



# Effects of the COVID-19 pandemic on body composition among patients with rheumatoid arthritis

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## ABSTRACT

**Objectives:** To evaluate effects of the COVID-19 pandemic on body composition among patients with rheumatoid arthritis (RA).

**Methods:** A total 102 patients with RA were enrolled. We examined muscle mass, fat-free mass index (FFMI) and fat mass index (FMI) values using bioelectrical impedance analysis between November 2019 and January 2020 (for the first measurement) and September 2020 and January 2021 (for the second measurement).

**Results:** The muscle mass was significantly decreased from a median of 34.6 kg at the first measurement to a median of 33.9 kg at the second measurement ( $p = 0.002$ ). The FFMI was significantly decreased from a median of 15.3 at the first measurement to a median of 14.8 at the second measurement ( $p = 0.011$ ).

**Conclusions:** The present study reveals that muscle mass and FFMI decreased among patients with RA during the COVID-19 pandemic.

**KEYWORDS:** Body composition; COVID-19; muscle loss; rheumatoid arthritis

The coronavirus disease 2019 (COVID-19) pandemic had serious effects around the entire world. In some countries, shops, schools, and gyms and other services have been closed to decrease the risk of infection with COVID-19. In Japan, the government asked people to self-quarantine from February 2020 and announced a state of emergency between April 2020 and May 2020. Patients with older age and/or chronic diseases were more likely to stay home [1]. This has led to many patients with diabetes experiencing increased weight gain and decreased exercise during COVID-19 pandemic [2]. While this effect has been noted, the effects of the COVID-19 pandemic on muscle mass among patients with rheumatoid arthritis (RA) are unclear. We hypothesized that patients with RA would have experienced a decline in muscle mass during the course of the COVID-19 pandemic. To investigate this hypothesis, we enrolled 102 patients with RA between November 2019 and January 2020 (for the first measurement) and September 2020 and January 2021 (for the second measurement). Patients who completed two muscle mass measurements using bioelectrical impedance analysis (MC-780A, TANITA, Tokyo, Japan) 2–4 hours after breakfast were assessed. The fat-free mass index (FFMI) and fat mass index (FMI) values were used to analyze body composition and were calculated from the fat-free mass and fat mass divided by the square of the patient's height ( $\text{kg}/\text{m}^2$ ), respectively. We investigated self-assessment reports for the infection risk of COVID-19 and the amount of exercise during the COVID-19 pandemic. Analyses of comparison between values of the first and second measurements in body composition and patient

characteristics, and results of self-assessment reports were carried out with Mann–Whitney's U test and Fisher's exact test. Statistical significance was established at a  $p$ -value  $< .05$ .

Table 1 shows the demographic and clinical characteristics of the study population. Table 2 shows the results of univariate analysis of body composition to compare the first and second measurements. Our analyses revealed that FFMI was significantly decreased during the COVID-19 pandemic (from a median of 15.3 at the first measurement to a median of 14.8 at the second measurement,  $p = .011$ ). However, FMI and basal metabolic rate did not change significantly. Of the total patients, 51.0% had felt anxious that patients with RA had a higher risk in infection of COVID-19 than the general population, the patients with anxiety and reduced exercise had a significantly decreased FFMI than those without anxiety and reduced exercise ( $p < .001$  and  $p < .010$ , respectively).

Lockdown or quarantine during the COVID-19 pandemic has been reported to have increased psychological distress in various populations [3–5]. Among patients who were discharged from hospitals following admission for infection with COVID-19, 63% experienced fatigue or muscle weakness at 186 days after symptom onset (median follow-up period) [6]. On studying the body composition of the patients in this study, the FMI was almost the same, and the FFMI was lower than those of the patients in the previous reports [7, 8]. These results are considered to be influenced by the difference in body mass index (BMI) between this study and the previous reports (BMI: 27.9–28.4). In patients with RA, muscle loss is accelerated compared with the healthy population

