A HEALTHY DIET

But what works for me personally?

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If everyone would simply stick to dietary recommendations, most people would age healthily and avoid chronic diseases such as heart disease and cancer.

A  Yes
B  No
C  It's not that simple really…
Randomised controlled trials (RCTs) as the ‘gold standard approach’ to assess the efficacy of diet and drugs in the prevention and treatment of diseases in target populations.

Guidelines for medical treatments and dietary recommendations which have proven efficacy at the population level.


Measure the **average change** in the level of a risk factor/biomarker in the treatment group as compared with the control group.

Many of the large randomised controlled trials have effectively demonstrated that only ~40% of a cohort responds to dietary interventions...

De Roos and Brennan, Nutrients 2017;9:E847
Efficacy of wheat & oats to lower blood pressure

Could we, somehow, predict who will be responding to certain foods or diets, and who won’t?

Would it be more effective to promote healthy eating if people, somehow, could make better informed dietary choices, based on their genotype, metabotype, current dietary intake, or on their environment?
Inter-individual variability in response to plant bioactives

Main determinants for inter-individual variations?

- Polyphenols
- Carotenoids
- Glucosinolates
- Phytosterols

Bioavailability

Biological responsiveness

Cardiometabolic health

Addressing the inter-individual variation in response to consumption of plant food bioactives: Towards a better understanding of their role in healthy aging and cardiometabolic risk reduction

Claudine Manach1*, Dragan Milenkovic1*, Tom Van de Wiele2, Ana Rodriguez-Mateos3, Baukje de Roos4, Maria Teresa García-Conesa5, Rikard Landberg6,7, Eileen R. Gibney8, Marina Heinonen9, Francisco Tomás-Barberán10 and Christine Morand1
Single genotypes have generally poor predictive values.

Thus far we have **only 2 properly controlled dietary intervention studies** that have shown a diet-genotype – phenotype relationship:

- Riboflavin lowers blood pressure in cardiovascular disease patients homozygous for the MTHFR 677C→T polymorphism.
- Long-chain n-3 polyunsaturated fatty acids have a greater triacylglycerol-lowering action in males than in females, and there was a trend toward greater responsiveness in apolipoprotein E4 carriers.

Prediction of glycaemic responses

Per person profiling
- Gut microbiome
  - 16S rRNA Metagenomics
- Blood tests
- Questionnaires
  - Food frequency
  - Lifestyle
- Anthropometrics

Computational analysis
- Main cohort
  - 800 Participants
- Validation cohort
  - 100 Participants
- PPGR prediction
- Dietary intervention
  - 26 Participants

Diary (food, sleep, physical activity)
Using smartphone-adjutsted website
5,435 days, 46,896 meals, 9.8M Calories, 2,532 exercises

Continuous glucose monitoring
Using a subcutaneous sensor (iPro2)
130K hours, 1.56M glucose measurements

Standardized meals (50g available carbohydrates)
- Day 1: Bread, Bread
- Day 2: Bread, Butter, Bread & Butter
- Day 3: Glucose, Glucose, Fruuctose

Zeevi et al, Cell 2015; 163:1079
N-of-1 studies, the power of replicates
- Ruminococcus bacteria play an essential role in the initial breakdown of fibres to allow cross-feeding.
- Ruminococcus is a keystone species – without this bacteria the fibre remains unavailable to other bacteria.
Could we, somehow, predict who will be responding to certain foods or diets, and who won’t?

Would it be more effective to promote healthy eating if people, somehow, could make better informed dietary choices, based on their genotype, metabotype, current dietary intake, or on their environment?
Level 0
- Generic healthy eating guidelines

Level 1 PN
- Dietary intake

Level 2 PN
- Dietary intake
- Phenotype

Level 3 PN
- Dietary intake
- Phenotype
- Genotype

Generic

Personalised

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</table>
Following a 6-month intervention, participants randomized to personalised nutrition arms consumed less red meat, salt and saturated fat, increased folate intake and had higher Healthy Eating Index scores than those randomized to the control arm.

There was no evidence that including phenotypic and phenotypic plus genotypic information enhanced the effectiveness of the personalised nutrition advice.
Meta-analysis revealed no significant effects of communicating DNA based risk estimates on smoking cessation, diet, or physical activity. There were also no effects on any other behaviours (alcohol use, medication use, sun protection behaviours, and attendance at screening or behavioural support programmes) or on motivation to change behaviour.
Precision Medicine versus Precision Nutrition

**Health belief model**: health behaviours are more likely to be adopted if the related benefit are perceived as high, whilst individual burdens (“costs”) are low.
Consumption of an ‘unhealthy diet’ - assuming this could be determined in an objective way - should be classified as a high risk behaviour and therefore be penalised with an increased health insurance premium

A  Yes
B  No
C  Perhaps only in ‘older’ people…
Acknowledgements

www.nugo.org

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