Author’s response to reviews

Title: A cross-sectional study of the associations between the traditional Japanese diet and nutrient intakes: The NILS-LSA project

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Author’s response to reviews:

To the Editor:

We appreciate the opportunity to address the Editor’s and Reviewers’ comments and revise our manuscript (manuscript ID# NUTJ-D-19-00046). Below, please find our item-by-item responses to the comments, which are included verbatim. All line numbers refer to locations in the revised manuscript.

Responses to Associate Editor:

In nutritional epidemiology, nutrient density refers to the nutrient amount divided by energy intake. The choice of the nutrient density index you used needs further explanation and justification. It might also need a different name.
Response: We agree with the editor that without explanations, “nutrient density” in our manuscript could be misunderstood. Therefore, some explanations were added to the METHODS, as follows:

“In the present study, “nutrient density” was redefined as the percentage of daily actual intake relative to the Dietary Reference Intake (DRI) for Japanese 2015 [19].”

Instead of p-values, please present 95% confidence intervals for Spearman correlation coefficients. This illustrates the precision of the estimate, and is more informative to the reader. Presentation of energy-adjusted correlation coefficients would also be very beneficial.

Response: We appreciate the editor’s suggestion and revised the results in Table 3. Additionally, corresponding sentences have also been revised in the ABSTRACT and RESULTS sections as follows:

ABSTRACT

“Scores of the JDI and mJDI12 were positively correlated with the nutrient density score (corresponding Spearman’s ρ [95% confidence interval; CI], 0.34 [0.31, 0.38] and 0.44 [0.41, 0.48], respectively; P < 0.05 for both).”

“The wJDI9 score was also positively correlated with the nutrient density score (Spearman’s ρ [95% CI] = 0.61 [0.58, 0.64]; P < 0.05).”

“The wJDI9 score obtained using dietary record data from 2008–2010 was also positively correlated with the nutrient density score (Spearman’s ρ [95% CI] = 0.61 [0.58, 0.64]; P < 0.05).”

RESULTS

“Both the JDI score and the mJDI12 score were positively correlated with the nutrient density score (Spearman’s ρ [95% CI], 0.34 [0.31, 0.38] for JDI score and 0.44 [0.41, 0.48] for mJDI12 score; both P < 0.05),…”

“The wJDI9 score was positively correlated with the nutrient density score (Spearman’s ρ [95% CI] = 0.61 [0.58, 0.64]; P < 0.05).”

“This correlation coefficient significantly differed from those of the JDI (Spearman’s ρ [95% CI] = 0.34 [0.31, 0.38]) or the mJDI12 (Spearman’s ρ [95% CI] = 0.44 [0.41, 0.48])…”
“…(Supplementary Figure 1; Spearman’s ρ [95% CI] = 0.61 [0.58, 0.64]; P <0.05). This correlation coefficient was also significantly different from that of the JDI (Spearman’s ρ [95% CI] = 0.35 [0.31, 0.39]) or the mJDI12 (Spearman’s ρ [95% CI] = 0.44 [0.41, 0.48]) (z = 11.2 and 7.7, respectively; P <0.05 for both).”

In the Figures, you have drawn regression lines. These Figures illustrate that linear regression may not be appropriate as the data do not seem to meet its assumptions and I’m not convinced that the associations are linear. Please demonstrate that your analysis meets the assumptions of the chosen regression model, and revise the analyses accordingly.

Response: We appreciate the editor’s comments and checked the linearity of the associations. Only wJDI9 showed a linear association. Therefore, we fitted a spline by spline regression for JDI and mJDI12. All corresponding figures have been revised. Please find figures (Figure 1, Figure 2, Figure 3, Supplementary Figure 1) as PDF files attached with our revision.

Please explain why each selected component was weighed by 10 times its standardized coefficient. Please also clarify how the standardized coefficient was computed.