**Table 1.** Demographic and clinical characteristics of the study population.

Variables	First time	Second time	<i>p</i>
Age, years; mean (SD), median (Q1, Q3)	67.9 (11.6), 70.5 (59.3, 76)	68.7 (11.5), 71.5 (60.3, 77)	NA
Sex, female; <i>n</i> (%)	95 (93.1)		NA
Disease duration, years; mean (SD), median (Q1, Q3)	12.8 (9.1), 10 (7, 16)	13.6 (9.1), 11 (8, 17)	NA
BMI; mean (SD), median (Q1, Q3)	22.5 (4.1), 22.1 (19.8, 24.9)	22.4 (4.2), 21.8 (19.7, 24.4)	.776
Anti-CCP Ab positive; <i>n</i> (%)	85 (83.3)		NA
bDMARDs or tsDMARDs use, <i>n</i> (%)	51 (50.0)	54 (52.9)	.779
MTX use; <i>n</i> (%)	72 (70.6)	71 (69.6)	1.000
Glucocorticoid use; <i>n</i> (%)	17 (16.7)	12 (11.8)	.524
DAS28-ESR; mean (SD), median (Q1, Q3)	2.35 (0.90), 2.37 (1.73, 2.87)	2.38 (0.79), 2.47 (1.88, 2.83)	.847
HAQ-DI; mean (SD), median (Q1, Q3)	0.26 (0.46), 0 (0, 0.38)	0.29 (0.51), 0 (0, 0.38)	.323

SD: standard deviation; Q1: 25th percentile; Q3: 75th percentile; NA: not applicable; anti-CCP Ab: anti-cyclic citrullinated peptide antibody; bDMARDs: biological disease-modifying antirheumatic drugs; tsDMARDs: targeted synthetic disease-modifying antirheumatic drugs; MTX; methotrexate; DAS: disease activity score; ESR: erythrocyte sedimentation rate; HAQ-DI: Health Assessment Questionnaire Disability Index.

[9]. The prevalence of sarcopenia in patients with RA was higher than the control group [8, 10]. Therefore, we should note muscle loss in patients with RA, including the effects of the COVID-19 pandemic. The change of FFMI was also associated with aging [11, 12]. There was a negative correlation between age and muscle mass, and there were no gender differences with respect to gender [12]. Since the amount of change in the FFMI per year is predicted to be about 0.06, we believe that the effect of aging on the results of this study is small. A report from Spain indicated that physical activity levels were reduced among older community dwellers during the COVID-19 lockdown period [13]. The World Health Organization recommends that home-based exercises are carried out during self-quarantine for good health. The European League Against Rheumatism Task Force recommended physical activity and exercise for patients with RA [14], and partaking in exercise has been shown to improve depression and increase quadriceps muscle mass among such patients [15, 16]. We believe that patients with RA may have a strong fear of COVID-19 infection and, therefore, have less opportunity for physical activity during lockdown or self-quarantine. For this reason, the COVID-19 pandemic may lead to increased muscle loss in patients with RA in the long term.

This study has some limitations, which should be acknowledged. First, we did not evaluate the daily physical activity of the study population during the COVID-19 pandemic. Second, the timing of the measurement does not coincide exactly with the beginning of the COVID-19 pandemic. Finally, there is no control group. Similar to the observations of this study, muscle loss may occur in the general population as well. However, we believe that an understanding of the effects of the COVID-19 pandemic should focus on muscle loss in patients with RA. Further prospective studies are warranted to confirm the results of this study.

**Table 2.** Results of univariate analysis in body comparing first-time and second-time measurements of body composition calculated from the fat-free and fat mass indices.

Factors; median (Q1, Q3)	First time	Second time	<i>p</i> value
Body weight, kg	52.5 (47.4, 60.5)	53 (47.7, 59.6)	.959
Muscle mass, kg	34.6 (31.9, 37.5)	33.9 (32.0, 36.3)	.002
Body water, kg	26.6 (23.8, 29.1)	26.3 (24.2, 28.3)	.843
FFMI	15.3 (14.3, 15.9)	14.8 (14.0, 15.5)	.011
FMI	6.4 (4.7, 8.1)	6.7 (5.2, 8.4)	.231
Basal metabolic rate, kcal	1053 (969, 1148)	1035 (956, 1134)	.488

Q1: 25th percentile; Q3: 75th percentile; FFMI: fat free mass index; FMI: fat mass index.

The present study reveals that FFMI decreased among patients with RA during the COVID-19 pandemic. We conclude that lockdown and self-quarantine experienced by such patients during the COVID-19 pandemic situations lead to muscle loss due to reduced opportunity for physical activity. Hence, it is crucial to assess the current status of muscle loss in order to implement measures of prevention, such as exercise regimens during COVID-19 pandemic.

## Conflict of interest

None declared.

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