Author's response to reviews

Title: Spending on Vegetable and Fruit Consumption Could Reduce All-Cause Mortality among Older Adults

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Title: Spending on Vegetable and Fruit Consumption Could Reduce All-Cause Mortality among Older Adults

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Responses to Referees:
Reviewer #1: Jesus Vioque

1. Abstract. The conclusion should be rewritten according to main study results.

Response: Thank you. We have revised the conclusion. (Lines: 21-22)

2. The use of one 24 hour recall to explore associations in nutritional studies is mistaken as the one day diet may not represent usual intake (or expenditure). It may be true that day-to-day diet in this population be stable as authors mention in Discussion. However, some comment on the potential bias and its influence on study results should be mention as well (eg non-differential biasing the HR toward the null).

Response: Thank you for your suggestion. We understand that 24-hr dietary recall data has its limitations. Since individual diets vary from day to day, one 24-hr dietary recall might result in less precise the measurement of usual food intake. However, for any participant, the survey day was random which might lead to non-differential misclassification and might bias overall HR estimates toward the null value [1-2]. Even so, we still see a significant financial effect in relation to mortality. Therefore, with a more precise dietary method, the effect would be more evident. We have further added explanation in lines 259-264.

References
3. It is suggested a review of the manuscript (eg, line 124 “in relationship to each…”, should be changed “in relation to …”

Response: Thank you. We have revised it.

4. Figure 1 should be removed as it does not add new information with respect to table 3.

Response: Thank you for your suggestion. We have deleted it.

5. Sentence in line 143-144 is wrong. Information for Grain is presented in table 3. Despite non-significant, information for animal-derived foods should be included in that table.

Response: As we have indicated in the Statistical Analysis section of the Methods (Lines: 107-113 ), in order to interpret the estimates for each food category while total food expenditure is kept constant, only three food category expenditures can be allowed in the model. This is because animal-derived foods needed to be excluded given their significantly higher cost. The same notion informs the models we have now introduced which include animal-derived foods, but not grains. In this way, we have taken the Reviewer’s advice in regard to Animal-Derived foods in the revised Table 3. Further explanations are provided in the footnotes to the table.

6. Table 2 present a lot of data and it is somehow confusing with no clear purposes. Thus, table 2 could be removed: Information on characteristics could be placed in the text or using a more succinct table

Response: In Table 2, which we wish to retain in our response to Reviewer 2, we provide socio-demographic profiles of the population studied in relation to quintiles of vegetable expenditure by way of example, but similar to the profiles for fruit.

7. It is not clear why to focus on food expenditure instead of food intake also collected in 24 hour recalls. Since not all purchased foods are eaten and information on food and nutrient intake are available, why information on food expenditure was preferred? Was fruit and vegetable intake also related to better survival?

Response: Previous studies [1-2], including our own [3-5], have focussed on whether
greater vegetable or fruit intakes are beneficial to health and generally concluded that they are or are as contributors to dietary diversity. However, few studies [6-7], apart from ours, and none as far as we can tell in elders, provide information and insight into whether food expenditure and affordability are associated with survival. (Lines: 254-257)

Fruit and vegetable intake were related to better survival. The Q3 to Q5 for vegetables expenditures had HR values significantly lower than Q1 for all-cause mortality (Q3, HR = 0.59, 95% CI: 0.38-0.93; Q4, HR = 0.67, 95% CI: 0.47-0.96; Q5, HR = 0.50, 95% CI: 0.34-0.74), and the dose-response relationship was significant. For fruits, Q4 and Q5 expenditures were associated with significantly lower mortality rates compared to Q1 (Q4, HR = 0.56, 95% CI: 0.36-0.86; Q5, HR = 0.54, 95% CI: 0.33-0.87), and the dose-response relationship remained significant in the final model. Please see table below.

