Original article DOI: 10.2478/aiht-2024-75-3886

Body composition and nutritional status in nursing home residents during the COVID-19 lockdown: a 15-month follow-up

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[Received in August 2024; Similarity Check in August 2024; Accepted in November 2024]

Since the beginning of the corona virus disease (COVID-19) pandemic, nursing home residents had been under strict quarantine, which greatly affected their lifestyle and health. In this follow-up study, we analysed whether lifestyle changes during the lockdown had an impact on their body composition and nutritional status. For this purpose we determined body composition, nutritional status, and osteosarcopenic adiposity (OSA) prevalence in 24 volunteer nursing home residents just before the February 2020 COVID-19 lockdown and about 15 months into the lockdown. Body composition (total bone mass, lean and fat tissue components) was assessed with bioelectrical impedance. OSA was established if the participants had sarcopenia, osteopenia, and adiposity. Information on dietary habits, weight loss, and self-perception of health were obtained with the Mini Nutritional Assessment (MNA) form, while nutritional status was assessed with the MNA-Short Form (SF). At baseline, OSA was determined in 14 participants and at the follow-up in 16 participants. The results show an overall decrease in bone and lean tissues and increase in fat tissue. There were significantly more participants with a normal nutritional status than those at risk of malnutrition or malnourished ($p=0.045$). Our findings suggest that negative changes in body composition during the pandemic are owed to age rather than to changes in lifestyle caused by the pandemic. Regular monitoring of body composition in nursing homes may help to preserve the health of older people in general and particularly in cases of possible future lockdowns.

KEY WORDS: bioelectrical impedance; elderly; Mini Nutritional Assessment form; osteosarcopenic adiposity; pandemic

Older age inevitably brings unfavourable changes in body composition leading to loss of bone and muscle mass/strength and to an increase and redistribution of fat tissue (1). These changes may lead to the development of osteoporosis, sarcopenia, adiposity/obesity, and eventually to the osteosarcopenic adiposity (OSA) syndrome (2). OSA may worsen various physiological processes and is considered a risk factor for major chronic conditions, such as cardiovascular diseases and diabetes (2, 3). Its prevalence varies widely but ranges between around 48 % in men to around 71 % in women living in nursing homes (4). As has frequently been reported, older people were more vulnerable to the negative health consequences of the COVID-19 lockdown than younger adults (5–7). This was particularly manifest with lower dietary intake and worsened nutritional status, as the elderly either reduced or changed their food intake. Several population-based studies (conducted in the general population older than 50 years) showed that restrictions during the lockdown led to changes in eating habits (8), while others reported that older people maintained food security despite quarantine (9–11). Moreover, it is expected that other changes in lifestyle, including restricted movement, reduced physical activity, and psychological stress would adversely affect the body composition in the elderly, especially if they were nursing home residents (9).

Therefore, the aim of our study was to follow changes in body composition and nutritional status in nursing home residents who had a relatively good health status 15 months into the first COVID-19 lockdown, that is, between February 2020 and May/June 2021, when the lockdown was lifted. Since everyone experienced significant changes in the daily rhythm of life, we hoped that this study would provide useful information on the impact of those changes on body composition and nutritional status and help to develop or improve preventive health measures in that specific and sensitive population group.

PARTICIPANTS AND METHODS

A detailed description of participants, recruitment, and measurements has been reported in a previous article that included six nursing homes in Zagreb, Croatia (12). The inclusion criteria were the ability to stand/walk independently (with or without aid) and to give informed consent. The exclusion criteria were a history of a serious chronic disease (severe mental/psychiatric disorder, epilepsy, cancer, Parkinson's disease, stroke, severe dementia, significant cognitive impairment) and health conditions that prevented bioimpedance measurement (e.g., pacemaker, amputation). This study included a total of 24 nursing home residents (22 of whom were women), who were followed for 15 months. Seven (six

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women) had COVID-19, confirmed by real-time polymerase chain reaction (PCR). All of them recovered without serious consequences.

