

Atelier 3: Computational and Mobil based solutions in personalized nutrition – effectiveness and limitations (e)

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David de Lorenzo is a B.Sc. (Honours) graduated from the University of Navarre, and PhD (cum laude, Molecular Population Genetics) from the University of Barcelona. He has focused his scientific career on the understanding of the genetic basis of complex diseases, and the study of the interactions between genetic and nutritional factors in relationship to human health. His past professional experience consists of different positions at the University of Texas Health Science Center (USA), the Ludwig-Maximilians University of Munich (Germany), and the University of Lleida (Spain). Currently David de Lorenzo is associated professor at the university Pompeu Fabra in Barcelona (Spain), and director of the area of Personal Genomics at NIMGenetics SL (Scientific Park of Madrid, Spain). He is member of the Spanish Society of Genetic Counselling (SEAGEN), the Spanish Association of Human Genetics (AEGH), and the Spanish Society of Genetics (SEG).

Moderation: Dr. Robert Sempach, Migros Kulturprozent

Computational and mobile based solutions in personalised nutrition

Effectiveness and limitations

Dr. David de Lorenzo
Director - Personal Genomics Area

Associate Professor



IT solutions in personalised nutrition

1. IT solutions for Nutritional Assessment
2. Challenges in Nutrition
3. Challenges in Personalised Nutrition
4. Ethics and Perspectives



IT solutions for Nutrition Assessment

1. Nutrition assessment

- Dietary Recalls
- Food Frequency Questionnaires (FFQ)
- Multiple-day Food Records
- Specific Food Questionnaires



IT solutions for Nutrition Assessment

1. Nutrition assessment

- Dietary Recalls

In-depth "unannounced" interview that collects detailed information on all foods and beverages consumed by a participant during the previous 24 hours.



IT solutions for Nutrition Assessment

Limitations of Dietary Recalls (24 h recalls)

1. Less cognitively challenging (relies on short-term recall)
2. Rich detail & fewer assumptions required in converting to nutrient and food group intake
3. Aims to capture recent diet -> Need more than one to assess usual intake
4. Expensive to collect and code



IT solutions for Nutrition Assessment

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3. Aims to capture recent diet -> Need more than one to assess usual intake
4. Expensive to collect and code
5. BUT Computational approaches (web-based recalls) makes possible this approach at much lower cost.



IT solutions for Nutrition Assessment

Intake24 is an open source self-completed computerised dietary recall system based on multiple-pass 24-hour recall. The online system offers similar data quality to interviewer-led recalls at a significantly lower cost.

[Try a demo »](#)



IT solutions for Nutrition Assessment

Please use the slider on the right to indicate how full your cup:

139 g

268 ml



State of the art - IT solutions for Personalised Nutrition



State of the art - IT solutions for Personalised Nutrition



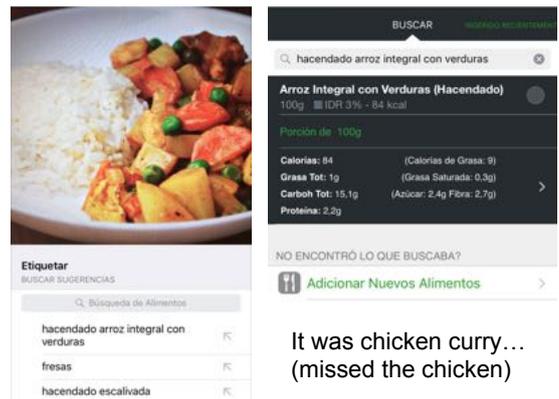
Food Diaries: e.g. Fat Secret

All the tools to achieve your diet goals.

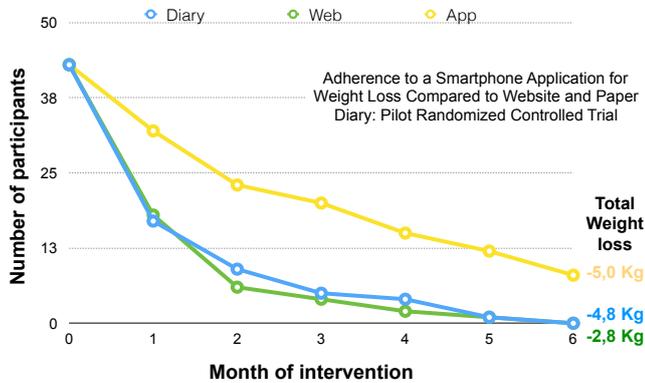
- ✓ A FOOD DIARY To keep track of what you're eating.
- ✓ AN EXERCISE DIARY To record all the calories you burn.
- ✓ HEALTHY RECIPES A large collection for your diet.
- ✓ A WEIGHT CHART AND JOURNAL To record your progress.
- ✓ NUTRITIONAL INFO For all foods, brands and restaurants.
- ✓ MOBILE APPS For iPhone, iPad, Android, BlackBerry and Windows.