Response: We appreciate the editor’s constructive comments. The corresponding explanation and clarification have been added to the METHODS, as follows:

“… (2) each selected component was weighted by 10 times its standardized coefficients to obtain an integer point (for the convenience of summing up the JDI score) (standardized coefficient refers to per standard deviation increase in the predictor variable and implies the relative importance of the associations of food components with the log nutrient density score; i.e. the weight); …”

Please replace the word ‘predict’, ‘predictive’, ‘predicted’ throughout the text by words that indicate ‘associations’. This is because your analysis focuses on assessing associations between variables, and does not aim to predict future dietary intake.

Response: These words have been revised according to the comment throughout the manuscript (by using “which was significantly associated with”, “associated with” and so on).

I agree with the reviewers that the BACKGROUND and discussion would benefit from further consideration of literature and circumstances outside Japan. This would increase the relevance of the manuscript to readers of other countries. Please revise accordingly.
Response: We agree with the editor’s and reviewers’ suggestion that some BACKGROUND and discussion of the literature and circumstances outside Japan would be a benefit to our study. Therefore, the corresponding text has been added to the BACKGROUND and DISCUSSION sections. Please find the corresponding text in the revised manuscript.

BACKGROUND

“In our previous study [4], the JDI was derived by factor analysis (principal component analysis; PCA) and confirmatory factor analysis by using the daily consumption (weight in grams) of 39 food items from the FFQ. Recent studies [9-11] also showed consistency in regard to the food components with the JDI with other typical Japanese dietary patterns derived by PCA or dietary records (DRs).”

“In brief, the JDI score was positively correlated with protein, fiber, vitamins A, C, and E, calcium, iron, potassium, and magnesium, and negatively correlated with saturated fat and sugar. Nevertheless, our previous study also showed that the JDI score was positively correlated with sodium. Furthermore, similar to the JDI, a previous study using a nationally representative dataset suggested an associations between rice and plant food and fish in the Japanese population [12], although rice (basically white rice) intake has been suggested to be related to a higher risk of diabetes both in Japan and in western countries [13, 14]. To date, except for the traditional Japanese diet, almost no dietary patterns include unhealthy dietary factors (e.g. sodium and refined grains). To investigate the nutritional characteristics of the traditional Japanese diet (which includes unhealthy dietary factors but has beneficial effects on health) would be intriguing and informative.”

“Additionally, as another limitation, the places of residence for the population formerly used to generate the JDI and that used in the simulation study are very close geographically, making the external validity of the simulation results still a concern.”

Please discuss to which extent the Japanese diet of 2006 and 2008 is still applicable today (as Reviewer #1) also indicates.

Response: We regret that we have no recent dietary data of our participants to confirm the reproducibility today. However, according to the National Health and Nutrition Survey (NHNS) in 2006 and 2017 (the latest), the consumption of the main food items for Japanese (≥20 y) were as follows:

<table>
<thead>
<tr>
<th>Food items</th>
<th>Mean consumption (g/d)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Food Category</th>
<th>NHNS 2006</th>
<th>NHNS 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>354.6</td>
<td>305.5</td>
</tr>
<tr>
<td>Miso</td>
<td>- *</td>
<td>10.8</td>
</tr>
<tr>
<td>Fish and shellfish</td>
<td>86.4</td>
<td>68.8</td>
</tr>
<tr>
<td>Green and yellow vegetables</td>
<td>102.0</td>
<td>87.7</td>
</tr>
<tr>
<td>Seaweeds</td>
<td>13.5</td>
<td>10.4</td>
</tr>
<tr>
<td>Pickles</td>
<td>- *</td>
<td>9.2</td>
</tr>
<tr>
<td>Green tea</td>
<td>- *</td>
<td>277.6 (including all kinds of tea)</td>
</tr>
<tr>
<td>Meat (including meat, poultry and internal organs)</td>
<td>76.7</td>
<td>97.0 (67.2 for beef, pork and processed meat)</td>
</tr>
<tr>
<td>Coffee</td>
<td>- *</td>
<td>167.9 (including coffee and cocoa)</td>
</tr>
<tr>
<td>Soybeans and soybean foods</td>
<td>60.4</td>
<td>66.2</td>
</tr>
<tr>
<td>Fruit</td>
<td>110.1</td>
<td>108.7</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>16.1</td>
<td>17.2</td>
</tr>
</tbody>
</table>

* The corresponding food category was not defined in the NHNS 2006.

