Author’s response to reviews

Title: Associations between dietary patterns and blood pressure in a sample of Australian adults

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Author’s response to reviews:

Thank you for the detailed comments on our manuscript. All comments have been addressed below and changes made to the manuscript have been highlighted in yellow in the revised MS attached. We appreciate the opportunity to submit the revised MS on this important topic and thank the reviewer for their support of publication.

Response to reviewer’s comments:
REVIEWER 1
Reviewer #1: “This is a commendable and useful paper which should be published. It speaks to the new and important trend of considering whole diets as complex nutrient interactions in terms of health impact rather than isolated nutrients. “
Thank you

Reviewer Comment “I have a couple of questions, and some minor ones in the attached document but would urge the authors to consider these issues to improve their paper.”

Reviewer Comment “The MS is aimed at an international journal and readership, and while Australian diet and the research findings are relevant globally, there is much parochial in the MS that an international audience may find difficulty with - a case in point is "cordial" which in many places means alcoholic, among other meanings. Similarly "casseroles", "sauc es and dressings", "prepared main dishes" (are these commercially prepared - industrialised?) - some disambiguation would be helpful. Do vegimites cause itching?”
Definitions have been added for the terms cordial, and Vegemite as footnotes in Table 2: “*cordial is a non-alcoholic fruit drink concentrate; ***Vegemite is an Australian food spread made from brewers' yeast extract”.
The term ‘Casseroles’ has been deleted as stews are already listed and they mean a similar thing.
A definition of dishes has been added to the methods with examples: “Dishes were a combination of ingredients/foods to make a meal/dish as opposed to an individual foods. For example mixed cereal dishes included hamburgers or sandwiches, meat/poultry dishes included stews or curries or stir fry, eggs dishes included quiche or scrambled eggs, vegetable dishes included cauliflower cheese, pasta and rice dishes included cheese and spinach ravioli or Asian noodle dishes.”
‘Dressings’ has been changed to ‘salad dressings’ throughout.
Reviewer Comment “Just to give perspective, "30 standard (10g alcohol) alcoholic drinks weekly" would be considered a sin beyond the pale in much of the world and an alcoholic in most of it, so author's specific exclusion would be as obvious as excluding any other severe pathology to a non-Western-non-beer-swilling population.”

Because of the short and long term direct links between alcohol and blood pressure we felt it was important to include this specifically, but happy if the editor wishes to remove.

Reviewer Comment “A major problem is the sample being some 40% hypertensives (table 1). This is a serious limitation, and authors seem to gloss over it, which is not proper, even if the statistical adjustment suggests it does not influence their chosen variables. Nevertheless, one would want to be convinced that the distribution of hypertensives in the 3 groups does not differ significantly, one would want to see the contribution of AHT as a confound or covariate; for instance, is the interaction of AHT, tertiles, and dietary pattern significant? (ditto, if less important to discuss, for sex proportions?).”

“Authors seem to miss that this is an important issue in their paper as they define its primary aim in its first word ("Hypertension"). The data beg the question of the relationship between AHT and the diet - consideration of cause-and-effect of the diet patterns on the one hand and AHT distribution on the other would seem to be highly warranted. Surely seeking changes in BP in a sample of which ~40% are on AHT would be expected to be fairly self-defeating? Would the paper stand with hypertensives excluded, or, perhaps benefit from considering them as separate groups?

Again, in view of the prominence of this confound, the statistical panacea are insufficient to put the this reader at ease. “

Thanks for raising this point. 39% of the sample on hypertensive medication is consistent with the incidence of hypertension in the adult community in this age group (about 34% of Australians aged 18 and over have high blood pressure, based on measured data from the 2017–18 Australian Bureau of Statistics National Health Survey, and this increases with age. The mean age in this study was 55 years). Participants also needed to have been on the AHT medication for enough time (screening question) that their blood pressure was stable (usually still in the hypertensive range or at least above recommended levels, but certainly lower than without the medication!!). The models were adjusted for use of anti-hypertensive medication, smoking status, physical activity and education level (model 2) and this is the recognised method of adjustment. It is important to note that dietary interventions to reduce sodium and/or increase potassium have been shown previously to result in larger improvements in blood pressure in those who are hypertensive compared to those classified as normotensive, and also are effective in those who are taking antihypertensive therapy.