- + Social Network
- + Photo-calories automatic calculation (yesterday's update)

Food Diaries: e.g. Fat Secret



Food diaries



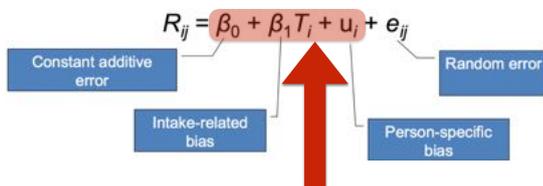
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Challenges in Nutrition

Challenges to estimate usual intake

Self-report instruments used to assess usual dietary intake are affected by several types of measurement error – If we ignore this error, our results may be biased



Systematic errors that can be reduced by the use of Computational (web+app) solutions

Food Scan, Type I (Barcodes Scanner)

Yatekomo Pollo
Marca: Gallina Blanca

Energía	Grasas	Grasas saturadas	Azúcares	Sal
282,00 kcal/1179,0 kcal	13,00 g	7,10 g	1,90 g	2,30 g
1414	19%	36%	2%	39%

100g 310,00g % IR/VRN*

Valor energético	Grasas	Grasas saturadas	Hidratos de carbono	de los cuales azúcares	Fibra alimentaria	Proteínas	Sal
88,00 kcal/368,00 kcal	4,00g	2,30g	11,00g	0,60g	0,70g	1,60g	0,76g
282,00 kcal/1179,0 kcal	13,00g	7,10g	35,00g	1,90g	2,30g	5,00g	2,30g
1414%	19%	36%	31%	2%	3%	32%	39%

*Ingesta de Referencia/Valor de Referencia de Nutrientes de un adulto medio (8400 kJ/2000 kcal)
Número de raciones por envase: 1

Food Scan, Type II (Real Scanner)

Food Scanner Horizon Prize

<https://www.youtube.com/watch?v=v0uggsj4Ars>

Do we really know what we eat?



Why IT solutions for Personalised Nutrition?

Tellspec

<http://tellspec.com/howitworks/>



Why IT solutions for Personalised Nutrition?

Scio

<https://www.consumerphysics.com/myscio/order/>

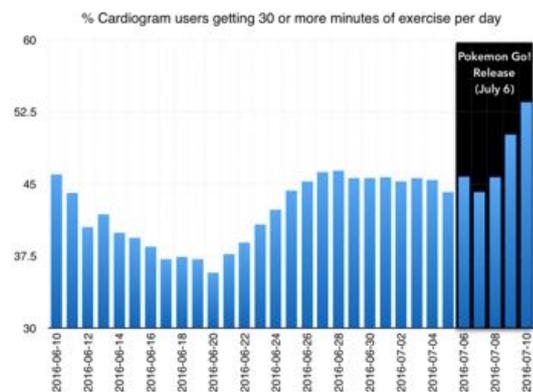


Why IT solutions for Personalised Nutrition?

Let's say a scanner tells me how many grams of sugar my fruit contains, or what the alcohol percentage of a drink is. So what?

It won't change my behaviour and dietary habits unless I'm a dietitian and understand what the data means, and how it can be acted upon.

Example of app that changes habits...



Why IT solutions for Personalised Nutrition?

Food scanners will need to progress similarly to wearable health trackers – move from raw data to automated analysis and smart suggestions to the user.

But... How?

Second part: IT solutions for Personalised Nutrition

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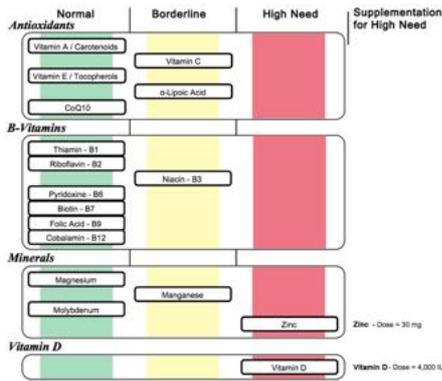
Challenges in Personalised Nutrition

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But... How?

Challenges in Personalised Nutrition

+ Metabolic biomarkers:



Challenges in Personalised Nutrition

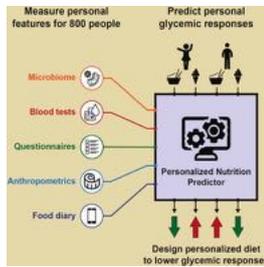
+ Metabolic biomarkers:



Challenges in Personalised Nutrition

1. Nutrition assessment
2. Personalised recommendations

Based on Nutrition assessment + metabolic & metagenomic markers



Source: Personalized Nutrition by Prediction of Glycemic Responses. Zeevi et al. Cell 163, 1079–1094, November 19, 2015

Challenges in Personalised Nutrition

Summary

- Continuously monitoring glucose levels in an 800-person cohort
- Measured responses to 46,898 meals, and found **high variability in the response to identical meals**, suggesting that **universal dietary recommendations may have limited utility**.
- Devised a **machine-learning algorithm** that integrates blood parameters, dietary habits, anthropometrics, physical activity, and gut microbiota measured in this cohort
- **Accurately predicts** personalized postprandial glycemic response to real-life meals (validated in an independent 100-person cohort).
- A blinded, randomized controlled dietary intervention based on this algorithm resulted in **significantly lower postprandial responses**.

