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NUTRITION

JANUARY 2023

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TABLE OF

CONTENTS

Kebbe M, Gao M, Perez-Cornago A, Jebb SA, Piernas C. Adherence to international dietary recommendations in association with all-cause mortality and fatal and non-fatal cardiovascular disease risk: a prospective analysis of UK Biobank participants. *BMC Med*. 2021;19(1):134.

What We Know, Think We Know, or Are Starting to Know

Allow me, Dear Reader, to begin with a quote:

"The flawed science behind this message and subsequent change in dietary guidelines introduced for Americans in 1977 followed by the UK...in 1983 has resulted in increased consumption of low fat junk food, refined carbohydrates and polyunsaturated vegetable oils. The conspicuous rise in obesity immediately following their introduction suggests that they are a root cause of the problem." [1] [Emphasis added].

No doubt you are all overly, and tragically, familiar with this line of reasoning at this point; that dietary guidelines are causative of increased levels of non-communicable disease in the population over the period following their introduction.

This is not only found in the realm of random reports such as that cited for the quote above, but is present in the published literature, including claims that evidence did not support the introduction of guidelines [2,3], and that the evidence does not support current guidelines [4,5].

In a previous Deepdive (October 2021), we covered the Copenhagen General Population Study, a prospective cohort study in Denmark which showed that low adherence to Danish national dietary guidelines was associated with higher risk of cardiovascular and total mortality.

However, while dietary guidelines are implemented at the national level, they also have international scope due to their relative similarities in the broad dietary characteristics recommended. Consequently, in 2004 the World Health Organisation [WHO] Expert Consultation identified several dietary characteristics for dietary recommendations, which have been considered in the adoption of dietary guidelines in up to 81 countries [6].

What of adherence to these more universal recommendations in a national-level population? The present study investigated this question in the United Kingdom.

The Study

The present study was conducted in the UK Biobank, a national prospective cohort study in adults aged 37–75yrs. The aim of this study was to analyse the associations between four main WHO dietary recommendations and mortality risk.

The exposure of interest was adherence to the following recommendations:

i. Saturated fat <10% energy
ii. Added sugars <10% energy
iii. Dietary fibre >25g per day
iv. Fruit and vegetables >5 servings [~400g] per day

The primary analysis categorised participants based on number of recommendations met: 0, 1, 2, or 3-4. A secondary analysis was also conducted based on each individual recommendation.

Those meeting 0 recommendations were the reference group [i.e., the group against which the other categories were compared].

The outcomes of interest were all-cause mortality, total cardiovascular disease [CVD] ["total" = a composite of hospital admissions and/or death from coronary heart disease, heart failure, cardiomyopathy, and stroke], and CVD mortality.

Dietary intake was assessed using an online, web-based 24 h recall. To be included in the analysis, participants were required to have completed a minimum of two 24 h recalls. Other questionnaires were completed at baseline for data on factors like education status, smoking status, alcohol intake, etc.

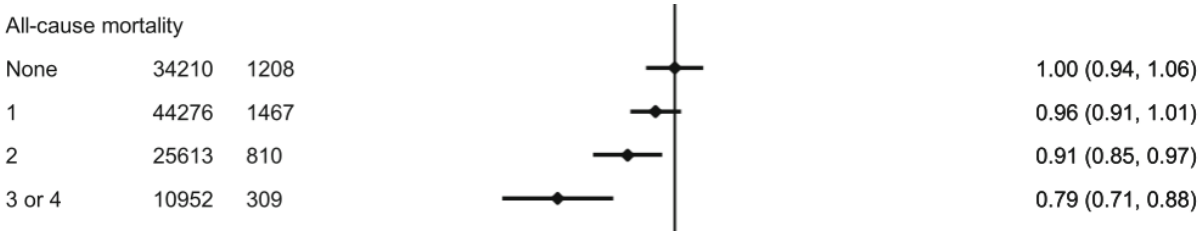
In a subgroup of this cohort, blood samples were also taken to analyse cardio-metabolic risk factors. The study also analysed cross-sectional associations between adherence to the dietary recommendations and levels of cardiometabolic risk factors.