All measurements were taken and the questionnaires administered in the nursing home in the morning. Body weight and height were measured in indoor clothing without shoes to calculate body mass index (BMI) (kg/m^2). Body composition was assessed with a bioelectrical impedance device BIA-ACC® (BioTekna, Marcon, Venice, Italy) in a supine position with legs slightly spread apart and arms not touching the body. Two electrodes were placed on the right hand (metacarpal and wrist area) and two on the right leg (metatarsal and ankle area). The measured parameters were fat mass (FM; kg; % of body weight); abdominal adipose tissue (AAT; cm^2); fat-free mass (FFM; kg; % of body weight); skeletal muscle mass (SM; kg; % of FFM; yielding the S-score), and total bone mass (BM; kg, yielding the T-score). OSA prevalence was calculated based on the criteria used previously (13), including the T-score of ≤-1.0 for the identification of osteopenia/osteoporosis, the S-score of ≤-1.0 for identification of sarcopenia, and total fat mass ≥25 % for men and ≥32 % for women.

All study procedures followed the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of the Institute for Medical Research and Occupational Health (approval No. 100-21/18-10), and all participants signed informed consent at the beginning of the study.

Questionnaires

Before the measurements, the study participants were asked to complete the Mini Nutritional Assessment-Short form (MNA-SF) questionnaire to estimate nutritional status (14). It comprises six questions about appetite, weight loss, mobility, psychological stress or acute disease, neuropsychological problems, and body mass index. The scoring ranges from 0–14 points: scores 12–14 points denote normal nutritional status; 8–11 risk of malnutrition, and 0–7 points malnutrition. In addition to the MNA short form, we also applied questions from the full MNA form related to mid-arm and calf circumference (necessary for nutritional status assessment), dietary habits (number of meals, consumption of food that is a good source of proteins, fruit and vegetable intake, and fluid intake), and self-perception of health and nutritional status (15).

Statistical analysis

The results are expressed as means ± standard deviations and percentages. The distribution of variables was tested with the Kolmogorov-Smirnov test. Only the S-score was not normally distributed. Due to a small number of participants, the Wilcoxon matched-pairs test was used to compare medians of dependent variables collected at baseline and at follow-up. This model assumes that the data originate from two dependent populations, following the same person through time, and is suitable for sample sizes of less than 30. The suitability of the sample size was confirmed by the post-hoc power analysis for the Wilcoxon matched-pairs (signed rank) test on the G*Power software, version 3.1.9.7. (Universität Kiel, Kiel, Germany). The input parameters were the sample size of two dependent groups (n=24), effect size of 0.5, and alpha error probability of 0.05. The power (1- β err prob) was 0.749.

To test the differences in medians between the participants who had had and those who had not had COVID-19 we used the Mann-Whitney *U* test. Pearson's chi-squared test was used to compare the percentages between two or more different answers to the MNA. Analyses were done with Statistica 14.0.0.15 software (StatSoft, Inc., Tulsa, OK, USA). The level of significance was set to $p<0.05$.

