




MICRO REPORT

Association between eating balanced meals and depressive symptoms in Japanese hospital workers during the COVID-19 pandemic

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Funding information

NCGM COVID-19 Gift Fund; the Japan Health Research Promotion Bureau Research Fund, Grant/Award Number: 2020-B-09

Abstract

Aim: While accumulating evidence suggests a protective role of healthy diet against depression, evidence on this issue is limited among healthcare workers combating COVID-19 pandemic. The aim of this study was to determine the cross-sectional association between frequency of balanced meal consumption and depressive symptoms among Japanese hospital workers during the COVID-19 pandemic.

Methods: Participants were 2,457 workers of the National Center for Global Health and Medicine who responded to a questionnaire survey in October or December 2020. Depressive symptoms were assessed using the patient health questionnaire-9 (PHQ-9). The number of days per week of eating two or more balanced meals was categorized into four from ≤ 1 day/week to daily. The association between frequency of balanced meal consumption and depressive symptoms was assessed using logistic regression analysis, with adjustment for lifestyle and COVID-19-related factors.

Results: The prevalence of depressive symptoms was 14.8%. The odds of depressive symptoms increased with decreasing frequency of balanced meal consumption. The multivariable-adjusted odds ratios (95% confidence intervals) of depressive symptoms were 1.00 (reference), 1.09 (0.75-1.58), 1.62 (1.17-2.24), and 2.21 (1.54-3.17) for balanced meal consumption categories of daily, 4-5 days/week, 2-3 days/week, and ≤ 1 day/week, respectively (P for trend < 0.001).

Conclusions: Our results suggest that infrequent consumption of well-balanced meal is associated with increased depressive symptoms among hospital workers during the COVID-19 pandemic.

KEYWORDS

balanced meals, COVID-19, depressive symptoms, epidemiology, Japanese

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1 | INTRODUCTION

The ongoing pandemic of the coronavirus disease 2019 (COVID-19) has imposed a large psychological burden on healthcare workers.¹ Adequate nutrition has a potential to mitigate the psychological impact of COVID-19 for healthcare workers.² Meanwhile, restrictions on daily life and demanding work under the pandemic may reduce diet quality of healthcare workers, as suggested by a Chinese study,³ raising a concern of the adverse effect of poor diet on mental health. To date, some studies have reported an inverse association between adherence to a healthy/balanced diet and depressive symptoms in the general population during the COVID-19 pandemic.⁴⁻⁶ To our knowledge, however, no study has yet explored this issue among frontline healthcare workers. Here, we report the cross-sectional association of the frequency of balanced meal consumption with depressive symptoms among staff of the National Center for Global Health and Medicine (NCGM), which have accepted a large number of COVID-19 inpatients. We hypothesized that lower frequency consumption of balanced meals is related to higher depressive symptoms.

2 | METHODS

Data for the present study were derived from the NCGM Clinical Epidemiology Study on SARS-CoV-2 antibody, an ongoing clinical epidemiological study being conducted among workers at the NCGM during annual health checkups in October (Toyama area, Tokyo) and December (Kohnoday area, Chiba) 2020. Depressive symptoms were assessed using the Japanese version of the Patient Health Questionnaire (PHQ-9).⁷ Participants were asked how frequently they ate balanced meals using the following question: How many days per week do you eat at least two meals a day comprising a staple food (eg, rice, bread, and noodles), main dish (eg, fish, meat, eggs, and soy products), and side dish (eg, vegetables, mushrooms, potatoes, and algae)? Response options were ≤ 1 day/week, 2-3 days/week, 4-5 days/week, or daily. The balanced meals described are recommended by dietary guidelines for Japanese.⁸ In the first model, we adjusted for age, sex, work site, and occupation. The second model was further adjusted for leisure-time physical activity, smoking status, alcohol consumption, sleep duration, body mass index, comorbidity of chronic disorders, living arrangement, and frequency of eating with others, working hours and degree of possible exposure to SARS-CoV-2. Logistic regression analysis was used to estimate odds ratios (ORs) of depressive symptoms (PHQ-9 score ≥ 10). Details of the study procedure and variables used in this analysis are described in online supplementary file.