Reviewer Comment “One issue I hope the authors will consider in the interests of objectivity, transparency, and their primary aims in carrying out this study, as they state, it is important to consider whole diets in terms of health impact rather than isolated nutrients. So while I understand why authors nevertheless emphasise sodium and potassium throughout the MS, I note that it somewhat undermines their stated intent. Thus, why are these 2 electrolytes the only electrolytes or nutrients selected for analysis and submitted to the reader as subliminally explanations for the specific effects of diet 2? “

The primary aim of this study was to assess the impact of dietary patterns (using a data driven approach using factor analysis with principal component analysis extraction), on blood pressure in sample of free living individuals living in the community. We also assessed if any dietary patterns were associated specifically with dietary sodium and potassium as these are the 2 primary nutrients consistently found to be associated with blood pressure. It is beyond the scope of this paper to assess associations of the derived dietary patterns with other nutrients where there is less evidence of direct associations with blood pressure. But would be interesting to look at and maybe with associations to other health outcomes.
Reviewer Comment: “Further, does this imply that no other electrolytes, macronutrients, food or other dietary components correlated with the diet and with BP? We didn’t look at others. Or do authors concentrate on these 2 because they are the ones implicated in so many single-nutrient studies of CVD etc? Yes. To this reader this is a contradiction of authors' stated aim of a broader dietary analysis. Clearly Na+ and K+ should remain in the analyses, but surely we should be informed if they were the only correlates of BP in the diets? And if not, then for the sake of author's hypothesis, if not for transparency and scientific objectivity, do pls inform the reader.”

We are not implying that no other nutrients are correlated with the dietary patterns that we identified from the data, as we did not look at any other nutrients. Have tried to make this clearer in the manuscript by adding “Correlations with other individual nutrients were not assessed.” To the results section. We focussed only on Na and K as the two main nutrients associated with BP, so we felt it was still important to see if any of the dietary patterns we identified, were also associated with these 2 key nutrients. Have added in the following to the results section “Correlations with other individual nutrients were not assessed.“

Additional comments in manuscript from reviewer 1:
Reviewer Comment in manuscript: Table 1 comment on potassium “Adjusted for weight?”
I have added in potassium and sodium density values (so adjusted for energy intake) into Table 1, as this is mentioned in the manuscript.

Reviewer Comment in manuscript: Table 2 comments on footnote – “Please clarify why.” And “how does this differ from fish dishes in pattern 1.”
“as their absolute factor loading was &lt;0.2 and were thus were not considered to significantly contribute to a pattern” has been added to the footnote
A definition of dishes has been added with examples to the methods section

Reviewer Comment in manuscript: Table 4. “Dietary patterns defined differently in the tables. How do they relate to patterns 1,2 and 3.” This was an error when we changed the names of the patterns. I have corrected this in the revised manuscript.

Reviewer Comment in manuscript: “The ratio is the same as the Na and K correlations, so it’s a bit repetitive”
The NA:K molar ratio is actually very different. So a person could have a high Na intake but if they also have a high K intake and a molar ratio of Na:K of closer to 1 then that is different to a person with a high Na intake a low K intake (who would have a high Na:K ratio) or the person with a low N and high K intake who would have a low Na:K ratio. So it is important to look at the nutrients separately also and as a molar ratio. This is highlighted in dietary pattern 3 which is positively correlated with potassium but and inversely correlated with the Na:K molar ratio.