References
Table. Daily food group intake and all-cause mortality (n=1781)

<table>
<thead>
<tr>
<th>Food category</th>
<th>Quintile of daily food intake (gram)</th>
<th>P for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
<td>Q2</td>
</tr>
<tr>
<td>Vegetable, range</td>
<td>&lt;145</td>
<td>145-253</td>
</tr>
<tr>
<td>Crude</td>
<td>Ref 0.71</td>
<td>0.51, 0.98</td>
</tr>
<tr>
<td>Adjusted*</td>
<td>Ref 0.83</td>
<td>0.60, 1.16</td>
</tr>
<tr>
<td>Fruit, range</td>
<td>0</td>
<td>&lt;158</td>
</tr>
<tr>
<td>Crude</td>
<td>Ref 0.84</td>
<td>0.65, 1.07</td>
</tr>
<tr>
<td>Adjusted*</td>
<td>Ref 0.86</td>
<td>0.64, 1.15</td>
</tr>
<tr>
<td>Grain, range</td>
<td>&lt;136</td>
<td>137-185</td>
</tr>
<tr>
<td>Crude</td>
<td>Ref 0.59</td>
<td>0.44, 0.80</td>
</tr>
<tr>
<td>Adjusted*</td>
<td>Ref 0.52</td>
<td>0.36, 0.75</td>
</tr>
</tbody>
</table>

* Adjusted for total food and vegetable, fruit, and grain intakes (but not animal-derived foods), gender, age (yr), ethnicity (Fukienese, Hakka, mainlander, indigenous), personal education (illiterate, primary and below, secondary education and above), living arrangement (lived alone, lived with spouse), personal income (<5000, 5000-19,999, ≥20,000 NTD/month), smoking (yes, no), alcohol drinking (yes, no), health status (good, fair, poor), physical activity (<1.5, 1.5-3, >3 MET/day), chewing ability (satisfactory, unsatisfactory), body mass index (<18.5, 18.5-23.9, 24-26.9, ≥27 kg/m²), diabetes mellitus (yes, no), and energy (kcal).

† All subjects who died in the first year of follow-up were excluded.
Reviewer #2: Julie Brimblecombe

Thank you for the opportunity to review this well written and informative paper. This paper is making an important contribution to evidence regarding the role of fruit and vegetable expenditure and mortality.

Major revisions for consideration:

The study hypothesis is clearly presented and addressed by the authors. The method is clearly presented.

- Although the results explain the consideration of co-variates in the model, I would suggest that the consideration of co-variates is described in the methods section when describing the statistical analysis.

Response: Thank you. We have revised the Statistics section of the Methods accordingly. (Lines: 121-127)

- The methods section also does not describe the derivation of nutrient content from 24 hour dietary recalls. Please see comment below, as I am suggesting that the authors consider this for another paper and remove from this paper.

- In the methods, please indicate if food items were categorized according to nutrient profile or food type.

Response: Thank you for your suggestion. We have added “Food items were categorized according to the same or similar names, similar nutrient profile, comparable food physical properties, and similar ingredients and different preparations”. (Lines: 65-67)

- I would suggest that the authors consider the description of nutrient content and differences in nutrient profile in relation to fruit and vegetable expenditure as a separate paper as these data do not contribute to answering the hypothesis. The data are sound and well controlled.

Response: We understand these points, but we particularly wanted to indicate what expenditures were on nutrients, alongside foods, in regard to survival. We would rather not to have to develop a separate paper on this account. We ask for leave to
retain this Table and have assumed this to be possible in the Revision.

- Clarification is needed on type of diabetes mellitus referring to (type 1 and type 2 or just type 2) and if this was self-reported or clinically diagnosed.

**Response:** It is type 2 diabetes, ascertained by questionnaire. This has been made clear in the Methods. (Lines: 100-101)

- I think further explanation in the limitations part of the discussion is required on why only one 24 hour dietary recall assessment was made and the implications of this on study findings.

**Response:** Thank you for your suggestion. Please see our response to Reviewer 1 (Question #2). We have added a clarification in lines 258-266.

- Similarly I would like to see an explanation on why dietary diversity was not considered as a co-variate or outcome measure in this study based on the evidence cited that expenditure on vegetables and fruits to reduce mortality may be mediated by increasing dietary diversity.

**Response:** We have now added an additional adjustment for DDS in model 2 in Table 3. While the significance of the HR for vegetables is unchanged, that for fruits is diminished. This indicates a greater dependence on dietary diversity or an integrated food pattern for fruit than for vegetable expenditure where the latter appears to have associations with mortality of its own. This has now been developed in the Discussion.

- It is not clear on why the emphasis in the discussion is on vegetables and not fruit as fruit expenditure and vegetable expenditure were both found to be associated with a decreased risk of all-cause mortality. For example, fruit also needs to be included in statement made in discussion (line 176/ line 188/189). The data for fruit from the HR model needs to be presented in the text (line 150/151). Similarly (line 144) results need to be shown for fruit as shown for vegetables.