Link to the NHNS 2006: [https://www.mhlw.go.jp/bunya/kenkou/eiyou08/dl/01-01a.pdf](https://www.mhlw.go.jp/bunya/kenkou/eiyou08/dl/01-01a.pdf); link to the NHNS 2017: [https://www.mhlw.go.jp/content/000451759.pdf](https://www.mhlw.go.jp/content/000451759.pdf).

From the table above, we can see that, except for slight decreases in average consumptions of rice, fish and shellfish, and green and yellow vegetables, the average consumptions of other food items were similar. Therefore, we have added limitations, as follows:

“Third, although participants used for validation (2008–2010) were not totally the same as those used for the main analyses (2006–2008), they were collected from the same region. Additionally, the National Health and Nutrition Surveys in 2006 [37] and 2017 [38] indicated that the average
consumption of “fish and shellfish”, and “green and yellow vegetables” decreased, and the average consumption of “beef and pork” increased during the recent 10 years (the Westernization of the Japanese diet [39]). Thus, the average higher consumption of these food components by our participants would represent a relatively traditional Japanese diet in Japan. A further validation study would be needed with participants in a different context.”

Please explain how the data were validated in the sentence “The findings were validated with data from 2008-2010.”.

Response: A further explanation has been added to the corresponding part as follows:

“The findings were validated with data from 2008–2010 by assessing the associations between the Japanese Diet Indices scores and the nutrient density score.”

As Reviewer #1 points out, please discuss the limitations of having used an internal sample for the validation, rather than using an external, independent study population. The limitation of not having used data of biomarkers would also need to be discussed.

Response: We agree with the editor and reviewer that an external validity study using data collected from an external sample would be a better choice. However, we do not have any data on a totally different population.

Therefore, we added this point as a limitation in the manuscript as follows:

“Third, although participants used for validation (2008–2010) were not totally the same as those used for the main analyses (2006–2008), they were collected from the same region. … A further validation study would be needed with participants in a different context.”

Additionally, the limitation of not having used biomarker data has also been added, as follows:

“Finally, the associations between JDIs and biomarkers were not assessed in the present study. It would be informative to investigate this issue in the future to confirm the nutritional characteristics of the traditional Japanese diet.”

As the online calculator you cited in reference 14 may not be available in the future via the link provided, please replace this calculator by statistical software methodology instead.

Response: The calculator has been replaced by equations in the METHODS as follows:
“...values of $z$ for JDI, mJDI12, and wJDIin, respectively, were calculated as follows: $z=1.1513\times lg (1+\rho)/(1-\rho)$; where $\rho$ means the Spearman’s correlation coefficients between the JDI score, the mJDI12 score, the wJDIin score and the nutrient density score. Then $S_{((z_1-z_2))}=\sqrt{1/(n_1-3)+1/(n_2-3)}$ was calculated; in a same survey wave, $n_1 = n_2 = n$, so $S_{((z_1-z_2))}=\sqrt{2/(n-3)}$. Finally, $U_{((z_1,z_2))}=(z_1-z_2)/S_{((z_1-z_2))}$ was calculated; if $U_{((z_1,z_2))}>1.96$ or $<-1.96$, then $P <0.05$; otherwise $P \geq0.05$.”

Responses to Reviewer #1:

Title: Please change or specify the term of 'the Japanese diet', which cannot be representative for all dietary patterns in Japanese people. The Japanese diet indices were developed in a sample including adults living in a limited location during a certain period of time.

Response: It is true that, according to our previous study, the Japanese diet index (JDI) was developed with a sample including adults living in a limited location during a certain period of time. However, when we were modifying the JDI, we referred to a recent systematic review that included 39 research articles involving adult participants from different regions in Japan. The 12-component modified Japanese Diet Index (mJDI12) contained the top ten components that we used to define the Japanese diet. Additionally, a recent study (Murakami et al. Advances in Nutrition 2019) showed that, of 12 studies in which a “Japanese dietary pattern” (literally named similar to ours) was derived, the median congruence coefficient was 0.8 (considered to represent fair similarity in reproducibility). Therefore, the components of our JDIs would be representative of a Japanese dietary pattern in Japan.