Results: 115,051 participants were included in the final analysis, of which 57% were female. Average follow-up time for all-cause mortality and CVD mortality was 11.2yrs, respectively, while average follow-up time for total CVD was 10.6yrs.

The average age of participants was 55.8yrs at baseline. 29.7% of participants met 0 of the dietary recommendations; 38.5% met 1; 22.3% met 2; and 9.5% met 3–4.

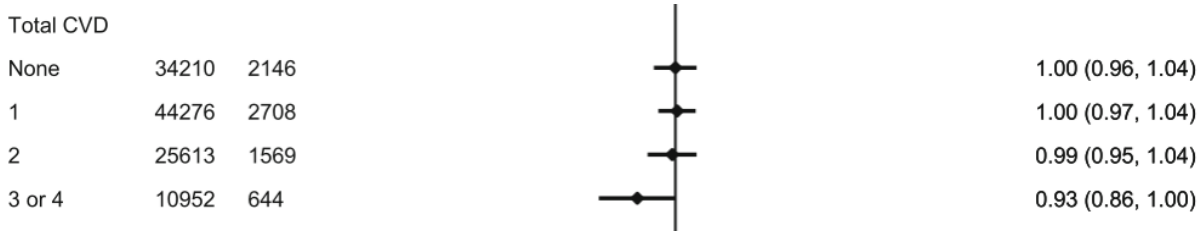
Of the individual dietary recommendations, 28.4% met the target of <10% saturated fat; 41.9% met the target of <10% added sugars; 10.9% met the target for >25g/d fibre; and 26.1% met the target for >5 servings per day of fruit and vegetables.

***All-Cause Mortality*:** Compared to the reference group of 0 recommendations, those meeting 2 recommendations had a 9% [HR 0.91, 95% CI 0.85 to 0.97] lower risk of all-cause mortality. Those meeting 3–4 had a 21% [HR 0.79, 95% CI 0.71 to 0.88] lower risk.



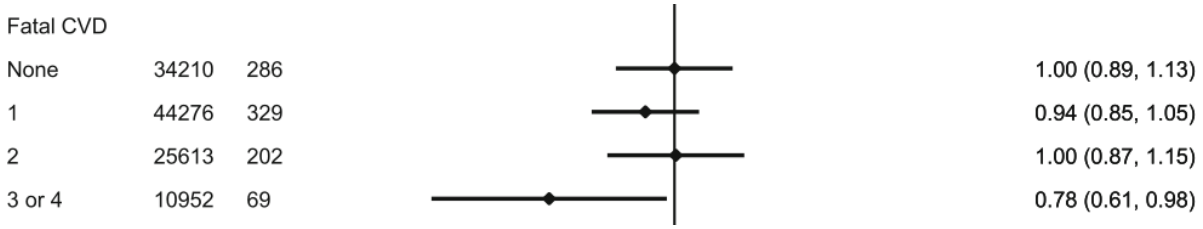
Forest plot *from the paper illustrating the associations between adherence to the dietary recommendations and risk of all-cause mortality. As you can see from the forest plot, the association was linear, with each increasing number of recommendations met associated with progressively lower risk of death from any cause.*

Total CVD: Compared to the reference group of 0 recommendations, those meeting 3–4 had a 7% [HR 0.93, 95% CI 0.86 to 1.00] lower risk of total CVD.



Forest plot *for total CVD from the paper; as is clear, only the highest category of adherence showed any lower risk of total CVD.*

CVD Mortality: Compared to the reference group of 0 recommendations, those meeting 3–4 had a 22% [HR 0.78, 95% CI 0.61 to 0.98] lower risk of death from CVD.