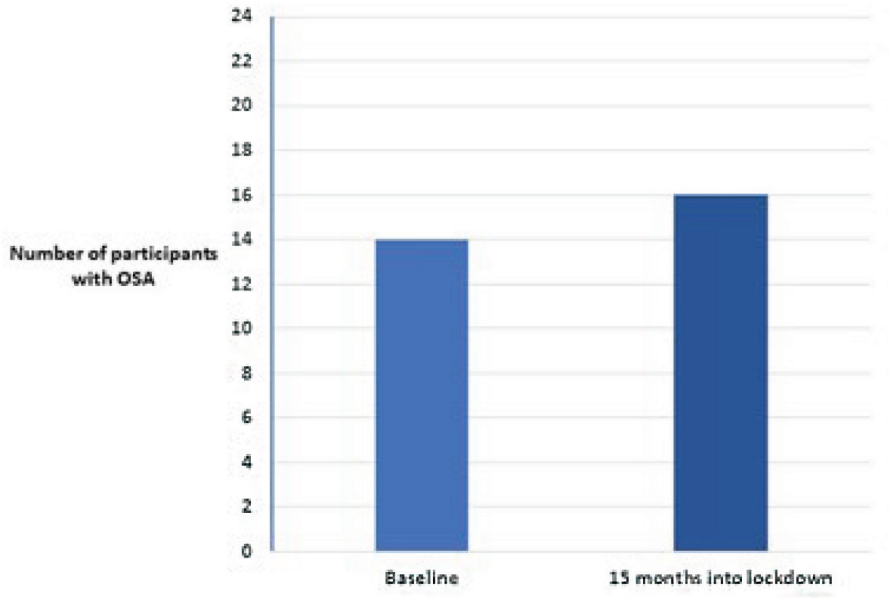

Figure 1 Prevalence of osteosarcopenic adiposity (OSA) in all participants at baseline and 15 months into the first COVID-19 lockdown

Table 1 Comparison of mean age and body composition parameters between baseline and follow-up measurements in all participants (n=24)

Parameter	Baseline (mean±SD)	Follow-up (mean±SD)	Reference range	p*
Age (years)	83.3±5.3	84.0±5.8	/	**0.002**
BMI (kg/m^2)	29.2±5.9	29.3±5.5	18.0–24.9	0.434
FM (% BW)	41.4±5.9	42.5±4.8	12–30	0.465
AAT (cm^2)	504.3±117.8	503.6±160.8	<460	0.614
FFM (% BW)	58.5±5.9	57.4±4.8	>75	0.465
SM (% FFM)	27.1±5.9	25.4±6.8	>30	**0.008**
S-score	-1.2±1.7	-1.4±1.8	>-1.0	**0.046**
BM (kg)	2.8±0.7	2.7±0.7	>3.0	**0.014**
T-score	-1.3±1.0	-1.5±1.1	>-1.0	**0.005**

AAT – abdominal adipose tissue; BM – bone mass; BMI – body mass index; BW – body weight; FFM – fat-free mass; FM – fat mass; SM – skeletal muscle mass; * Wilcoxon matched-pairs test

RESULTS

The mean age of the participants was 83.3 years at baseline. Eighteen had hypertension, six had chronic heart diseases, and one participant had hypothyroidism. No participants had particular eating habits (dietary requirements). As for the baseline BMI, eight participants had normal weight, seven were overweight, and nine were obese. At the follow-up, seven had normal weight, six were overweight, and 11 were obese.

Table 1 shows mean values of all body composition parameters in both measurements. At baseline, mean values of BMI, FM %, and AAT were higher than normal, while skeletal muscle (SM %, S-score) and bone mass (BM, T-score) were below the reference values. At follow-up, BMI remained unchanged and FM % slightly increased, while skeletal muscle mass decreased (p=0.008 for SM %; p=0.036 for S-score), as did the bone mass (p=0.014 for BM; p=0.005 for T-score). OSA was determined in 14 participants at baseline and in 16 at follow-up (Figure 1).

There were no significant differences in body composition between participants who had had COVID-19 and those who had not had it either at the baseline or the follow-up (results not presented). In participants who had had COVID-19 we observed a non-significant decrease in bone, lean, and fat tissue between two measurements. In contrast, participants who had not had COVID-19 experienced a significant increase in FM % (p=0.046), while bone and lean tissue values significantly decreased (p=0.038 for SM %; p=0.027 for BM and p=0.025 for the T-score) (results not presented).

Table 2 shows that, according to the MNA-SF questionnaire, 18 participants had normal nutritional status, far more than those who ran the risk of or suffered malnutrition (p=0.045). Seventeen participants reported no decline in food intake in the previous three months. However, eight reported weight loss (between 1–3 kg or >3 kg) at follow-up, but according to objective body mass measurement, all eight gained weight by that time. This discrepancy is probably the result of false body weight self-perception, possibly due to relatively infrequent weight control. A large majority reported good mobility, being able to go outside the nursing home, having three meals per day and consuming dairy products and meat/fish every day. Most consumed 3–5 cups of fluid per day. We found no significant differences in body composition between participants who had normal nutritional status and those who ran the risk of malnutrition or were malnourished.