Reviewer Comment in manuscript: “Do authors mean that there were no correlations with other dietary components such as other electrolytes, calories, macronutrients? If so it should be stated. Also, adjusted for energy. Clearly, an objective assessment of which significant components work for the complex diet is warranted, but are authors only looking for the key under the lamp?”
Thanks. Have added in the following to the results section to make that clear: “Correlations with other individual nutrients were not assessed.“

Reviewer Comment in manuscript: “Yes, but authors ignore that all other dietary components also increase with energy, so what is OBJECTIVELY (in their data) different about sodium that it warrants special and exclusive mention?”
Not all other dietary components always increase with increased energy intakes. Sodium is one nutrient that due to the fact of it being fairly widespread in the food supply as energy increases, it also usually increases, as there are not many widely consumed food sources of energy that don’t also contain sodium. The aim of adjusting for energy was to see if the association with sodium was simply due to a higher energy (food) intake overall, or if it was a higher intake of higher sodium foods. This is what was found with DP2, which when adjusted for energy the association with Na was no longer found but the association with K was, pointing to the foods in this pattern being high in E and Na but not high in K. Or to put it another way, eating more of this pattern (or getting more E from this pattern) did not mean a higher K. Highlighting the point that all other dietary components do not always increase with energy.

Reviewer Comment in manuscript: “And calcium, protein, fat, CHO, you name it! The relation to K is interesting, tho’.”
Yes I agree it would be very interesting to look at other nutrients and other health outcomes but this was outside the scope of this paper.

Text in manuscript: “While this pattern is also associated with higher sodium and higher energy, we did not observe any relationship with BP” - Reviewer comment: “But it might be because so many in this group were on hypertensive medication. Statistically that this does not occur in the other patterns does not permit us to reject H0 Models were adjusted for anti-hypertensive use. Also for participants on AHT, it doesn’t mean their BP is now normotensive. They can still have varying BPs on AHTs. As mentioned previously, dietary intervention studies have been shown previously to have significant effects on blood pressure of both hypertensives and those on medication.

Reviewer Comment in manuscript on Table 4:” Authors missed that in Tables 4 & 5 diets are named differently from preceding tables and text”
Thanks. This was an error when we changed the names of the patterns. I have corrected this in the revised manuscript.

REVIEWER 2

Reviewer #2: This manuscript describes the results of a cross-sectional analysis of the association of dietary intakes and blood pressure among 251 participants before starting a dietary intervention trial. The manuscript is relatively well prepared. There are many unclear points in the manuscript and they are listed below for the authors' consideration.

1. What were the timings of BP measurement and diet assessment arranged for each participant? As stated in the methods, blood pressure was measured daily (standard protocol for time, rest period seating etc). The daily home BP was calculated as the mean of the last two of three measurements. The daily means were averaged over the week to determine the home BP for that week. Were the two diet recalls completed during the same week when the BP readings were collected? Yes the two diet recalls were completed during the same week. “during the same week as the home blood pressure measurement” has been added into the manuscript to clarify. As stated in the methods this was on random, non-consecutive days.

2. Page 7, lines 2-3, how much impact is the omission of discretionary salt intake may have on the true total sodium intake in this population?
Discretionary salt intake is always very difficult to quantify and whilst it may have changed the total
sodium intakes it would not have changed dietary patterns. Discretionary salt is a different issue and not the focus of this paper.

3. Page 7, lines 24-25, unclear how the surveys of physical activities from two measures were used in the analysis. In the self-administered questionnaire, participants were asked to quantify the number of hours of vigorous PA they did per week. They were also asked in another question to rate their PA level from a choice of levels. A self-report of more than 4 hours OR a self-assessment of quite/very/extremely active was considered to be physically active for this study. This has been clarified in the methods section. “Participants were asked to quantify the number of hours of vigorous physical activity they did per week. In another question, they were also asked to self-assess their overall physical activity level. A self-report of more than 4 hours OR a self-assessment of quite/very/extremely active was considered to be physically active for the purpose of this study” has been added.

4. Table 2, in the factors for dietary pattern, may be helpful to explain briefly what "take-away" and "unprocessed cereals" includes. Does "unprocessed cereals" mean whole grains?
   Thanks. “Unprocessed cereals” has been changed to “pasta, noodles and rice” to remove this confusion. Have added in descriptors in the footnote of the table for take-away (and Vegemite and cordial)

5. Tables 4 and 5, the terms "Traditional Australian diet" "Convenience diet" "Modern diet" are not mentioned anywhere in the text.
   Thanks. This was an error when we changed the names of the patterns. I have corrected this in the revised manuscript.