**Response:** As indicated above, the data for fruit from the HR model has now been added in the Results in lines 159-162 and lines 171-172. We have also added relevant comment to the discussion in Lines 199-203 and 216-220.
- Line 140: A CI of 0.50-1.08 for Q5 for vegetable expenditure suggests that HR not statistically significant.

Response: That is correct. We emphasise in the Discussion that the survival advantage of greater vegetable expenditure is realized by Q4 and that this realization makes the prospects of food security for those with limited means and marginal vegetable supplies more achievable. (Lines 208-211)

- As regional differences in pricing were not taken into account, can the authors explain the implications of this in relation to the findings of this study as people in regional/remote areas may be spending more on fruit and vegetables, but consuming less than their counterparts in urban areas or vice versa. Is this study not demonstrating differences in amount (weight) consumed of the different food products (fruit, vegetables, animal derived foods etc) rather than expenditure if pricing of these commodities is a constant across the population? Perhaps information in the discussion on how different prices are of these commodities across the country would help to address this concern.

The authors conclude that consideration of the affordability of fruit and vegetables should improve food security for the elderly population. I believe the findings of this study suggest that considering affordability of fruit and vegetables should improve food security and longevity.

Response: Firstly, in Table 2, we provide socio demographic profiles of the population studied in relation to quintiles of vegetable expenditure by way of example, but similar to the profiles for fruit. Inter alia it can be seen that there are widely divergent associations with ethnicity (e.g., indigenous Taiwanese) and living arrangements, although not for education or income. The ethnic divergence is correlated with locality and region [1], with Indigenes being more mountainous and east coastal. Since plant food sources may be more local or home-garden and less retail for Indigenes, our generalisations may be correspondingly limited. At the same time, remote communities are less likely to participate in the mainstream food supply as studied by us. There are health risk and outcome variations across Taiwan which may also limit our deductions. Taking these points into account, we have revised the discussion in lines 282-289.
We agree that reference should be made to longevity in the conclusions. The Abstract now concludes: “Greater and more achievable vegetable and fruit affordability may improve food security and longevity for older adults.”

In addition, the concluding paragraph of the paper now reads: “… an emphasis on national nutrition policy in Taiwan advocating affordable fruits and vegetables should improve food security and longevity among older adults.”

References

Minor Essential Revisions:

Line 16 – spelling of co-variates

**Response:** Thank you. We have corrected the spelling.

Line 21 – or should be of

**Response:** We are unable to identify a problem at or about this line 21, which is blank, or in a search for the words ‘or should be of’.

Line 61 – delete “a” before 24 hour

**Response:** Thank you. We have made the correction in line 62.

Line 61 – on the survey day not in

**Response:** Again, thank you. (Line: 63)

Line 73 – totally should be “in total”

**Response:** Thank you. We have revised it. (Line: 78)

Line 131 – or who lived alone

**Response:** Thank you. We have revised it. (Line: 147)
Line 165 – inclusion of legumes in this statement seems contradictory as legumes are a food type not an integrated indice of the diet.

**Response:** Thank you for your suggestion. We have revised it. (Line: 187)

Line 178-182 – not completely clear on point being made in relation to study.

**Response** Thank you for your suggestion. We have revised it. (Lines: 201-211)

Line 212 – use of “for” incorrect

**Response:** We have altered the sentence structure for clarity. (Lines 240-241)

Line 217 – age-group not aged group

**Response:** Yes. (Line: 246)

Line 140/141: are the authors suggesting that further research in this area is required?

**Response:** No, not at this point where we are stating what we have done.

Line 161-171: are the authors suggesting that fruit and vegetable intake may be a marker of dietary diversity?

**Response:** Yes, we do consider that the way in which expenditure on fruits and vegetables may contribute to survival may be through integrated food patterns such as food diversity. We have separately reported for this cohort that the DDS (dietary diversity score) predicts survival and we refer to this literature in the present paper references # 6).

In Table 3, we have adjusted for DDS and find that, while the contribution of vegetable expenditure to survival persists in its own right, that for fruit does not. This suggests a greater dependence on DDS for fruit than for vegetable expenditure. We have now emphasized this point in lines 199-203.