3 | RESULTS

Table 1 presents the characteristics (age- and sex-adjusted) of the study participants according to the frequency of balanced meal

consumption. Compared with participants who ate balanced meals on a daily basis, those who ate balanced meals less frequently were younger and more likely to be a current smoker, live alone, work long hours, and sleep shorter hours; they were less likely to eat with others and be engaged in physical activity on leisure.

Of 2,457 participants, 364 participants (14.8%) were identified as having depressive symptoms. In the age-, sex-, work site-, and occupation-adjusted model (model 1 in Table 2), the ORs of depressive symptoms tended to increase with decreasing frequency of balanced meal consumption (P for trend < 0.001). Participants who ate balanced meals ≤ 1 day/week and 2-3 days/week had significantly higher depressive symptoms than those who ate balanced meals daily. The association was somewhat attenuated after further adjustment for lifestyle and COVID-19-related work factors (model 2), but it remained statistically significant: the multivariable-adjusted ORs of depressive symptoms (95% confidence interval) for eating balanced meals 2-3 days/week and ≤ 1 day/week were 1.62 (1.17-2.24) and 2.21 (1.54-3.17), respectively, compared to eating balanced meals daily (P for trend < 0.001).

4 | DISCUSSION

Among healthcare workers and ancillary staff of a large hospital in Tokyo, Japan, we found increased depressive symptoms associated with a lower frequency of eating balanced meals, even after controlling for a range of lifestyle and COVID-19-related work factors. To our knowledge, this is the first study to demonstrate a link of depressive symptoms to diet quality among healthcare workers under the COVID-19 pandemic.

Our finding is in line with the results of a meta-analysis of pre-pandemic studies, which reported a lower risk of depressive symptoms among people who adhered to a high-quality diet.⁹ During the COVID-19 pandemic, studies among the general population replicated the association between adherence to a healthy/balanced diet and better mood.⁴⁻⁶ The present study extended the evidence on this link to frontline hospital workers under the pandemic.

In the present study population, those who less frequently ate a balanced diet tended to work in demanding situations (eg, long working hours) and were less likely to adhere to a healthy lifestyle (eg, short sleep duration) than those who did so daily. Therefore, the observed association between balanced diet and lower depressive symptoms could be ascribed to confounding by these correlates. We confirmed, however, that the association was virtually unchanged after controlling for lifestyle factors, arguing against confounding as an explanation for the observed association.

The balanced diet has good nutrition profile. According to a study based on the National Health and Nutrition Survey in Japan, the intake of nutrients with mood-modulating potential such as vitamins (eg, folate) and minerals (eg, magnesium)² increased with increasing frequency of well-balanced meals.¹⁰ These nutrients in balanced diet may jointly protect against depression.

TABLE 1 Age- and sex-adjusted characteristics of the study participants by categories of the frequency of balanced meal consumption*

	Frequency of balanced meal consumption			
	Daily	4-5 days/ week	2-3 days/ week	≤1 day/ week
Number of participants	822	484	717	434
Age (mean ± s.d., year)	42.9 ± 0.40	39.9 ± 0.52	36.2 ± 0.43	34.0 ± 0.55
Sex (men, %)	0.29	0.31	0.30	0.31
Work site (Tokyo, %)	77.8	77.8	83.2	79.6
Occupation (doctor, %)	15.1	12.2	15.5	9.1
Working hours (≥11 hours/day, %)	10.4	11.0	14.1	14.9
Degree of possible exposure to SARS-CoV-2 (high [†] , %)	20.6	25.2	23.2	24.0
Leisure-time physical activity (≥ 60 minutes/week, %)	34.0	35.2	29.2	30.2
Smoking status (current, %)	5.0	5.5	6.2	10.1
Alcohol consumption (current [‡] , %)	41.5	35.8	39.7	35.6
Sleep duration (<6 hours/day, %)	42.1	52.5	51.2	62.3
BMI (mean ± s.d., kg/m ²)	21.7 ± 0.11	21.9 ± 0.15	22.1 ± 0.12	21.9 ± 0.16
Comorbidity of chronic disorders (yes [§] , %).	18.0	18.7	17.1	18.9
Living arrangement (living alone, %)	15.4	31.1	47.3	54.3
Frequency of eating with others (<1 day/week, %)	10.8	13.6	22.2	29.8

Abbreviations: s.d., standard deviation, BMI, body mass index.

*Data were expressed as means (s.d.) and percentages for continuous variables and categorical variables, respectively, adjusted for age and sex. Their differences across categories of the frequency of balanced meal consumption were tested using linear regression analysis or multiple logistic regression for continuous and categorical variables, respectively.

