

## The effect of male body mass index (BMI) on COVID- 19 disease infection

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Article Info	Abstract
<p>Original Article</p> <p><b>Article history:</b></p> <p>Received: 19 August 2020</p> <p>Revised: 25 August 2020</p> <p>Accepted: 4 October 2020</p> <p>Published online: 1 January 2021</p> <p><b>Keywords:</b> BMI, COVID-19, obesity.</p>	<p><b>Background:</b> Since the outbreak of COVID-19 virus and the rise in concerns, researchers have been investigating risk factors of this disease. One of the factors affecting the hospitalization of influenza patients is high BMI. Due to the relation between COVID-19 disease and influenza.</p> <p><b>Aim:</b> the purpose of this study was to investigate the effect of BMI on the infection and severity of COVID-19 patients.</p> <p><b>Materials and Methods:</b> BMI of 126 men was calculated and three groups of "appropriate weight", "overweight" and "obese" were identified. Then, the prevalence and severity of their disease were recorded. For data analysis, chi2 test was used in SPSS 26 software at a significance level of <math>P= 0.05</math>.</p> <p><b>Results:</b> Prevalence of COVID-19 infection in the group with "appropriate weight", "overweight" and "fat" were 56%, 61% and 58%, respectively. Mild infection was reported in the three groups, 27%, 27% and 26%, respectively; Moderate infection was 22%, 26% and 26%, respectively; and severe infection was 7%, 8% and 5%, respectively. Therefore, there was no significant difference between their infection and the severity of infection in groups (<math>P&gt;.05</math>).</p> <p><b>Conclusion:</b> Obesity has negative effect on the body's immune response and lung function. The hospitalization rate for influenza is higher in this group. But in infection of COVID-19 and severity of this disease, no significant difference was observed between men with different BMI. However, due to the relation between obesity, cardiovascular disease, diabetes, and the vulnerability of these patients to the COVID-19 virus, serious attention is necessary to prevent these individuals from COVID-19.</p>

**Cite this article:** Seyedazizi V, Bala Khiyavi S, Sarparast F. "The effect of male body mass index (BMI) on COVID- 19 disease infection". *Sport Sciences and Health Research*. 2021, 13(1): 109-114. Doi: 10.22059/SSHR.2021.89703.



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EISSN: 2717-2422 | Web site: <https://sshr.ut.ac.ir/> | Email: [sshr@ut.ac.ir](mailto:sshr@ut.ac.ir)

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## 1. Introduction

In December 2019, a new viral disease caused by SARS-CoV-2 was reported in Wuhan, China, and was named Covid 19. Due to its dramatic contagious power, the virus spread rapidly throughout the world and in a short time, infected most of the world [1] and affected the holding of many major world events such as the Olympics [2].

Researchers are trying to find risk factors for the disease, and so far it has been clearly identified advanced age, male sex, and the presence of multiple comorbidities are the major risk factors for developing severe COVID-19 [3, 4, 5]. There is now emerging evidence that COVID-19 and its severity is associated with overweight and obesity. This is not unexpected. A significant association between obesity and disease severity and mortality was already reported for other respiratory virus pandemics, including that of 2009 H1N1 influenza [6, 7].

Body Mass Index (BMI) is defining as a measure of body weight at the individual level and justifies possible differences in adult weights with different height sizes.

BMI is calculated as dividing a person's weight (kg) in kilograms by his or her height<sup>2</sup> (m) (Eq. 1)

$$BMI = \frac{\text{Body weight (kg)}}{\text{Height}^2(\text{m})} \quad (1)$$

BMI's above 30 and 40 are highly associated with mortality from this disease [6]. A subsequent Mexican study confirmed these observations that influenza-positive adults were more likely to be hospitalized if obese [6].

In California, the 268 adults were hospitalized for 2009 influenza A (H1N1) and 58% were obese [6].

In China, patients with overweight/

obesity were more likely to be hospitalized longer than those with normal BMI [8].

A retrospective case-control study of young Chinese patients with COVID-19 showed that obesity was the most important critical factor contributing to their death [9].

The Centers for Disease Control and Prevention considers people with BMI 40 kg/m<sup>2</sup> as being at risk for flu complications [10]. Higher BMI is associated with increased health care expenditures due to increased use of hospital and health care services [11].

Additional large retrospective case series from New York confirm that obesity is a major risk factor for COVID-19 disease severity and intensive care unit requirements [12, 13].

That obesity is emerging as a risk factor for COVID-19 outcomes regardless of age and comorbidity [14, 15, 16].

In a USA study about children and adolescents hospitalized with COVID-19, obesity was significantly associated with disease severity [17].

Therefore, considering the relationship between influenza and Covid disease, as well as the risks of obesity and the lack of articles comparing the prevalence of this disease in overweight and obese people, we decided to discuss the relationship between BMI with COVID-19 disease and severity.

## 2. Materials and Methods

This is a field research with the aim of applied research in which the research method used is comparative. The statistical population of the study was 128 men who referred to the school during August and September 2021.

First, the height and weight of the mentioned parents were measured and then the general questionnaire with a few questions was completed by them or our

colleagues. A mini triangle height gauge was used to measure height, and a digital weight gauge was used to measure weight. Excel software was used to calculate BMI.

