

## Ramadan and COVID-19: A Challenge amongst Challenges

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Ramadan is the holy month in the Islamic calendar marked by many social and behavioral changes in Muslim societies. The ongoing COVID-19 pandemic raises concerns about the effect of Ramadan on COVID-19 and vice-versa. The global fight against COVID-19 can only be effective if measures taken for its attenuation are in sync with accepted evidence and the same is communicated to the population at large. Muslims comprise one-fourth of the world's population and have their presence in every nook and corner of human civilization, and they celebrate Ramadan across the world with intermittent fasting (IF) from dawn to dusk with the duration ranging from 12-20 hours, depending on the latitude of the place. During this period, no food, drink, or smoking is allowed. The beginning and end of IF are marked by a gathering of family and friends to partake of common food and some portions of the night are devoted to prayers [1].

There have been multiple studies in the past evaluating the effect of fasting on immunity, infection, and dehydration. Whereas a few of them showed impaired immunity, a majority highlighted otherwise. The combined effects of IF and sleep deprivation led to a decrease in IgG level, salivary IgA levels, and creatinine clearance, along with poorer control of auto-immune diseases due to an increase in auto-antibodies like anti-dsDNA in fasting cohorts [2, 3].

Though a majority of the studies indicates that fasting is associated with no decline in immunity, some studies show it to augment immunity. These studies have mainly delved into the levels of cytokines in the body. It has been shown consistently that IF was associated with a decrease in proinflammatory cytokine levels like IL-6, IL-1B, and TNF-alpha. In addition, loss of weight and adipose tissue due to IF in Ramadan was naturally associated with a better cytokine profile. As far as cell-mediated immunity is concerned, it was shown in an in-vivo animal study that IF increased the bactericidal efficiency of macrophages. IFN-gamma has been shown to be upregulated during IF, and this cytokine has demonstrated anti-viral activity, although at this point, it is difficult to extrapolate this response to cover SARS-COV-2 as well [4, 5].

The course of COVID-19 in severe cases has been marked by a cytokine storm; therefore, it is essential to understand the effect of IF on oxidative stress. It has been shown in both cytokine-based and gene-based studies that IF has been associated with an overall decrease in oxidative stress [6].

Fasting during the day, especially in summer in the northern hemisphere and tropical countries may result in dehydration. In addition, dehydration can theoretically lead to a decreased mucociliary activity, which can impair the removal of noxious agents from the respiratory tract. However, most research has shown that IF in Ramadan is associated with increased pre- and post-fasting fluid intake, effectively attenuating any total decline in fluid intake. Moreover, the increased concentrating ability of the kidneys particularly late into the fasting contributes to effective maintenance of fluid volume without any detriment to the general health [7].

Despite a volume of research on the subject, the final word in terms of Ramadan-induced immune-modulation has not been spoken, with some studies also showing adverse effects related to ritualistic IF. It mostly boils down to how an individual manages his/her diet, sleep, and exercise schedule during the month of Ramadan. In addition, because Ramadan rotates through different seasons, and because daylight hours differ based on latitude, the period of fasting varies. This is

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in turn influenced by climatic conditions, which might make fasting hazardous if proper precautions are not observed. Overall, focusing too much on fasting during Ramadan and ignoring other aspects of it might prove to be the Achilles's heel in the fight against COVID-19. As most evidence does not support any impairment of immunity, the social gatherings and spiritual practices like common worship in closed spaces and use of common cleaning facilities before prayers could lead to its spread. We suggest that pending further research on fasting and COVID-19, it is safe to keep up with intermittent fasting, but one has to avoid any social or spiritual gathering at all costs.

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