

# Letter: Does Obesity Affect the Severity of Exercise-Induced Muscle Injury? (J Obes Metab Syndr 2021;30:132-40)

Anna Vittoria Mattioli<sup>1\*</sup>, Francesca Coppi<sup>2</sup>, Milena Nasi<sup>1</sup>, Marcello Pinti<sup>3</sup>

<sup>1</sup>Surgical, Medical and Dental Department of Morphological Sciences Related to Transplant, Oncology and Regenerative Medicine, University of Modena and Reggio Emilia, Modena; <sup>2</sup>Cardiology Division, Azienda Ospedaliero-Universitaria di Modena, Modena; <sup>3</sup>Department of Life Sciences, University of Modena and Reggio Emilia, Modena, Italy

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\*Corresponding author  
Anna Vittoria Mattioli

 <https://orcid.org/0000-0003-1487-9530>

Surgical, Medical and Dental Department of Morphological Sciences related to Transplant, Oncology and Regenerative Medicine, University of Modena and Reggio Emilia, Via del Pozzo, 71 41100 Modena, Italy  
Tel: +39-59-422-4043  
Fax: +39-59-422-4323  
E-mail: [annavittoria.mattioli@unimore.it](mailto:annavittoria.mattioli@unimore.it)

We have read with great interest the article “Does obesity affect the severity of exercise-induced muscle injury?” by Kim and Yoon<sup>1</sup> and found it of interest in prevention of muscle injury related to obesity. In this literature review, the authors investigated the effects of obesity on exercise-induced muscle injury and reexamined the potential mechanisms of exercise-induced muscle injury related to obesity. With reference to the findings reported in the paper, we would like to make the following contribution to the discussion. The current severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)/coronavirus disease 2019 (COVID-19) pandemic is characterized by increase in stress and anxiety leading to an unhealthy lifestyle.<sup>2,3</sup> Unhealthy lifestyle includes sugar and fat-rich diet, reduced physical activity, and decreased quality of sleep.<sup>3</sup>

In order to improve physical activity and to reduce sedentary habits, the World Health Organization (WHO) has published helpful advice titled “Stay physically active during self-quarantine,” which contains practical suggestions such as online exercise classes and video- or app-led workouts at home.<sup>4</sup> Despite these helpful suggestions, several articles have shown that physical activity decreased during quarantine, and diet and sleep quality worsened.<sup>2,3</sup> This unhealthy lifestyle led to an increase in obesity. Obesity causes

a systemic inflammatory state due to both the increase in cytokines and the higher infiltration of macrophages in the adipose tissue. In fact, obese subjects have higher level of leptin, a pro-inflammatory adipokine, and lower level of adiponectin, an anti-inflammatory adipokine.<sup>5,6</sup> Kim and Yoon<sup>1</sup> reported that excess body fat is associated with increased levels of inflammatory markers such as interleukin-7 and C-reactive protein in postmenopausal women and in elderly obese women, supporting the relationship between obesity and inflammation. The researchers also underline that obesity-induced inflammatory responses are highly likely to contribute to the increase in post-exercise delayed onset muscle soreness (DOMS) severity.<sup>1</sup> Although the causes of DOMS are unclear, a major hypothesis suggests inflammatory responses as one cause.<sup>1</sup> Obesity is an important cardiovascular risk factor in women, especially visceral obesity that develops during menopause and is associated with high levels of inflammation.<sup>2,7</sup>

Furthermore, obesity is associated with other co-morbidities that are no less dangerous than obesity itself, such as essential hypertension, atherosclerosis, coronary artery diseases, type 2 diabetes mellitus, and cerebrovascular stroke.<sup>2,7</sup> Regular physical activity helps in the fight against obesity and inflammation.<sup>6,7</sup> However, women

are less likely to perform regular physical activity due to their roles at work and in the family as a result of traditions and stereotypes.<sup>2,8</sup> In addition, government-induced closures of gyms and sports facilities during the pandemic contributed to less exercise and more sedentary time.<sup>8</sup> Moreover, it should be emphasized that physical activity at home and without adequate supervision can lead to an increase in muscle and joint injuries. It is necessary to introduce spontaneous physical activity with caution, suggesting that people, especially untrained subjects, go for long walks, short bike rides, or engage in water activities.

Changes in lifestyle during the COVID-19 pandemic have been reported in women more than in men and were mainly related to diet and development of food cravings to cope with stress.<sup>7,9</sup> Food craving is defined as “a multidimensional experience” since it includes cognitive and emotional feelings (e.g., thinking about food and desire to eat), as well as behavioral (e.g., seeking and consuming food) and physiological (e.g., salivation) aspects.<sup>2,9</sup> Food craving often is associated with reduced physical activity and increased sitting time. During the pandemic, the consumption of fresh fruits and vegetables, foods rich in antioxidants, decreased while intake of preserved foods rich in fats and sugars increased.<sup>2</sup>

The WHO recommended engaging in relaxing activities such as yoga and chi-kung. A review on the effects of yoga in managing stress reported that, in the majority of trials, yoga intervention significantly reduced stress. However, there are some limitations related to the characteristics of the studies included in the review, such as small sample sizes, lack of randomization, and lack of control groups. The word yoga, meaning “union,” is a complex mind-body-spirit practice that can include meditation, breathing awareness, postures, and relaxation. It is possible that all these activities alter nervous system regulation and improve psychological well-being.<sup>10</sup>

In the current pandemic, it is important to find strategies to control weight, and an increase in physical activity could provide a solution.<sup>8</sup> For this purpose, new technologies and the web could be a useful tool to improve physical exercise even when at home. Many trainers and sports groups have developed online courses to stimulate the recovery of physical activity, useful for prevention of chronic diseases and for weight control. The greatest limitation is the lack of support from the group and the absence of sociality that arises from attending gyms or sports facilities.

Given the difficulties experienced by women in adhering to physical activity and exercise over the long term, it is important that future research focus on identifying social and psychological obstacles and barriers and suggesting actions to promote long-term maintenance of exercise.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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## AUTHOR CONTRIBUTIONS

Study concept and design: AVM and FC; acquisition of data: FC; drafting the manuscript: AVM and MN; critical revision of manuscript: MP; and study supervision: AVM, MN, and MP.

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