According to the data, three groups of "appropriate weight", "overweight" and "obese" were identified. Two "low weight" individuals were excluded due to their low number in the sample; Then, the prevalence and severity of the disease in the remaining 126 patients were recorded and quantified.

To calculate the differences, chi2 Test was used in SPSS 26 software at a significance level of 0.05.

## 2. Results

Table 1 provides information on the demographic characteristics of the participants and Tables 2 to 3 show the results of the chi2 test.

Figures 1 and 2 facilitate the observation of differences.

## 3. Discussion

The emerging association between COVID-19 outcomes and overweight/obesity has biological and physiological plausibility. In overweight and obesity, macronutrient excess in the adipose tissues stimulates adipocytes to release tumor necrosis factor (TNF-), interleukin 6 (IL6), and other pro-inflammatory mediators and to reduce production of the anti-inflammatory adiponectin, thus predisposing to a pro-inflammatory state and oxidative stress [18].

Moreover, obesity itself has been shown to impair immune responses with an overall negative impact on the efficiency of pathogen defenses [19].

**Table 1.** Characteristics of the participants

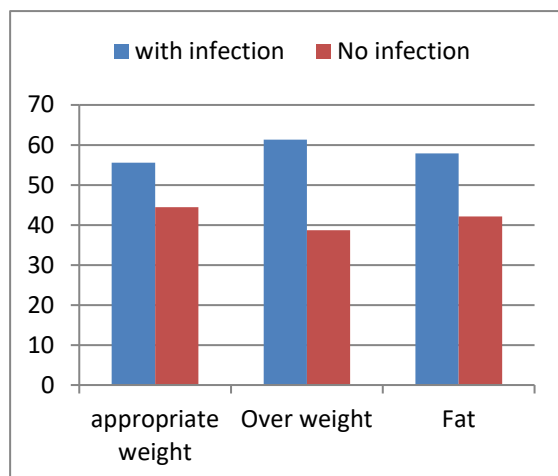
Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	126	21	53	37.92	7.24
Height	126	60	120	84.68	11.82
Weight	126	1.60	1.92	1.78	0.05

**Table 2.** Comparison result between infection and non-infection in different BMIs with chi2 test

Percentage of COVID-19 infection			
	Observed N (%)	Expected N	Residual
Appropriate weight	56	58.3	-2.3
Over weight	61	58.3	2.7
Fat	58	58.3	-3
Test statistics			
Chi-square		0.217 <sup>a</sup>	
df		2	
Asymp.sig.		0.897	

**Table 3.** Comparison result between severity of infection in different BMIs with chi2 test

	Appropriate weight (%)	Over weight	Fat	Chi2	Significantly
Non-infection	44	39	42	0.89	-
Mild infection	26	27	26	0.98	-
Moderate infection	22	26	26	0.80	-
Severe infection	7	8	5	0.70	-



**Figure 1.** The difference between infection and no infection COVID-19 between different BMIs

There is now emerging evidence that COVID-19 and its severity is associated with overweight and obesity. This is not unexpected. A significant association between obesity and disease severity and mortality was already reported for other respiratory virus pandemics, including that of 2009 H1N1 influenza [6, 7].

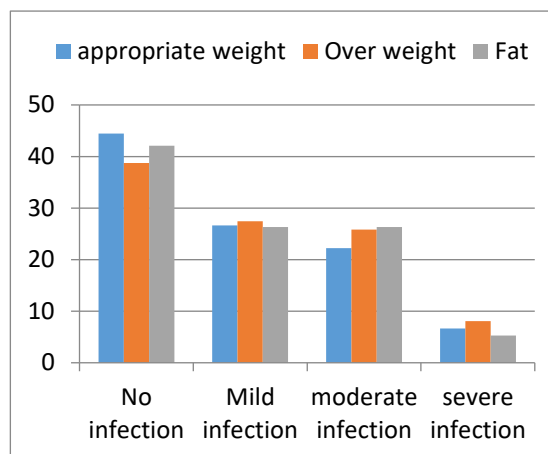
In summary, due to the fact that obesity disrupts immune responses and also reduces lung function, and the rate of influenza hospitalization is higher in this group, it seemed that this factor is also effective in Covid 19 disease.

#### 4. Conclusion

This research was conducted after the outbreak of the fifth wave of Covid-19 in Iran. Because the CORONA virus belongs to the influenza family, and the dangers of the flu virus to obese people and its contagion to these people have been proven in numerous articles, it was possible to generalize those results to the new CORONA virus.

In this paper, we examined the infection and severity of infection in 126 men with different BMI and finally the following results were obtained:

1. The infection of COVID-19 was not



**Figure 2.** The difference between severity of infection in different BMIs

2. The severity of the COVID-19 disease was not significantly different in BMI groups.

Therefore, it is concluded that BMI is not a risk factor for COVID- 19 disease; although due to the relationship between obesity with cardiovascular disease and diabetes and the vulnerability of cardiovascular and diabetic patients to COVID-19 and also the vulnerability of patients obese versus infection, serious attention is needed in the prevention of these people.

#### Conflict of interest

The authors declared no conflicts of interest.

#### Authors' contributions

All authors contributed to the original idea, study design.

#### Ethical considerations

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

## Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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