Forest plot *for CVD mortality from the paper. Similar to the finding for total CVD, only the highest category of adherence showed any lower risk of death from CVD.*

Cross-Sectional Risk Factor Analysis: Compared to the reference group of 0 recommendations, those meeting 3–4 had 1.06% lower body fat, 1.53cm lower waist circumference, 0.19mmol/L [7.3mg/dL] lower LDL-C, 40mg/dL lower ApoB, 0.10mmol/L lower triglycerides, and 0.55mg/L C-reactive protein [CRP].

The Critical Breakdown

Pros: The study had clearly defined aims, exposures, and outcomes. The primary, secondary, and sensitivity/subgroup analyses were all clearly distinguished. The study included a very large sample size and was well balanced between sexes. The study was also well balanced for socio-economic status, with similar representation from the top and bottom quintiles of the deprivation index. The follow-up times for the analyses were adequate. Detailed assessments were taken of participant characteristics, which included the subgroup with biomarker data which permitted the analysis of cardiometabolic risk factors. The analysis only included participants with a minimum of two completed dietary assessments, and also conducted a sensitivity analysis according to number of completed 24 h recalls [the results were largely similar for those completing 3+ or 4+ 24 h recalls].

Cons: The dietary assessment utilised 24 h recalls for a prospective [i.e., over time] study, and despite a minimum of two 24 h recalls being required for inclusion in the analysis, this may still have introduced measurement error and failed to capture 'true' representative day-to-day intake [i.e., did a participant just happen to consume <10% energy from added sugars the day before]. The sample was 96.6% White ethnicity, which is not representative of the general UK population [~81%]. Certain outcomes, e.g., CVD mortality, had small samples for the outcome of interest, which may introduce some bias and lack of precision in the findings. For the cross-sectional analysis of risk factors, not all blood samples were taken at the same point in time [i.e., blood samples taken at a different time to dietary assessment], thus the analysis is not quite "cross-sectional" in the literal meaning of this design.

Key Characteristic

In addition to the primary analysis which investigated adherence to any number of the four WHO dietary recommendations, the secondary analysis of the study also considered the associations for each individual recommendation. Interestingly, only the target of meeting >5 servings per day of fruits and vegetables was significantly associated with any outcome, specifically a 9% [HR 0.91, 95% CI 0.84 to 0.89] lower risk of all-cause mortality.

None of the other recommendations were individually associated with significant reductions in any of the outcomes, but the directions of effect for some findings were still informative. For example, fibre >25g/d was associated with an 8% [HR 0.92, 95% CI 0.85 to 1.00] lower risk of total CVD.

Of course, this could give rise to some questions; is saturated fat or sugar <10% energy not beneficial? Well, no. One crucial factor to bear in mind is that this analysis only adjusted for the other dietary recommendations, i.e., the analysis for <10% saturated fat only adjusted for <10% sugar, >25g/d fibre, and >5/d servings of fruits and vegetables. However, prior knowledge clearly demonstrates that the replacement nutrient for saturated fat is a crucial moderating factor, and the replacement of saturated with unsaturated fats, or with complex carbohydrate, is associated with lower CVD risk [7,8].

As an example of why the threshold for saturated fat in isolation may not alone be sufficient to see significant reductions in risk in observational research, consider the Women's Health Initiative intervention trial, in which ~49,000 women were randomised to a low fat dietary pattern or usual care control diet [9]. Despite lowering saturated fat from 12.5% to 8.1%, there was no significant reduction in CVD risk over 8yrs; however, the reduction in saturated fat came largely with refined carbohydrates replacing the saturated fat [9]. The participants merely replaced one risk-related nutrient with another.

Thus, the present study should not be interpreted as evidence against any single recommendation, as the analysis did not consider potentially crucial substitution effects.

Interesting Finding

It is interesting that, despite the stronger finding in relation to all-cause mortality, the outcome for total CVD was less impressive, and fatal CVD exhibited quite wide confidence intervals, indicative of a lack of precision [which likely reflected the very small (*n* = 69) number of events and variability in the group meeting 3–4 dietary recommendations].

