The effect of ApoE genotype, MTHFR genotype and dietary intake on intermediate cardiovascular disease risk factors. Does personalised nutrition advice based on ApoE and MTHFR genotype affect dietary behaviour?

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Introduction

- Cardiovascular disease (CVD) is a preventable cause of death and dietary intake is linked to numerous modifiable risk factors of CVD (1).
- The individual response to current public health nutrition advice to reduce the risk of CVD is variable and may be explained by individual genotype (2).
- Studies have attempted to understand the gene-diet interactions to reduce CVD risk through dietary modification, with mixed findings (3,4).
- Two well studied single nucleotide polymorphisms associated with CVD are the apolipoprotein E (ApoE) gene and the methylenetetrahydrofolate reductase (MTHFR) gene.
- Some evidence suggests individual response to dietary advice following genotype information may be more effective in eliciting dietary change than general dietary advice (5). However, the effectiveness of personalised nutrition and how it is delivered remains unclear (6).

Methods

Participants: 115 men and women aged >18 years without coronary heart disease or stroke/transient ischaemic attack.

Measures:

Genotype: DNA was extracted from a saliva sample. Genotyping for APOE genotype rs7412 (E2) rs429358 (E4) and MTHFR genotype C677T rs1801133 was carried out using the TaqMan method.

CVD risk: Estimated using QRISK®2-2017 cardiovascular disease risk calculator. Total cholesterol : HDL cholesterol was measured using The CardioChek® Professional Analyser point-of-care test system. Blood pressure was measured using a Digital Blood Pressure Monitor.

Dietary intake: Estimated using the Automated Multiple-Pass Method. Analysed using Nutritics, nutrition analysis software to determine reported energy, fat and folate intake.

Aim

To determine the effect of genotype (ApoE and MTHFR) and diet (fat and folate) combined or in isolation on intermediate CVD risk factors. Also, to determine if personalised nutrition advice based on genotype affects dietary change.

