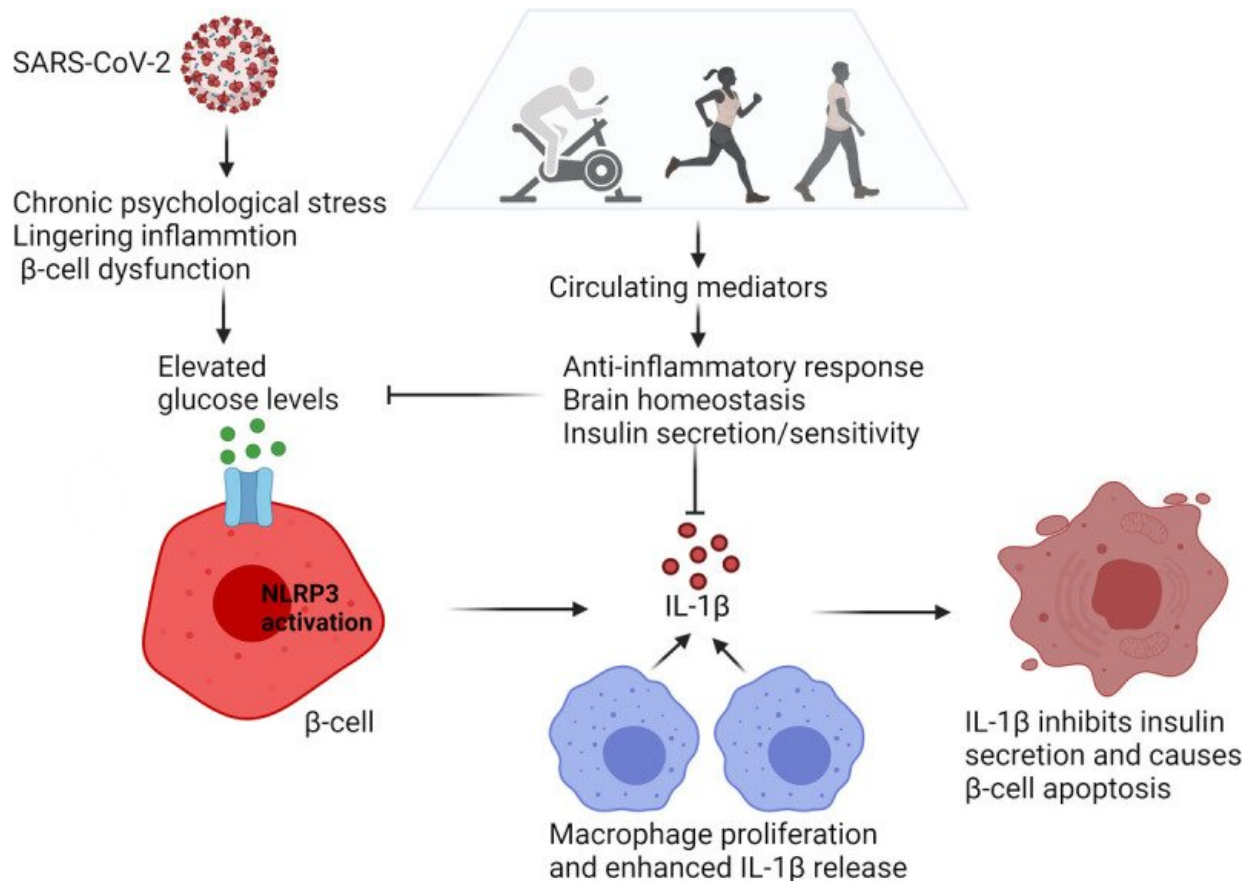


# Exercise may treat long COVID-induced diabetes, depression

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The development of hyperglycemia arising from disruption of immune metabolic homeostasis in COVID-19. High glucose levels induced by psychological stress, lingering inflammation, and β-cell dysfunction can lead to activation of the NLRP3 inflammasome in pancreatic β cells. As a result, pro-IL-1β is processed to the biologically active IL-1β. IL-1β released from β cells causes the recruitment and activation of macrophages, which prompts the release of more IL-1β. High local concentrations of IL-1β in the β-cell

