

Risk/caution of vitamin D insufficiency for quarantined athletes returning to play after COVID-19

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With the ongoing COVID-19 outbreak, athletes have been restricted from outdoor training. This has affected the nutritional status of athletes in various ways, especially with regard to their vitamin D status/level, which is produced in response to sun exposure. Vitamin D is essential for maintaining bone mass, muscle strength and physical performance. It likewise plays multiple other roles in the body, such as helping in calcium absorption and supporting the immune system.¹ Therefore, sufficient vitamin D is indispensable not only for keeping healthy musculoskeletal conditions, but also for improving immune response, especially amidst the COVID-19 outbreak.

Insufficient vitamin D is known as a risk factor for developing stress fractures in military personnel and athletes; low level of vitamin D is also associated with the incidence of muscle injuries. Winter sports athletes have a greater chance of experiencing vitamin D insufficiency as compared to those engaged in spring sports. There is a high prevalence of vitamin D insufficiency among these athletes even in regular situations, resulting in higher risk of stress fractures, illnesses and delayed muscle recovery.²

Serum concentration of 25-hydroxyvitamin D (25-OHD) is the best indicator of vitamin D status with a long circulating half-life time (15 days). Ruohola *et al* demonstrated the association between the occurrence of stress fractures and low vitamin D level in 800 young Finnish men undergoing military training.³ They found that the median 25-OHD level was lower in the stress fractured group (25.7 ng/mL) than in the non-fractured group (30.5 ng/mL), with 81.8% of the fracture patients falling below the median. Shimasaki *et al* revealed that insufficient serum 25-OHD levels of less than 30 ng/mL were associated with significantly increased odds (OR=23.3) for developing fifth metatarsal stress fractures in male Japanese college footballers.⁴ Rebolledo *et al* demonstrated

that inadequate vitamin D levels showed a 3.61 higher odds of hamstring injury in NFL players.⁵

When athletes return to their sports after the COVID-19 hiatus, they are also exposed to the risks of excessive training and training errors. Excessive training is common early on in the athlete's season and is remedied by increasing the players' load gradually; however, given the COVID-19 situation, the athletes no longer have enough time to prepare for their competition. Meanwhile, training errors such as changes in training method, surface and shoes can also occur under restricted training situations of quarantined athletes. In addition to these abnormal situations, insufficient vitamin D level caused by less access to sunlight could synergistically increase the risk of injuries such as stress fractures and muscle strains.

According to these backgrounds, this study was performed to know whether lockdown affected the vitamin D status/level in athletes. On 7 April 2020, the Japanese prime minister declared a state of emergency due to the coronavirus pandemic. Thus, most of the football clubs stopped team training. This analysis involves a professional Japanese football team located 200 km north from Tokyo, which has stopped team training since 8 April 2020. **Table 1** shows a comparison of the serum vitamin D (25-OHD) levels among their players in 2018 (n=23) and 2020 (n=24). All of these players are men. Written informed consent was obtained from players before drawing the blood. The study was approved by the Ethical Committee of the Juntendo university (approval number: #20-157). In 2018, without the coronavirus pandemic, their vitamin D levels were higher during the spring season (May) than during the winter season (January) (29.1 vs 33.3 ng/mL on average). Contrastingly, in 2020, the results during the spring season taken on 8 May were strikingly low (23.8 vs 21.8 ng/mL). Based on the Japan Meteorological Agency report, the daylight



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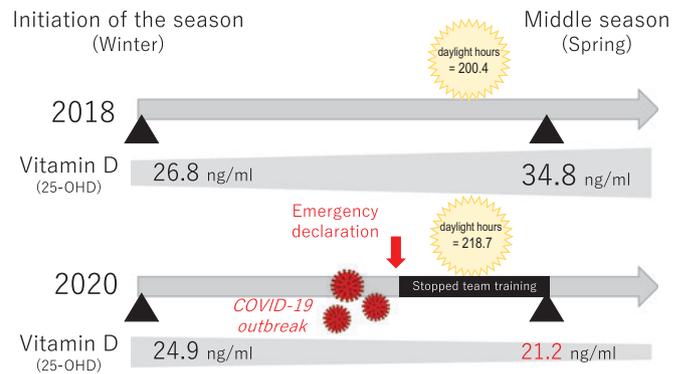
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Table 1 Serum vitamin D levels in 2018 and 2020

	2018	2020	P value
Number of players	23	24	
Body weight (kg)	73.2±6.4	73.7±7.7	n.s.
Height (cm)	175.0±6.2	177.0±6.7	n.s.
Body mass index	23.9±1.7	23.4±1.1	n.s.
Muscle mass (kg)	35.3±3.3	35.1±3.6	n.s.
Age (years)	22.7±2.0	23.2±2.0	n.s.
25-OHD (ng/mL) at winter	29.7±4.8	23.8±5.1	<0.001
25-OHD (ng/mL) at spring	36.0±5.4	21.8±3.6	<0.001
Difference between winter and spring	+6.3±2.9	-2.0±4.4	<0.001
Players belonging to the team in both 2018 and 2020 (n=7)			
25-OHD (ng/mL) at winter	26.8±3.8	24.9±5.5	n.s.
25-OHD (ng/mL) at spring	34.8±6.8	21.2±5.3	<0.001
Difference between winter and spring	+8.0±3.6	-3.7±3.7	<0.001

hours during this period at this region were 218.7 and 200.4 hours in 2020 and 2018, respectively. In 2018, only three players (13%) were vitamin D insufficient (less than 30 ng/mL) in spring. However, surprisingly, all of the players were at less than 30 ng/mL in spring 2020, although five players (20.9%) were above 30 ng/mL at the beginning of the season. Seven players belonged to the team for both years; their vitamin D levels were not different in winter season between 2018 and 2020, but were significantly low in spring 2020 (table 1).

These facts clearly indicate that the stay-at-home orders and restriction of outdoor training have resulted in low vitamin D levels in athletes (figure 1). This phenomenon is not just limited to athletes, but applies to anyone who has refrained from going outside given the emergency declaration. According to these observations, everyone, especially athletes and sports-loving people, must be cautious when returning to their training after the COVID-19 quarantine period to decrease the risk of sports-related injuries. The physicians who manage sports participants should recognise this fact and inform the athletes about the importance to maintain the status/level of vitamin D to prevent injury.

**Figure 1** COVID-19 affected the serum vitamin D level.

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