DISCUSSION

During the 15-month lockdown, the nursing home residents in our study lost bone and lean tissue and gained fat tissue. The prevalence of OSA, as the most unfavourable change in body composition, was relatively high at the baseline and slightly increased after 15 months. These changes in body composition occurred even though weight and/or BMI did not change, which is in line with other reports (16, 17). In fact, they are most likely owed to the adverse trajectories of ageing (1). However, that may also have been heightened by the lockdown and restricted living conditions in nursing homes, as indicated by noticeable differences in the pattern of change in body composition between the participants who had had COVID-19 and those who had not had it, since participants with COVID-19 experienced a drop in bone, muscle, and fat tissue. Therefore, our results point to the importance of body composition for overall health and its quick responses, not just to ageing but to other health and living conditions, which were markedly changed in the first year of lockdown, regardless of whether the residents had had COVID-19 or not.

At the follow-up, OSA was found in two new participants, and we believe that in the sample of 24 subjects, this increase is not negligible. To our knowledge, there is no longitudinal follow-up study on OSA, particularly among nursing home residents, to which we can directly compare our results. In one follow-up study conducted in a nursing home in Australia, residents (mean age >80

Table 2 Results of the Mini Nutritional Assessment forms

MNA short form	n=24 (%)	p*
Food intake decline (last 3 months)		
Severe	4 (16.6)	**<0.001**
Moderate	3 (12.5)	
No decline	17 (70.9)	
Weight loss (last 3 months)		
>3 kg	5 (20.8)	**0.008**
1–3 kg	2 (8.3)	
No weight loss	10 (41.6)	
Does not know	2 (8.3)	
Mobility		
Bed-bound	0	**<0.001**
Goes out	22 (91.6)	
Doesn't go out	2 (8.3)	
Psychological stress or acute disease (last 3 months)		
Yes	5 (20.8)	**<0.001**
No	19 (79.2)	
Neuropsychological problems	0	
Nutritional status		
Normal	18 (75.0)	**0.045**
Risk of malnutrition	5 (20.8)	
Malnourished	1 (4.1)	
MNA full form (selected data)		
Full meals per day		
1	0	**<0.001**
2	1 (4.2)	
3	23 (95.8)	
Dairy products every day		
Yes	23 (95.8)	**<0.001**
No	1 (4.2)	
Meat, fish, or poultry every day		
Yes	20 (83.4)	**<0.001**
No	4 (16.6)	
≥2 servings of fruit or vegetables per day		
Yes	4 (16.6)	**<0.001**
No	20 (83.4)	
Fluids per day		
<3 cups	8 (33.3)	**0.021**
3–5 cups	16 (66.6)	
Mode of feeding		
Self-fed	24 (100)	/

*Chi-squared test: differences in frequency of answers to the specific question

years) who did not have sarcopenia at baseline had a very slight decrease in skeletal muscle index (kg/m^2), and those who had sarcopenia at baseline showed even a slight increase (18). Some other studies in older community-dwelling adults of >65 years determined OSA prevalence of 10–30 % (19, 20). In the most recent epidemiological study (21), the OSA prevalence, determined by bioimpedance measurement in apparently heathy, community-dwelling adults of over 80 years of age was above 76 %, which is much higher than in our participants.

However, when comparing the results, different criteria for the diagnosis of OSA should be considered along with different techniques and instruments. The greatest differences are usually seen in the diagnosis of sarcopenia, which can be based on muscle mass alone, like in our study, but also on muscle mass combined with grip strength (22). These differences in the definition of sarcopenia may produce differences in the diagnosis of OSA, which eventually may result in discrepancies in OSA prevalence between studies.

It is worth noting that mean the S- and T-scores were relatively good in our participants and similar to the results obtained on a larger sample of nursing homes residents (4).

As for nutritional status, it was adequate in most participants. Most consumed enough food rich in proteins and had an adequate intake of fluids. We did not assess the intake of specific nutrients, so it is possible that some participants were deficient in some minerals and vitamins (23). Additionally, nearly all of the participants had good mobility (not bed-bound), and all were able to feed themselves. As we witnessed conducting this study in the nursing home, all necessary health measures were put in place when the pandemic started, which is very commendable. However, the basic organisation and permanent care for residents before the pandemic might be of even greater importance, which seems to have had been in place there as well.