microenvironment may inhibit insulin secretion and trigger  $\beta$ -cell dysfunction and apoptosis. This leads to further increases in levels of glucose, thereby causing IL-1 $\beta$  autostimulation and establishing a vicious cycle. Exercise induces the release of circulating factors that mediate the anti-inflammatory response, support brain homeostasis, and increase insulin sensitivity. The net effect is the lowering of glucose levels and could be envisioned as a remission-induction therapy to counter the sequelae of COVID-19 (graphics program: Biorender). IL-1 $\beta$ , Interleukin-1 $\beta$ ; NLRP3, NOD-, LRR-, and pyrin domain-containing protein 3. Credit: Dr. Candida Rebello

While no medically recognized treatment exists for Long COVID, exercise may break the vicious cycle of inflammation that can lead to developing diabetes and depression months after a person recovers from the virus.

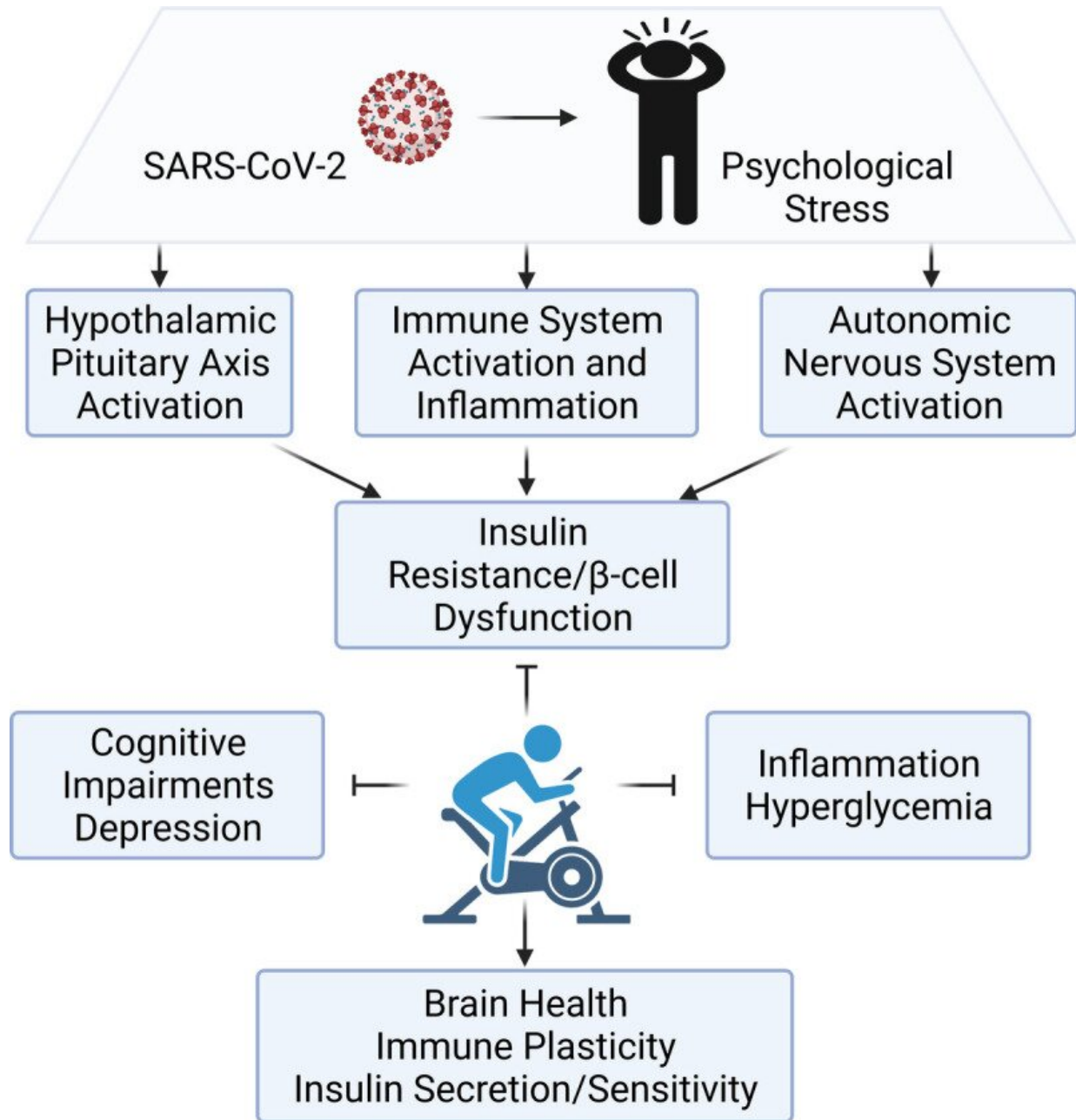
"We know that Long COVID causes depression, and we know that it can increase [blood glucose levels](#) to the point where people develop diabetic ketoacidosis, a potentially life-threatening condition common among people with type 1 diabetes," said Candida Rebello, Ph.D., a research scientist at Pennington Biomedical Research Center. "Exercise can help. Exercise takes care of the inflammation that leads to elevated [blood glucose](#) and the development and progression of diabetes and [clinical depression](#)."

