Reviewer's report

Title: Reducing GHG emissions while improving diet quality: exploring the potential of reduced meat, cheese and alcoholic and soft drinks consumption at specific moments during the day

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Reviewer: Hanna Tuomisto

Reviewer's report:

General comments

The authors used data from a Dutch food consumption survey to calculate the mean daily dietary GHG emissions and grouped the population based on gender and the level of dietary GHG emissions. The diets of the highest emitting groups for both genders were used as reference scenarios and were compared with various alternative scenarios, including replacing cheese with nuts, replacing soft- and alcoholic drinks with tap water, and reducing red meat consumption during dinners without substitution. Therefore, most of the scenarios resulted in reduction in intake of total energy, saturated fat and mono- and disaccharides. The authors conclude that "consumption of red and processed meat during dinner and of soft- and alcoholic drinks should be the main targets for dietary interventions to lower the GHG emission of Dutch diets".

The merit of the paper is the novel approach that focuses on modifying the main meals instead of changing the whole diets. This is a welcoming approach as consumers might be more likely accept these types of interventions compared to switching to completely new diets. The paper also presents some interesting data of the composition and GHG emissions of Dutch diets. The paper is clearly written and well-structured.

However, my main concern with the paper is that the analysis presented in the paper doesn't support the conclusions sufficiently for the following reasons:

1) Scientific papers rarely make as strong conclusion statements as was made in this paper. The expression "should be the main targets" sounds more like a political statement and is not generally used in scientific text. This type of paper can only conclude that certain scenarios were more effective in terms of reduction of GHG emissions and providing health benefits, but additional factors (e.g. feasibility, acceptability, etc.) might need to be considered before policy recommendations can be given.

2) The number of alternative scenarios tested in the paper is not sufficient. The paper tested the effect of only three interventions and concludes that two of those should be used as main targets to lower GHG emissions of Dutch diets. There may be many more effective
(and feasible) alternatives that were not tested in the paper (e.g. replacing red meat with white meat/eggs/fish/vegetarian options and reducing the consumption of dairy products in general).

3) Instead of focusing only on the tertile with the highest dietary GHG emissions, the paper would be more interesting if some of the scenarios included interventions that would be applied to the entire population. These could include scenarios such as replacing 50% of red meat with white meat/fish/eggs/vegetarian protein sources etc. The effectiveness of the scenarios could then be compared at the population level, and therefore, it would be possible to see whether it is more effective to target only the highest tertile or the entire population.

4) I have concerns about the feasibility of the scenarios tested in this paper. For example, I'm not convinced that replacing sugary beverages between meals with tap water is a realistic scenario. The function of consuming sugary beverages between meals is not only hydration, but also intake of energy. Therefore, replacing sugary drinks with tab water doesn't fill both functions, and therefore, a more adequate scenario could be to replace the sugary drinks with both tab water and a healthy snack (e.g. a fruit).

I'm also quite sceptical about scenarios involving reduction in meat consumption without substituting it anyhow. Surely, GHG emissions would be reduced if people ate less, but I'm not convinced that consumers would be willing to reduce the total energy intake due to environmental reasons. Currently, all the proposed scenarios in the paper involve reduction of total energy intake. However, those options are not feasible for people who are not aiming at loosing weight. Therefore, it would be better to include also scenarios where the total energy intake is kept at the same level with the reference scenario.

From the technical point of view, the data provided in the paper is not sufficient for reproducing the study. The paper should include a detailed composition of the average diets (at least at the level of food groups) in each tertile and the GHG emission data used for each food group.

The paper mentions that the GHG emission data covered the whole life cycle from cradle to grave, but it would be good to specify what exact processes were included. For example, if cooking was included, it would be good to explain the assumptions regarding the choices of cooking technologies used for each product and assumptions regarding eating out vs. cooking at home, etc. The paper should mention the name of the database used for environmental assessment and explain whether the data was specific for the Netherlands or whether it was generic data (e.g. European or the world average data).
The paper reports only point values for the environmental impact results. GHG data of food products has large uncertainty ranges, and therefore, at least some type of uncertainty or sensitivity analysis would need to be included in a scientific paper.

The study didn't consider food waste at the household level. However, food waste amounts are relatively high especially in households and the percentage of food wasted at the household level differs between food groups. As reduction of food waste has potential to be an effective way to improve the environmental performance of food systems, I would suggest that the authors would consider food waste at least in a sensitivity analysis. This could be done by using available data for average percentages of different foods wasted at the household level.

Detailed comments

P 3, l 61: The word "import" should probably be replaced by "important"?

P 3, l 61-63: The sentence states that "around 30% of the worldwide emission of greenhouse gases is related to the production and consumption of food" and the reference is to Garnett (2008) that estimated that the contribution of food systems to the total GHG emissions in the UK is 19%. Therefore, I don't think the reference is correct as Garnett (2008) didn't present the global figure. A better reference would be Vermeulen, et al. (2012) (Climate Change and Food Systems. Annual Review of Environment and Resources 37, 195-222) that estimated the global food systems contribute 19-29% to the total GHG emissions.

P5, l 123-124: The sentence states that GHG emissions were used as a proxy for the environmental impact of the diet. This gives the impression that it would be generally acceptable to use GHG emissions as a proxy for the environmental performance, which is not true. Carbon footprint doesn't always correlate with other environmental indicators, e.g. land use, water use, biodiversity impact, eco/human toxicity, etc. (e.g. substituting cheese with nuts reduces GHG emissions, but may increase water footprint). Therefore, I would suggest just stating that you included GHG emissions only without mentioning that it was used as a proxy for all environmental impacts, and the discussion section could mention that further research should consider a wider range of environmental indicators.

P9, l242: It is not clear what the meaning of "(non-)alcoholic drinks" is.

Figure 1: would be good to specify what the category "Other" includes.
P9, l232-233: do these figures of mean meat consumption include also fish and eggs?

P10, l262-263: The sentence states that replacement of 50% of soft and alcoholic drinks by tap water caused a significant decrease in mono- and disaccharides intakes for men and women, but energy intake was reduced for men only. This is confusing as surely the energy intake had to be reduced for women too, or should it say that the reduction in the energy intake was not significant for women?

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

Yes

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Yes

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

No

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