Nevertheless, we agree with the reviewer that our indices cannot be representative of all dietary patterns in Japanese people. Therefore, we revised the title as follows:

“A cross-sectional study of the associations between the traditional Japanese diet and nutrient intakes: The NILS-LSA project”

Line 72: 'the Japanese diet' may mean 'a traditional Japanese diet'. Please specify the diet.

Response: Corresponding text has been revised as the reviewer suggested throughout the manuscript.
Lines 77-86: More information regarding the JDI, the association between the JDI and dietary quality or nutrient intake, and some limitations in previous studies related to the JDI is needed for reviewers and readers.

Response: We appreciate the reviewer’s suggestion and revised the BACKGROUND. Please find the corresponding text in the revised manuscript.

In Method: The study population is 2221 male and female Japanese adults aged 40 years or over who were residents of a local area and members of the NILS-LSA. Their dietary data collected between 2006 and 2008 were used for this study to calculate several types of JDI and a nutrient density score. The data seem to be too old and partial to define 'the Japanese diet'.

Response: First, as in our response to comment 1, we think the components of our JDIs would be representative of a Japanese dietary pattern in Japan.

Second, in our study, the dietary data were only used to investigate the associations between food intakes and nutrient intakes. The nutrient and energy intakes were calculated according to the Standard Tables of Foods Composition 2010 in Japan and other sources. The nutrient components of food items would not change with time. Therefore, the lack of timeliness of our dietary data may not have affected our results (the association between the JDI score and the nutrient density) substantially.

In Method: An external validity study was conducted in the same population using data collected in a different period of time. It is necessary to validate the indices using an external sample.

Response: We agree with the reviewer that an external validity study using data collected from an external sample would be a better choice. However, we do not have any data on a totally different population.

Therefore, we added this point as a limitation in the manuscript a follows:

“Third, although participants used for validation (2008–2010) were not totally the same as those used for the main analyses (2006–2008), they were collected from the same region. … A further validation study would be needed with participants in a different context.”

The term of 'nutrient density' is used to indicate the sum of amount of certain nutrients per serving (or weight or calorie). It seems that the authors used their own definition. Please provide proper references or explanations regarding this issue.
Response: We agree with the reviewer that without explanations, “nutrient density” in our manuscript could be misunderstood. Therefore, some explanations were added to the METHODS as follows:

“In the present study, “nutrient density” was redefined as the percentage of daily actual intake relative to the Dietary Reference Intake (DRI) for Japanese 2015 [19].”

The nutrient density score is calculated as the sum of nutrient density values for 9 nutrients. A person, who consumed 2-fold amounts of DRI for iron and protein and half amounts of vitamins, and another person, who consumed DRI for iron, protein, and vitamins, would have same scores. Because "beef and pork" are non-adhering components in the JDI, there must be discrepancies in the nutrient density score and the JDI.

Response: We thank the reviewer for the thoughtful comments, which raise an important concern in our study. However, we assume that the possibility of a discrepancy as in the reviewer’s example would be rare (and indeed they were rare), and such cases are reflected in our figures as outliers far from the regression line (only a few at the top left of the regression line).

Additionally, the calculation of the nutrient density score (formulated by the US Food and Drug Administration (Drewnowski A, Fulgoni VL 3rd. Nutr Rev 2008)) was referred to in a previous article (Drewnowski A, Fulgoni VL, 3rd. Am J Clin Nutr 2014.), in which the nutrition density score was suggested as an accurate marker to build and distinguish healthier diets (Drewnowski A. J Am Coll Nutr 2009).

Taking all of the above into account, we consider that using the nutrient density score to assess the nutritional quality of JDIs would be appropriate.

The JDIs need to be evaluated with a gold standard method. Because the nutrient density score is another dietary index, the findings on the associations among these dietary indices are likely to depend on the study population.

