guarantees and malnutrition. Consequently, only a small number of African populations have reported obesity trends, and from the limited and fragmentary data available on obesity prevalence, it appears that obesity prevalence exists in both developing and more developed countries in the African regions, particularly among women [31].

*Algeria (Maghreb Region)*

Like other Maghreb countries, Algeria has not achieved food self-sufficiency and is still afflicted by undernourishment in some of its social strata. The alarming figures of the only survey recently conducted by the Ministry of Health show that 53% of women and 36% of men are overweight and obese [32].

*Metabolic Consequences of Obesity*

Obesity is considered as the major risk factor in the development of insulin resistance and non-insulin-dependent diabetes abdominal obesity. In particular, it has been associated with cardiovascular morbidity and mortality. Metabolic syndrome is defined by a severe set of cardiovascular risk factors such as non-insulin-dependent diabetes, hypertension, hypertriglyceridemia, and hypo-HDL-cholesterolemia. The manifestation of this syndrome is promoted by an overload of visceral fat (increased abdominal to pelvis ratio) [33].

*Adipose Tissue Storage Capacity*

Adipose tissue is the body's most important energy storage organ. Besides being an energy supply for other organs, it is made of triglycerides mobilized by lipolysis. In addition to releasing substrates for neo-glycogenesis (glycerol) and lipoprotein synthesis (free fatty acids), adipose tissue releases substrates for liver activities [34].

## Materials and Methods

*Subjects and Patients*

Our view study involves the demographic characteristics of the patients and controls which were recorded using a questionnaire; informed consent was signed by all participants in this study. The characteristics of the obese were selected to define the following characteristics **(Figure 2)**:

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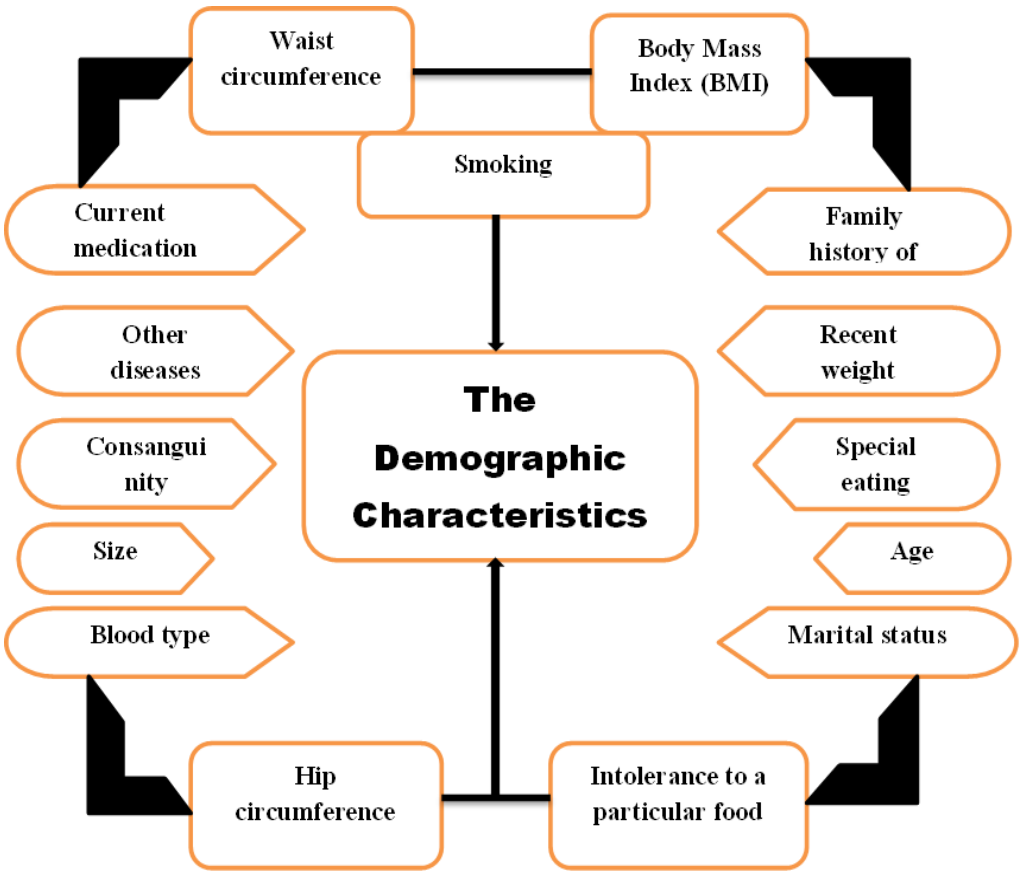


