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Editorial

Post-COVID-19 syndrome and type 2 diabetes: Primacy of exercise in prevention and management



COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has resulted in millions of infections and deaths and shows no signs of abating. Those infected with SARS-CoV-2, typically develop symptoms, including respiratory, renal, cardiac, enteric, or musculoskeletal, a few days after exposure. In contrast, in “long-COVID” (also termed Post COVID-19 syndrome), one or more symptoms is present even after the expected period of clinical recovery, with signs or symptoms persisting over 12 weeks [1]. Recovery from post COVID-19 is anticipated to take many months.

COVID-19 appears to have intersected with another extant but largely overlooked pandemic, physical inactivity, and sedentarism [2]. It is noteworthy that the inactive phenotype typically coexists with overweight or obesity, and over time, often with multiple co-morbidities such as hypertension, type 2 diabetes (T2D), coronary heart disease, chronic kidney disease and hepatic dysfunction, all largely preventable with engagement in sufficient habitual physical activity [3]. A consistent finding is that many of these conditions, including T2D, is associated with an increased predilection for complications and mortality [4]. Further, these conditions are more common in ageing populations (where sedentarism is highly prevalent and a natural decline of functional capacity is accelerated), and also populations with critical COVID-19 disease and higher hospitalization rates [5]. Recent epidemiological evidence indicate definitive significant associations between COVID-19 infections and rates of obesity. Specifically, at least a fifth of the variability in global infections and a tenth of total SARS-CoV-2 mortalities are attributable to high prevalence of obesity [6]. To this end, we postulate common underlying denominators, physical inactivity (and associated reductions in muscular strength), and higher prevalence of obesity, that predisposes to poor prognosis in COVID-19 patients.

Unfortunately, over the last 24 months, the augmented transmissibility of SARS-CoV-2 necessitated the implementation of a plethora of public health mitigation strategies aimed at curtailing the movement of large population numbers. For instance, most jurisdictions mandated physical confinement and perimeter closures of localities to limit mobility as a first step. Subsequent measures included the banning of all types of group activities, including many recreational and sporting activities, commonly undertaken in parks, leisure areas, gymnasium and swimming pools. A legacy of such restrictions designed to minimize the spread of the disease, may have been the escalation of inactivity, and consequently, increased chronic non-communicable diseases (NCDs). As a minimum, the collective impact of these restrictive measures has been

the further deterioration in the health of many people, including reductions in physical activity levels.

As with many other global health emergencies, people from socio-economically disadvantaged backgrounds – particularly in low-to-middle income countries (LMICs) - have endured the worst of COVID-19. Such is the gravitas of the situation, that some have contended that for people living in these settings, COVID-19 is a syndemic where a synergistic pandemic interacts with various social, ecological, and political factors and exacerbates other lifestyle-related diseases [7,8]. The resurgence of diabetes in the COVID-19 era in India, is a good case in point [9]. Interestingly, COVID-infected Asian Indians who have fared the worst have also harboured at least one lifestyle-related comorbidity, with T2D showing the strongest reported associations with severe disease, hospitalisations and death [10]. T2D stimulates viral replication, augments the risk of COVID-19 severity by 33%, increases Intensive care unit admissions by approximately 20%, and substantially increases the requirement for mechanical ventilation [11]. Further complicating the current situation, recent evidence points to a rise in new-onset diabetes mellitus, particularly in patients with long-COVID [12]. Considering all of the above, one could posit that much of the present scenario could potentially be attributed to chronic physical inactivity in India [13].

Post COVID-19 syndrome affects many persons, etiologically related to several factors, and consists of symptoms related to almost every organ. Overall, much of the damage caused by SARS-CoV-2 is centred around a malfunctioning inflammatory system (hypersecretion of proinflammatory cytokines etc.), which has shown to be effectively modulated by exercise-induced production/secretion of myokines [14]. The aetiology of COVID-19 associated myalgia and muscle loss can be varied although both neuropathy, myopathy and consequential sarcopenia can all be viable reasons. On the other hand, some evidence suggests that COVID-19 infection itself, along with the associated hospitalization, protein and vitamin deficiencies and corticosteroid medication, can also lead to rapid onset sarcopenia [15], indicating a bidirectional relationship. Further, certain phenotypes (e.g., elderly female patients with pre-existing T2D and are sarcopenic) have shown comparatively worse declines in functional capacity (excessive fatigue, difficulty walking etc.) and delays in recovery from COVID-19 [16]. Further, Post COVID-19 syndrome could affect patients with diabetes differentially [17]. Fatigue is the most common symptomatology of post COVID-19 syndrome, and according to a recent study, it is seen more in patients with T2D [16]. These people usually have suffered from severe disease and also show reduced handgrip

strength, a marker of sarcopenia [16]. Overall, given the potency of habitual physical activity to mitigate symptomatology of both SARS-CoV-2 infection and chronic NCDs (e.g., T2D) that exacerbate it [18], it is important to consider the inclusion of exercise as a possible prevention strategy of COVID-19, and for strengthening rehabilitation after post COVID-19 syndrome. Further, literature is replete with evidence regarding acute and chronic effects of exercise on the immune defence [14]. More specifically, it is evident that the exercise induced myokine production and the subsequent improvement of humoral immunity is particularly useful in mitigating the harmful effects of SARS-CoV-2 [19]. Currently it has been suggested that returning to exercise (with minimal exertion) is relatively safe for risk stratified patients after at least seven days without symptoms [20].

During this continuing pandemic, all people should be encouraged to at least achieve the minimum dose of regular physical activity to ensure fitness. More focussed work is warranted to better understand how exercise-based treatments may impact post COVID-19 syndrome remission and recovery, with further clarification and practical insights about the modality, intensity, and volume of potential exercise prescription. To this end, extant evidence supports the use of home and outdoor-based exercise regimens that may help reduce the impact of bed rest and physical isolation at different stages of treatment for mild COVID-19 [14]. Societal investments should acknowledge the reciprocity between infectious diseases, inactivity, and chronic NCDs and accordingly, be better prepared for crises in the future.

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