Response: As in our response to comment 7, although not being a gold standard method, we consider the nutrient density score to be a readily usable tool to assess overall nutrient intakes and chose to use it in the present study. Furthermore, the nutrient density score was calculated based on the DRI for Japanese 2015, which is used as the gold standard to define the optimal intake levels of nutrients. Additionally, as in our response to comment 4, the dietary data collected in the present study were only used to investigate the associations between food intakes and nutrient intakes. The nutrient and energy intakes were calculated according to the Standard Tables of Foods Composition 2010 in Japan and other sources. The nutrient components of food
items would not change according to geographic factors. Therefore, the study population was not likely to have affected our results (the association) substantially.

However, we agree again that using the data from a single area would not be the best. Thus, we have mentioned this in the limitations as in our response to comment 5.

Additionally, a limitation of not having used biomarker data has also been added as follows:

“Finally, the associations between JDIs and biomarkers were not assessed in the present study. It would be informative to investigate this issue in the future to confirm the nutritional characteristics of the traditional Japanese diet.”

Responses to Reviewer #2:

Lines 145-146 (page 8): Please explain "…. if their daily intake was equal to or over the sex-specific median" as well as "lines 147-148 (page 8): "…. if their daily intake was below the sex-specific median" - What was the „specific median”? No reference to such data. Whether these contents are linked to the data in Table 2?

Response: We agree with the reviewer that the definition of “sex-specific median” was not clear enough. We added the following as clarification:

“… (sex-specific median was calculated using the DR data of all participants)”

Statistical analysis (page 9): Please explain - what was the data distribution?

Response: The description for the distribution of the nutrient density score was added to the Statistical analysis part as follows:

“(1) because the values of the nutrient density score were not normally distributed (skewness = 1.35; kurtosis = 3.82), a logarithmic transformation of it was used (skewness = 0.25; kurtosis = 0.44). Then…”

Table 2 - the symbols placed in the table are not entirely clear (β, SE).

Response: The definitions for β and SE have been added in the footnotes of Table 2.
Discussion: The discussion includes only 8 references. In many places it contains the repetition of data contained in the results (e.g. lines: 252, 255, 259).

Response: Originally, we just wanted to emphasize our findings in the DISCUSSION section. However, as the reviewer suggested, it is not appropriate to repeat the results. Therefore, we deleted the results in the DISCUSSION section.

Additionally, more discussion and references have been added. Please find the corresponding text in the revised manuscript.

Line: 295 (page 14) "…. a lean diet might also contribute to undernutrition” - reference needed.

Response: A related reference has been cited with the revised sentence as follows:

“On the other hand, a lean diet (which is usually inadequately defined in terms of nutrient and food content, and contains less red meat and fat) might also contribute to undernutrition [29].”

It is recommended to extend this part of the manuscript for more references of the literature with particular attention to the practical aspects of the obtained results.

Response: We appreciate the reviewer’s constructive suggestion and have added more discussion as follows:

“Indices have been proven to be useful in epidemiological studies and to develop and apply nutritional strategies [30], and some dietary indices (such as the healthy eating index and Mediterranean diet index) have been widely applied in western populations. Given the specific situation of diet intake in Japan (a comparable lower total calorie intake, a different Protein-Fat-Carbohydrate balance, and a different fatty acid ratio compared with western countries [31-34]), development, modification, and application of the JDI may be important for public health promotion for the Japanese population. However, it is still worth noting that, among the practical aspects of our finding, comprehensive health consultation and guidance should be conducted involving other lifestyle behaviors (e.g. physical activity), socioeconomic context (e.g. sociocultural habits, religious beliefs), food access (e.g. food handling, preparation and storage, purchase of seasonal and local foods,) and so on [35].”

Reference: 32% of the references (7 with 22 items) are older than 10 years. I suggest to enrich the BACKGROUND and discussion with a few new literature items, including studies showing the results of research from other countries (from outside Japan).
Response: We revised the BACKGROUND and DISCUSSION sections according to the reviewer’s comment. Please find the corresponding text in the revised manuscript.