6. It's not obvious that dietary pattern 2 would be high in animal fats, meat as the authors described in lines 17-19 of page 15. Unless the group "meat, egg & poultry dishes" are in nature higher in animal fats. On the contrary, dietary pattern 1, with the higher loading factor "Meats, poultry and egg" seem to be more likely to be high in animal fats and meats.
   It is likely that both dietary pattern 1 and dietary pattern 2 are high in animal fats with the loading of "Meats, poultry and egg" on pattern 1 and "meat, egg & poultry dishes" on pattern 2. The commentary in the manuscript was not meant to be a comparison between our 3 dietary patterns, rather a statement about dietary pattern 2 specifically and the comparison of it to other patterns in the literature that have also shown an association with blood pressure. I have clarified this in the manuscript which now reads: “Whilst it is difficult to directly compare, there are some similarities between these other previously described dietary patterns which have shown associations with BP, and our Dietary Pattern 2, which was also positively associated with home SBP, namely a high intake of meat, fast food (take-away), animal fats and prepared main dishes (mixed dishes).”

7. Page 17, lines 11-12, unclear what this sentence is referring to: "Dietary pattern 3 was the only dietary pattern where both the energy adjusted associations were significant."
   Text has been amended to clarify. Now reads: “Dietary Pattern 3 was the only dietary pattern where both the sodium association and potassium association remained after adjusting for energy.”

8. Page 18, lines 3-4, it's also possible that the indication is of poor health choices, not necessarily of health consciousness.
   This has been added to the text which now reads: “….likely to consume dietary pattern 1, which may indicate a low level of health consciousness or poor health choices.”

9. Page 18, line 18, some researchers would disagree with this statement. Diet recall and food-
frequency capture different aspects of dietary intake and can both serve well in different research settings.

Have added to the text which now reads: “as recall data provides a more accurate assessment of dietary intake than food-frequency data54 in this type of analysis”

10. Page 18, line 24, there are some redundant words.
Have deleted “and” from this line which now reads: “This is likely because the main sources of potassium in this dietary pattern are fried potatoes, meat and fruit drinks, which are also likely high in energy.”

11. Page 19, lines 13-16, it may need some caution as to how the results are interpreted. Some of the food groups included in pattern 2 are commonly considered to be healthy for BP management, such as whole grains (if that's what unprocessed cereals mean), seeds and nuts.
Have changed the name of “unprocessed cereals” to better reflect what it is: “pasta, noodles and rice”.
“Seeds and nuts” were mainly salted nuts in this group of study participants. So I have added in a footnote to the food group table to explain this: “The food group seeds & nuts consisted mainly of salted nuts in this population group” and I have then used ‘salted nuts’ in the discussion and conclusion.
The key finding of this study is the nutrients (Na, K, Na/K) profile of the dietary patterns and their association with BP. How the different food groups make up a whole dietary pattern into a BP friendly nutrient profile or not can vary drastically depending on the proportion and type of foods within each food group. This point should be considered when making interpretation of the results. This is a known limitation of this type of analysis and when working with food groups which, as stated, can contain individual foods with quite different profiles depending on which nutrient is of interest. This was minimised as much as possible with the manipulation of food groups based on nutrients most relevant to BP. As stated in the methods “according to the similarities in food nutrient profiles, several major food groups were combined or spilt based on key nutrients such as sodium, fibre or fat”. Of course for some food groups this is more relevant than others. Following this line already in the discussion “The selection or creation of the food groups used is critical in exploratory factor analysis, therefore the food groups we created were based key nutrients for BP, our health outcome of interest, which may be considered a strength over using generic food groups” I have added “However the variation in both the type and proportion of individual foods within broader food groups, needs to be considered in dietary pattern analysis and interpretation.” to make the point clearer I hope.