The major limitation of our study is the relatively small number of participants, particularly of those with COVID-19. However, by using appropriate statistical methods, suitable for samples of less than 30 participants, we were able to show that negative changes in all body composition parameters are probably owed to ageing. The study was conducted in one of the ten city or state-owned nursing homes in Zagreb providing uniform care for their residents, including nutrition. Therefore, we believe that our sample, although small in number, is representative of public nursing home users.

Regardless of its limitation, our study has identified a different trend of changes in body composition in participants who had had COVID-19 and those who had not had it, since the participants who had had COVID-19 experienced a drop in all body composition parameters.

CONCLUSIONS

As far as we know, this is the only prospective follow-up study on body composition and nutrition in nursing home residents during the 15-month COVID-19 lockdown. The participants, who lived in a nursing home and had adequate nutritional and overall health status, experienced changes in body composition in terms of a decrease in bone and lean tissue and an increase in body fat. These changes can be attributed to the effect of age rather than to changes in the lifestyle during the lockdown, although a larger sample is needed to strengthen this conclusion.

Our findings also confirm the importance of body composition and nutritional status in the health of elderly persons and suggest that healthy body composition and adequate nutritional and health support in nursing homes can contribute to recovery from unfavourable circumstances like the pandemic lockdown and in preventing its consequences. Furthermore, this study provides arguments in favour of regular body composition and nutritional status monitoring to help to preserve the health of nursing home residents, and particularly in cases of possible future lockdowns.

Conflict of interests

None to declare.

Acknowledgments

This study was supported by the European Union—Next Generation EU (Program Contract of 8 December 2023, Class: 643-02/23-01/00016, Reg. No. 533-03-23-0006). The authors would like to thank all residents and staff of the nursing home "Sveti Josip" from Zagreb who participated in the study and made this research possible.

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Tjelesni sastav i nutritivni status tijekom pandemije u korisnika doma za starije osobe: 15-mjesečna studija praćenja

Od početka pandemije bolesti izazvane koronavirusom (COVID-19) korisnici domova za starije osobe boravili su u strogoj karanteni, što je značajno utjecalo na njihov način života i zdravlje. U ovom longitudinalnom istraživanju analizirali smo jesu li promjene u načinu života u tom razdoblju utjecale na tjelesni sastav i stanje uhranjenosti u toj specifičnoj populaciji. Sudjelovala su 24 volontera korisnika doma za starije osobe, kojima je određen nutritivni status i prevalencija osteosarkopenične pretilosti/adipoziteta (OSA) netom prije pandemijske karantene u veljači 2020. i ~15 mjeseci poslije. Tjelesni sastav procijenjen je metodom bioelektrične impedancije BIA-ACC®. Podatci o prehrambenim navikama, gubitku tjelesne težine, općem zdravstvenom stanju i samoprocjeni zdravlja dobiveni su upitnikom Mini Nutritional Assessment (MNA), a stanje uhranjenosti procijenjeno je upitnikom MNA-Short Form. Prevalencija OSA-e bila je 58,3 % na početku i 66,6 % nakon praćenja. Rezultati su pokazali smanjenje koštanog i nemasnog tkiva te povećanje masnog tkiva tijekom razdoblja praćenja. Značajno veći broj sudionika imao je normalan nutritivni status od onih koji su imali rizik od pothranjenosti ili su bili pothranjeni (p=0,045). Negativne promjene u tjelesnom sastavu u štićenika domova za starije osobe koji su imali dobar nutritivni status u 15-mjesečnom razdoblju praćenja, mogu se više pripisati promjenama vezanima uz dob nego posljedicama promjena načina života prouzročenih pandemijom. Redovito praćenje tjelesnoga sastava u domovima za starije osobe može biti jedna od korisnih mjera u očuvanju zdravlja starijih osoba općenito, kao i u slučaju mogućih budućih razdoblja izolacije.

KLJUČNE RIJEČI: COVID-19 pandemija; domovi za starije osobe; nutritivni status; starije osobe; tjelesni sastav