[†]Individuals engaged in COVID-19-related work with heavy exposure to the virus.

[‡]Alcohol consumption of at least one day per week.

[§]Chronic disorders include diabetes, hypertension, chronic obstructive pulmonary disease, heart disease, cerebrovascular disease, cancer, and other chronic diseases.

TABLE 2 Odds ratios and 95% confidence intervals for depressive symptoms according to categories of the frequency of balanced meal consumption

	Frequency of balanced meal consumption				P for trend [†]
	Daily	4-5 days/week	2-3 days/week	≤1 day/week	
Participants with/without depressive symptoms	80/742	57/427	121/596	106/328	
Model 1 [†]	1.00 (ref)	1.19 (0.83-1.71)	1.83 (1.34-2.50)	2.78 (1.99-3.88)	< 0.001
Model 2 [‡]	1.00 (ref)	1.09 (0.75-1.58)	1.62 (1.17-2.24)	2.21 (1.54-3.17)	< 0.001

*Based on multiple logistic regression analyses, assigning ordinal numbers of 1-4 to the categories of frequency of balanced meal consumption.

[†]Adjusted for age (years, continuous), sex, work site (Tokyo or Chiba), and occupation (doctor, nurse, allied healthcare professional, administration, or other).

[‡]Adjusted for age (years, continuous), sex, work site (Tokyo or Chiba), occupation (doctor, nurse, allied healthcare professional, administration, or other), leisure-time physical activity (none, <1, 1 to <2, or ≥2 hours/week), smoking status (never-smoker, quitter, or current smoker [cigarette or heat-not burn cigarette]), alcohol consumption (nondrinker or quitter, weekly drinker consuming <1, 1 to <2, or ≥2 go/day; one go contains approximately 23 g of ethanol), sleep duration (<6, 6-6.9, or ≥7 hours/day), body mass index (<18.5, 18.5-<23, 23-<25, 25-<30, or ≥30 kg/m²), comorbidity of chronic disorders (yes or no), living arrangement (living alone or living with others), and frequency of eating with others (<1 or ≥1 day/week), working hours (≤8, 9-10, or ≥11 hours/day) and degree of possible exposure to SARS-CoV-2 (low, moderate, or high).



The prevalence of depressive symptoms in the present study (14.8%) was similar to that reported from a recent Japanese study among healthcare workers using PHQ-9 (12.0%).¹¹ These figures were lower than the prevalence of depressive symptoms (PHQ-9) among hospital workers after the Great East Japan Earthquake (22.0%).¹²

Our study had several limitations. First, the cross-sectional design did not allow us to assess the temporal association between eating well-balanced meals and depressive symptoms. A lower frequency of well-balanced meals may be caused by the loss of appetite, a typical symptom of depression. Second, although we adjusted for many potential confounders, we could not rule out the possibility of bias due to unmeasured or residual confounding. Lastly, our study was conducted in a medical institute which accepted many COVID-19 inpatients; thus, caution should be exercised when generalizing the results to other settings.

5 | CONCLUSION

The present study among Japanese hospital employees suggests the importance of adherence to well-balanced meals in the prevention of depressive symptoms during the COVID-19 pandemic. The observed association in this cross-sectional study requires confirmation in prospective studies. The comparison of dietary habit and depressive status between pre- and post-pandemic periods would also contribute to the understanding of the impact of balanced diet on mental health during the pandemic.

ACKNOWLEDGMENTS

This work was supported by the NCGM COVID-19 Gift Fund and the Japan Health Research Promotion Bureau Research Fund (2020-B-09).

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

T. Miki wrote the first draft of the manuscript, and other authors critically revised the manuscript. All authors approved the final manuscript.

APPROVAL OF THE RESEARCH PROTOCOL BY AN INSTITUTIONAL REVIEWER BOARD

The study protocol was approved by the ethics committee of the National Center for Global Health and Medicine, Japan.

INFORMED CONSENT

Informed consent was obtained from all participants.

REGISTRY AND THE REGISTRATION NO. OF THE STUDY/TRIAL

N/a.