**Figure 2.** Schematic Summary of The Demographic Characteristics for obese patients.

*Determination of CRP by Immuno-Agglutination Technique*

The CRP assay was performed in serum by the immuno-agglutination technique combined with serial dilutions of two in two, using an antiserum containing anti-CRP antibodies fixed on latex particles [35, 36]. For example, Spain has allowed us to dose CRP by two types of qualitative dosing and semi-quantitative dosing [37]. The CRP-Latex elements are glazed with anti-human CRP antibodies and the CRP Latex reagent is standardized to detect serum CRP levels in the range of 6 mg/L, which is the least clinically relevant intensity. Mixing the latex reagent with serum-containing CRP results in an antigen-antibody reaction those results in readily visible agglutination within 2 minutes [38]. CRP is present or absent in a specimen based on the presence or absence of visible agglutination [39].

*Semi-Quantitative Analysis C-reactive Protein According to COVID-19 Cases*

The Body Mass Index (BMI) report is a typical metric for determining obesity. Increased ACE2 receptors have been found in adipose tissue, or fat, in several investigations [40, 41]. The ACE2 receptor, an enzyme found on the membranes of cells in the lungs, arteries, heart, kidneys, and intestines, has been identified as a co-receptor for the virus that causes COVID-19, Severe Acute Respiratory Syndrome Coronavirus 2 SARS-CoV-2 [42-45]. As a result of the increased ACE2 receptor secretion induced by having more adipose tissue, there is a larger risk of contracting SARS-CoV-2, which can progress to a more severe form of COVID-19 [46-48]. Due to their high viral load, they may also be more prone to spread the illness to others [49, 50].

*Obesity's Effect on Normal Body Function*

Lower lung capacity is caused by a decreased diaphragmatic movement influence on the entire respiratory system, resulting in a drop in oxygen saturation [51, 52]. This lowers the immune response to viral infection, affecting disease progression, infection immunity, and vaccination efficacy [53]. COVID-19 causes a greater death rate in a variety of places with significant populations of people with lower socioeconomic levels and a higher prevalence of obesity [54, 55]. Obesity (BMI > 35 kg/m) was linked to increased oxygen requirements (OR 3.09) and intubation (OR 3.87) and was a significant predictor of in-hospital death (OR 3.78) [56]. A higher level of Obesity was presented in patients identified with COVID-19 weakly pneumatology functions test which has reduced lungs work. According to the Lille Intensive Care, COVID-19 and Obesity study group in France, 47.6% of COVID-19 patients admitted to intensive care were obese (BMI >30 kg/m), with 28.2% being extremely obese (BMI >35 kg/m) [57]. With increasing BMI categories, the severity of illness and the concomitant necessity for IMV increased, reaching nearly 90% in inpatients with BMI >35 kg/m [58]. Serial dilutions of two in two (1:2.1; 4.1:8; 1:16.1:32) are carried out using physiological water. For each dilution, the qualitative test procedure is

performed [59]. The serum titer is the greatest dilution with a positive result, and the CRP concentration is calculated from the last dilution with visible agglutination [60-62]. Multiplying the titer of the sensitivity limit (6mg/l) by the approximate CRP concentration [63, 64]. For example: if it is a 1/8 dilution, the concentration was expressed. Determinations of circulating cholesterol and triglyceride levels were carried out using Bio Maghreb kits based on the same principle and protocols [65-67].

**Results and Discussion**

Molecular analysis of reactivity of some patients has been shown to be a useful marker of aggravation of severe COVID-19 patients; obesity is common among COVID-19 patients and contributes to poor ventilation and lower quantity of oxygen, which represent the secretion of proteins by immune system cells according to under-grade inflammation and altering of chronic state.

This review demonstrated that obesity has an inflammatory effect provided by higher levels of CRP and the importance of immune system activation and inflammatory status in obese subjects, Obesity becomes the leading non-infectious "inflammatory" disease. Furthermore, the distribution of adipose tissue appears to play a key role in the inflammatory process related to obesity.

Hyper inflammation indicated by CRP high level has also been described previously in the pathogenesis of other human coronavirus infections. The presence of markers of hyper-inflammation in this study was associated with the control for CRP levels and respiratory support for the risk of death in people with COVID-19.

**Conclusion**

The elevated level of CRP analysis as an inflammatory test on obese people in the severity of viral pandemic COVID-19 they have a higher risk of contamination which severe disease and death because obesity considered as an Autonomous risk factor for Severe COVID-19. When the rate of excessive adipose tissue is higher, it also increases the risk of infection by transmitting the virus to others. This review article aims have viewed the factors of risk caused by coronavirus disease toward obese populations, which included the CRP test and populations' immune function and prevention of respiratory system.

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**Ethics statement:** None

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