However, we can perhaps use the biomarker data to put together a bigger picture in relation to CVD. In this data, LDL-C and ApoB both decreased linearly with increasing adherence to the dietary guidelines, while triglycerides and CRP were also lower in the group meeting 3–4 recommendations. However, the magnitude of these differences was relatively small to modest. For example, average LDL in the 3-4 adherence group was 3.46mmol/L or 133.5mg/dL; ideally this would be <3.0mmol/L [115mg/dL].

If the biomarker data is representative of the overall cohort, it may be that the overall effect of adherence to these specific guidelines related only to modest effects on important CVD risk factors, including the causal pathway in LDL-C and ApoB [10,11], which may not have been sufficient to exert more pronounced effects on CVD risk reduction.

This does not mean the guidelines are ineffective; more likely it may reflect several factors. First, the age of participants at baseline [~55yrs] is relevant given that the underlying pathophysiology of CVD may already be advanced. In support of this, a sensitivity analysis that excluded individuals who had a CVD event within 2yrs of their last dietary assessment showed a slightly greater magnitude of risk reduction – 25% vs. 22% in the primary analysis – indicating that the effect of greater adherence to the dietary recommendations may be more pronounced in lower risk individuals.

Secondly, there were also no differences in other causal risk factors for CVD, specifically blood pressure, and the analysis did not include recommendations for sodium intake. Thus, bear in mind that the analysis was largely for a discreet number of dietary recommendations, albeit important ones, but is not entirely encompassing of other aspects of the recommendations – e.g., sodium, omega-3 polyunsaturated fats – that are important for cardiovascular health.

Relevance

At this point, we should be able to put questions over dietary guidelines, whether at the national level or the more universal WHO recommendations, to bed. The papers that are most cited in support of the contention that dietary guidelines are not evidence-based [2–5], all derived from the same author [Zoe Harcombe] in the same journals [BMJ Open Heart and British Journal of Sports Medicine], that respectively bear about as much resemblance to the truth of nutrition science as the Republicans to U.S. election results.

Several findings from the present study add weight to the refutation of common claims made against dietary guidelines. First, only 9.5% of the overall cohort [9,712 of 115,051 participants] met 3–4 of the recommendations. A 1984 study of British dietitians following the introduction of the UK dietary guidelines found that only 10% met the recommendation for fat intake, and 7% met the target for fibre intake [12]. In a study in 217 free-living adults two years after the introduction of the dietary guidelines, not one was found to meet all the recommended guidelines, and just 5% met the recommendation for fat and fibre intake [13]. Another analysis showed that at three years after the introduction, just 8.3% met the targets for fruits and vegetables [14]. Thus, the present study confirms the reality of the status quo: the guidelines were never really followed.

If the contention is that following the guidelines is associated with worse health outcomes, then this is also demonstrably falsifiable. In the Copenhagen General Population Study that we covered in a previous Deepdive, it was lack of adherence to the guidelines that was associated with 35% higher risk of CVD mortality and 46% higher risk of all-cause mortality. Cumulatively, there is little to no evidential wiggle room to argue that dietary guidelines are either:

a) Followed by any substantial proportion of the general population;
b) Associated with increased risk if they are adhered to, or;
c) Associated with better health if they are not adhered to.

The search for convenient scapegoats should really move on from the dietary guidelines.

Application to Practice

The emphasis on the four dietary characteristics in the present study is indicative of broad universal applicability of the core characteristics of healthy dietary patterns, notwithstanding that this specific analysis was conducted in the UK population specifically. And, importantly, notwithstanding that this analysis was *only* four specific recommendations, other characteristics – sodium, unsaturated fats, wholegrains – remain important aspects of dietary guidelines with broad applicability.

How many nutrition professionals and coaches, if asked what they recommend to clients, would say; "oh I recommend that they aim to follow the dietary guidelines". There is a lesson in all of this that I think is important for nutrition practitioners to hold dear; that the best practices are the ones right in front of us. Of course, saying the targets is easy; the role of nutrition professionals is to help an individual become competent in meeting these recommendations in their daily life, and that is the challenge.

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