DATA AVAILABILITY STATEMENT

The data are owned by the Department of Epidemiology and Prevention, the Center for Clinical Sciences, the National Center for Global Health and Medicine, Japan. The dataset is not publicly available due to ethical restrictions and participant confidentiality concerns, but de-identified data can be available for interested researchers after permission for using the data from the National Center for Global Health and Medicine Ethics Committee. The authors had no special access privileges to the data. Researchers who have an interest in the analysis using the data, please contact the Department of Epidemiology and Prevention, Center for Clinical Sciences, National Center for Global Health and Medicine, Japan (website: <http://ccs.ncgm.go.jp/index.html>, tel: +81 3 3202 7181).

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REFERENCES

1. De Brier N, Stroobants S, Vandekerckhove P, De Buck E. Factors affecting mental health of health care workers during coronavirus disease outbreaks (SARS, MERS & COVID-19): A rapid systematic review. *PLoS One*. 2020;15:e0244052.
2. Maffoni SI, Kalmpourtzidou A, Cena H. The potential role of nutrition in mitigating the psychological impact of COVID-19 in healthcare workers. *NFS J*. 2021;22:6–8.
3. J. Zhang SL, Lyu Q, Zhang P, Yang D, Kong J, Qi Y, et al. Diet and nutrition of healthcare workers in COVID-19 epidemic—Hubei, China. *China CDC Weekly* 2020;2(27): 505-506.
4. Garre-Olmo J, Turró-Garriga O, Martí-Lluch R, Zacarías-Pons L, Alves-Cabrato L, Serrano-Sarboza D, et al. Changes in lifestyle resulting from confinement due to COVID-19 and depressive symptomatology: A cross-sectional a population-based study. *Compr Psychiatry*. 2021;104:152214.
5. Fullana MA, Hidalgo-Mazzei D, Vieta E, Radua J. Coping behaviors associated with decreased anxiety and depressive symptoms during the COVID-19 pandemic and lockdown. *J Affect Disord*. 2020;275:80–1.
6. Papandreou C, Arijia V, Aretouli E, Tsilidis KK, Bulló M. Comparing eating behaviours, and symptoms of depression and anxiety between Spain and Greece during the COVID-19 outbreak: Cross-sectional analysis of two different confinement strategies. *Eur Eat Disord Rev*. 2020;28:836–46.
7. Muramatsu K, Miyaoka H, Kamijima K, Muramatsu Y, Tanaka Y, Hosaka M, et al. Performance of the Japanese version of the Patient Health Questionnaire-9 (J-PHQ-9) for depression in primary care. *Gen Hosp Psychiatry*. 2018;52:64–9.
8. Kurotani K, Nakade M, Takimoto H. Consumption of Meals Consisting of Grain, Fish and Meat, and Vegetable Dishes and the Relation with Nutritional or Health Status among the Japanese Population: A Systematic Review. *The Japanese Journal of Nutrition and Dietetics*. 2018;76:77–88.
9. Lassale C, Batty GD, Baghdadli A, Jacka F, Sánchez-Villegas A, Kivimäki M, et al. Healthy dietary indices and risk of depressive outcomes: a systematic review and meta-analysis of observational studies. *Mol Psychiatry*. 2019;24:965–86.
10. Ishikawa-Takata K, Kurotani K, Adachi M, Takimoto H. Frequency of meals that includes staple, main and side dishes and nutrient intake: findings from the 2012 National Health and Nutrition Survey, Japan. *Public Health Nutr*. 2021;24:2618–28.



11. Matsui K, Yoshiike T, Tsuru A, Otsuki R, Nagao K, Ayabe N, et al. Psychological burden of attention-deficit/hyperactivity disorder traits on medical workers under the COVID-19 outbreak: a cross-sectional web-based questionnaire survey. *BMJ Open*. 2021;11:e053737.
12. Sakuma A, Takahashi Y, Ueda I, Sato H, Katsura M, Abe M, et al. Post-traumatic stress disorder and depression prevalence and associated risk factors among local disaster relief and reconstruction workers fourteen months after the Great East Japan Earthquake: a cross-sectional study. *BMC Psychiatry*. 2015;15:58.

How to cite this article: Miki T, Yamamoto S, Fukunaga A, Inoue Y, Ishiwari H, Ishii M, et al. Association between eating balanced meals and depressive symptoms in Japanese hospital workers during the COVID-19 pandemic.

Neuropsychopharmacol Rep. 2022;42:109–113. <https://doi.org/10.1002/npr2.12230>

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