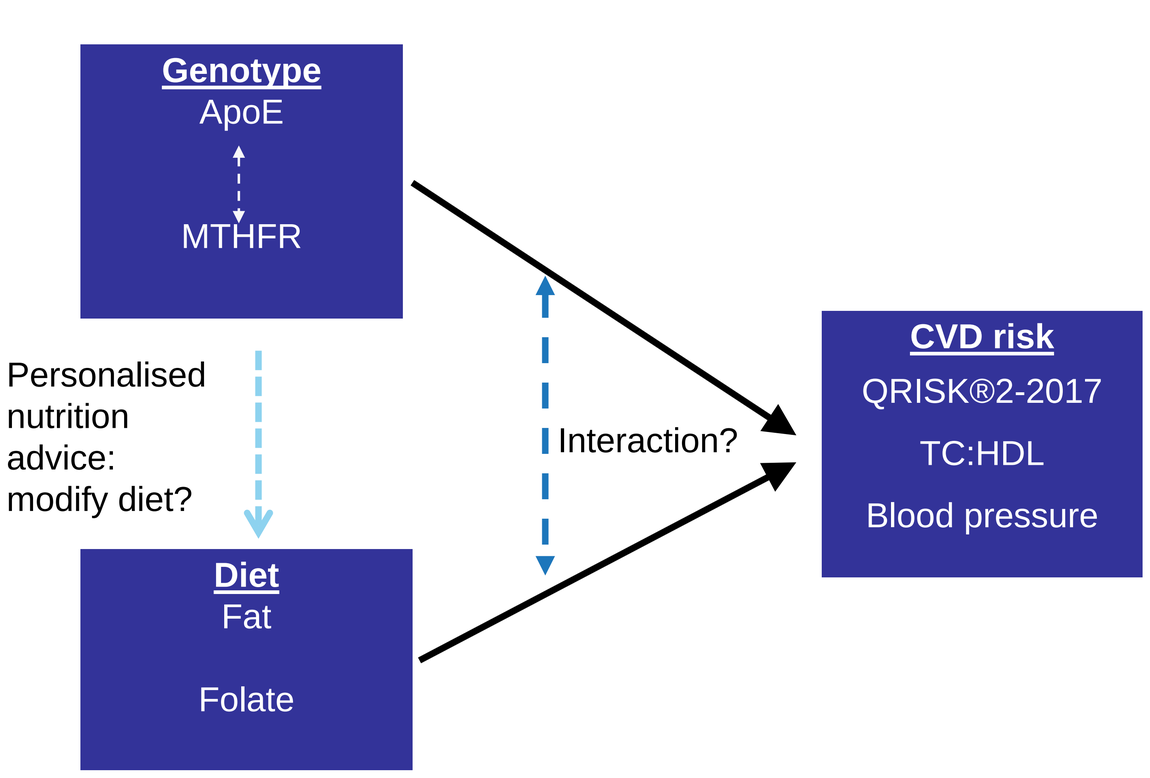

Figure 1. Overall study design

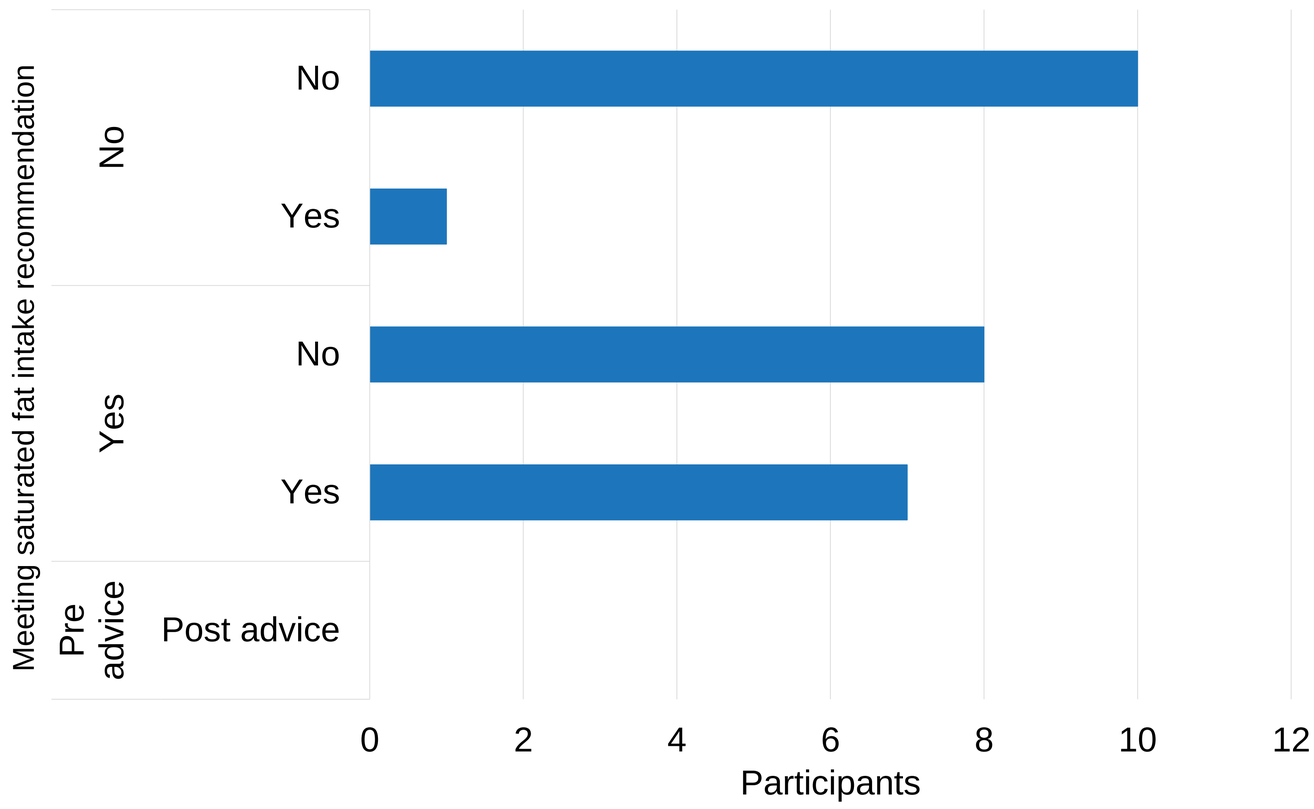

Figure 2. Number of participants, with a risk associated genotype (n = 26), meeting recommended saturated fat intake pre and post personalised dietary advice based on genotype.

Conclusions

- The preliminary findings from this study suggest there was no effect of genotype (ApoE and MTHFR) and diet (fat and folate) combined or in isolation on intermediate CVD risk factors.
- Personalised nutrition advice based on genotype does not elicit favourable dietary change, which is in agreement with previous research[7].
- Furthermore, in the case of saturated fat intake, personalised dietary advice to participants with a risk associated genotype elicits unfavourable dietary change.

Results

- A two-way MANOVA revealed the interaction effect between genotype and diet on the combined CVD risk factors was not statistically significant ($F = 0.820$, $p = 0.555$). The main effect of genotype on the combined CVD risk factors was not statistically significant, ($F=0.336$, $p = 0.962$). The main effect of diet on the combined CVD risk factors was not statistically significant ($F=0.719$, $p = 0.635$).
- An exact McNemar's test revealed the proportion of participants with a risk associated genotype that reported dietary intakes meeting recommendations for saturated fat significantly decreased following personalised dietary advice based on their genotype and reported intake ($p = 0.039$).

References

1. NICE. Cardiovascular disease prevention. Public health guideline [PH25]; 2010.
2. Caslake MJ, Miles EA, Kofler BM, Lietz G, Curtis P, Armah CK, et al. Effect of sex and genotype on cardiovascular biomarker response to fish oils: the FINGEN Study. Am J Clin Nutr. 2008 Sep 1;88(3):618–29.
3. Masson LF, McNeill G, Avenell A. Genetic variation and the lipid response to dietary intervention: a systematic review. Am J Clin Nutr. 2003 May 1;77(5):1098–111.
4. Wald DS, Morris JK, Wald NJ. Reconciling the evidence on serum homocysteine and ischaemic heart disease: a meta-analysis. PLoS ONE. 2011 Feb 2;6(2):e16473.
5. Arkadianos I, Valdes AM, Marinos E, Florou A, Gill RD, Grimaldi KA. Improved weight management using genetic information to personalize a calorie controlled diet. Nutr J. 2007 Oct 18;6:29.
6. Celis-Morales C, Livingstone KM, Marsaux CFM, Forster H, O'Donovan CB, Woolhead C, et al. Design and baseline characteristics of the Food4Me study: a web-based randomised controlled trial of personalised nutrition in seven European countries. Genes Nutr. 2015 Jan;10(1):450.
7. O'Donovan, C. B., Walsh, M. C., Forster, H., Woolhead, C., Celis-Morales, C., Fallaize, R., … Gibney, E. R. (2016). The impact of MTHFR 677C → T risk knowledge on changes in folate intake: findings from the Food4Me study. Genes & Nutrition, 11, 25.