

# COVID-19: a major cause of cachexia and sarcopenia?

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Coronavirus disease (COVID-19) has reached pandemic proportions. Two animal studies have shown that coronavirus-2 causes weight loss in animals associated with an increase in inflammatory cytokines. In humans, COVID-19 causes anorexia, weight loss and low albumin. While poorly studied, this suggests that severe COVID-19 is associated with cachexia. The angiotensin converting enzyme 2 is the receptor for coronavirus-2, and it occurs in skeletal muscle. Persons with COVID-19 have myalgias and muscle loss. This coupled by bed rest and being ventilated can lead to severe sarcopenia during the recovery period following COVID-19. Coronavirus 2 disease (COVID-19) is a pandemic that swept around the world.<sup>1</sup> The disease starts as a nasopharyngeal infection; it can sweep through the body infecting almost every organ (Figure 1). The coronavirus-2 spikes protein, uses the angiotensin converter enzyme 2 (ACE2) receptor to bind to a cell resulting in fusion of the viral envelope to fuse with cell membrane and allows the viral genetic material to enter the cell.<sup>2</sup> ACE2 receptors are present ubiquitously throughout the body resulting in a variety of tissue damages. It is important to recognize that many persons infected with coronavirus-2 have no or minimal symptoms. Others develop severe disease. People at highest risk appear to be those with comorbidity, diabetes, hypertension, smokers and older individuals.<sup>3</sup>

Cachexia is defined by our society as ‘a complex metabolic syndrome associated with underlying illness and characterized by loss of muscle.’<sup>4</sup> Its clinical features are weight loss, low albumin, anorexia, increased muscle protein breakdown and inflammation. Weight loss is a feature of COVID-19 and was clearly demonstrated by the CNN television host who lost 13 pounds over 2 weeks while infected with COVID-19. Both myalgias and muscle loss have been seen in COVID-19.<sup>5</sup> Muscle has an ACE2 receptor which might in part explain these effects. Persons with COVID-19 also have

hypoalbuminemia and elevated levels of C-reactive protein and a number of inflammatory cytokines such as tumour necrosis alpha, interleukin-1 and interleukin-6.<sup>6,7</sup> A further cause of muscle loss and weakness is the immobilization seen in mechanically ventilated patients in the intensive care unit.<sup>8</sup>

Anorexia is a component of COVID-19.<sup>1</sup> This is, in part, due to the anosmia and loss of taste that occurs in COVID-19, but is also secondary to the elevated levels of inflammatory cytokines, which are common causes of anorexia.<sup>9</sup>

When Syrian hamsters are injected with coronavirus-2, they develop typical signs of COVID-19 as well as weight loss.<sup>10,11</sup> This is associated with increases in interferon $\delta$  and tumour necrosis alpha. Mice infected with coronavirus-2 had had significant weight loss which was reversed by a ribonucleoside analog.<sup>12</sup>

Sarcopenia is defined as the decreased muscular function in the presence of muscle loss.<sup>13</sup> Primary sarcopenia is age related while secondary sarcopenia is when the sarcopenia is related to a chronic disease such as diabetes mellitus or chronic obstructive pulmonary disease.<sup>14</sup> In older persons, the need for social isolation during the COVID-19 pandemic has led to a decrease in daily physical activity which accelerates the loss of muscle strength and function. Persons with diagnosed COVID-19 are also likely to have 2 or 3 weeks of decreased function resulting in secondary sarcopenia. Following COVID-19, a number of persons have lung damage with hypoxemia. High-altitude hypoxia leads to loss of fat-free mass and physical disability.<sup>15</sup>

Persons who are physically isolated should be given recommendations to do daily exercises such as the ViviFrail graded exercise set (<sup>16</sup> vivifrail.com). There is evidence that persons in hospital have better outcomes if they receive exercise therapy during hospitalization.<sup>17</sup> There is evidence that persons with severe COVID-19 need prolonged exercise therapy to prevent or reverse disability.<sup>18</sup>

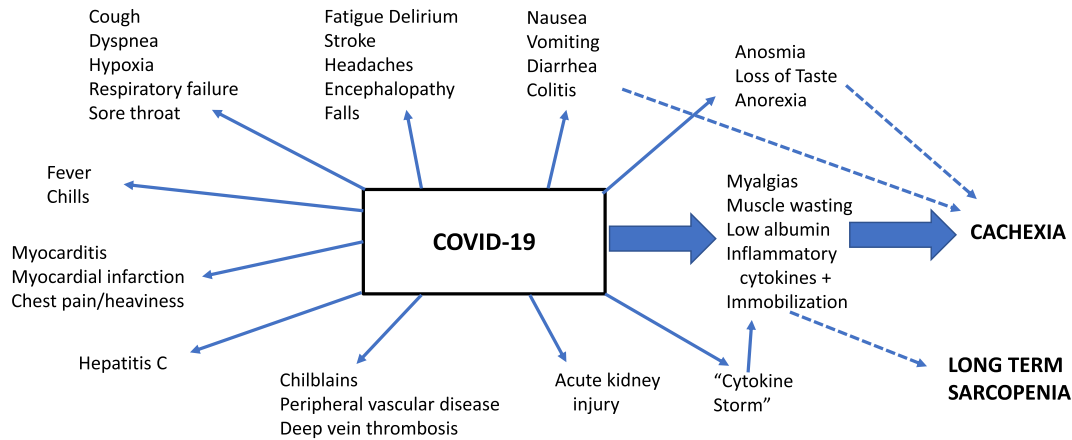


FIGURE 1 The effects of COVID-19

Cachexia and sarcopenia are major causes of mortality and disability. Persons who survive cachexia often require long periods of rehabilitation. Similarly, persons who develop sarcopenia secondary to a stressful event often require lifetime exercise and nutrition therapy. We need more research into the incidence of cachexia in COVID-19 and also more attention to rehabilitation during the recovery phase.<sup>19</sup>

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## Conflict of interest

The authors declare there are no conflicts of interest.

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