It's unclear how many people suffer from Long COVID. But estimates range from 15 percent to 80 percent of the people infected. Based on those figures, it's possible that as many as 1 million of Louisiana's residents suffer from Long COVID.

Long COVID causes what the Centers for Disease Control describes as "a constellation of other debilitating symptoms" including brain fog, muscle pain, and fatigue that can last for months after a person recovers

from the [initial infection](#).

"For example, a person may not get very sick from COVID-19, but six months later, long after the cough or fever is gone, they develop diabetes,' Dr. Rebello said.



Dysregulation of the physiological adaptation to changes and the modulatory effects of exercise. Psychological stress as may occur with COVID-19 activates the hypothalamic-pituitary-adrenal (HPA) axis, the autonomic nervous system, and the immune system. A dysregulated and overactive HPA axis drives sympathetic nervous system activation and an exaggerated immune response that promotes insulin resistance and  $\beta$ -cell dysfunction. Exercise contributes toward enhanced immunosurveillance and reduced inflammation to improve mental health outcomes and glycemic control. Credit: Dr. Candida Rebello

One solution is [exercise](#). Dr. Rebello and her co-authors describe their hypothesis in "Exercise as a Moderator of Persistent Neuroendocrine Symptoms of COVID-19," published in the journal *Exercise and Sport Sciences Reviews*.

"You don't have to run a mile or even walk a mile at a brisk pace," Dr. Rebello said. "Walking slowly is also exercising. Ideally, you would do a 30-minute session of exercise. But if you can only do 15 minutes at a time, try to do two 15-minute sessions. If you can only walk 15 minutes once a day, do that. The important thing is to try. It doesn't matter where you begin. You can gradually build up to the recommended level of exercise."

"We know that physical activity is a key component to a healthy life. This research shows that exercise can be used to break the chain reaction of inflammation that leads to high blood sugar levels, and then to the development or progression of type 2 diabetes," said Pennington Biomedical Executive Director John Kirwan, Ph.D., who is also a co-author of the paper.

**More information:** Candida J. Rebello et al, Exercise as a Moderator of Persistent Neuroendocrine Symptoms of Covid 19, *Exercise and Sport Sciences Reviews* (2022). [DOI: 10.1249/JES.000000000000284](https://doi.org/10.1249/JES.000000000000284)

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