Source: Personalized Nutrition by Prediction of Glycemic Responses. Zeevi et al. Cell 163, 1079–1094, November 19, 2015

Challenges in Personalised Nutrition

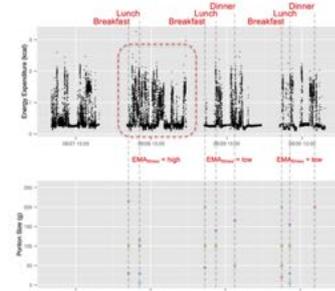
1. Nutrition assessment
2. Personalised recommendations

Based on Nutrition assessment + genetic (GxE), metabolic and metagenomic markers



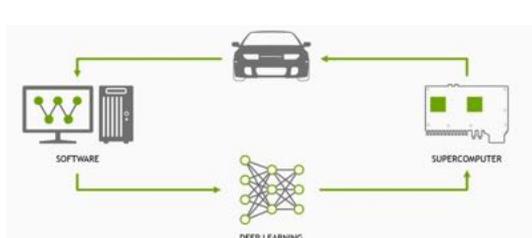
Challenges in Personalised Nutrition

1. Nutrition assessment
2. Personalised recommendations
3. (Machine) Learning from Genetic background + Environment-Nutrition and Health Outputs



Challenges in Personalised Nutrition

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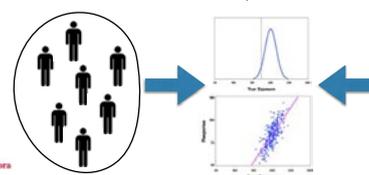


Challenges in Personalised Nutrition

- IT for Personalised Nutrition makes possible not one-directional knowledge, but bi-directional.



- The coming-of-age of Personalised Nutrition will arrive with N=1 studies, thanks to IT solutions.



Conclusions, Part II

Use of IT-solutions in Nutrition provide:

- Better estimates of population intake requirements
- Better regression of nutritional factors and health effects at population level

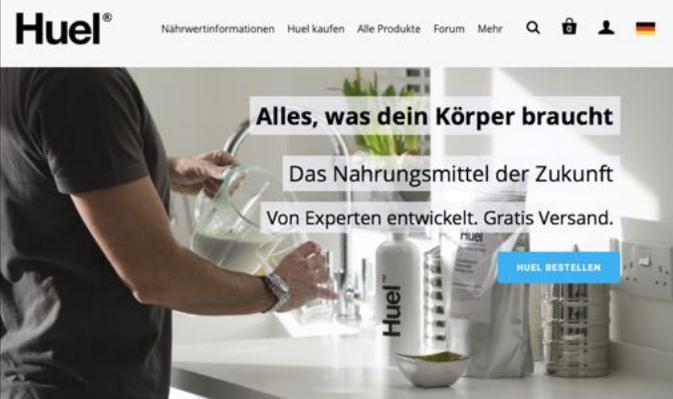
Use of IT-solutions in Personalised Nutrition provide:

- Better estimates of individual intake requirements
- Better regression of nutritional factors vs health effects

Conclusions, Part II

- A good lifestyle tracker should accurately determine my food ingredients, and compare the data to my lifestyle, dietary choices, and my genomic background.
- Given how different we all are genetically, so far pure luck and experience have alerted us to these differences.
- BUT, eating should be a conscious process where we know what we eat, and know what we should eat for optimum health.
- A food scanner, supported by a smart (machine learning) application could fill this place.

Perspectives & Ethics



Perspectives & Ethics

Ethical considerations

1. Complex systems biology: Genes implicated in different diseases with unwanted information - ApoE.

Potential problem given that the use of IT solutions imply scarce (if any) contact with health professionals.

Perspectives & Ethics

Ethical considerations

1. Complex systems biology: Genes implicated in different diseases with unwanted information - ApoE.
2. The results may have implications not only for the person who is being analysed, but also for genetically related family, raising questions about the sharing of the information with the patient's families.

Potential problem specifically with the use of IT solutions, since it makes easier the sharing of genetic information without viewing restrictions.

Perspectives & Ethics

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3. In addition, a genetic test is always a potential paternity test.

Potential problem when sharing variants, publicly or in the intimacy (family)

Perspectives & Ethics

Ethical considerations

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2. The results may have implications not only for the person who is being analysed, but also for genetically related family, raising questions about the sharing of the information with the patient's families.
3. In addition, a genetic test is always a potential paternity test.
4. There is growing concern about the best way to ensure that the results of a genetic test be kept confidential, and how to avoid discrimination based on genetic information.

Potential problem of hacking genetic information (possible)

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