Addressing inter-individual variation in response to consumption of plant polyphenols

Insights from the COST Action FA1403-POSTIVe



Vitafoods Europe

The global nutraceutical event

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Baukje de Roos

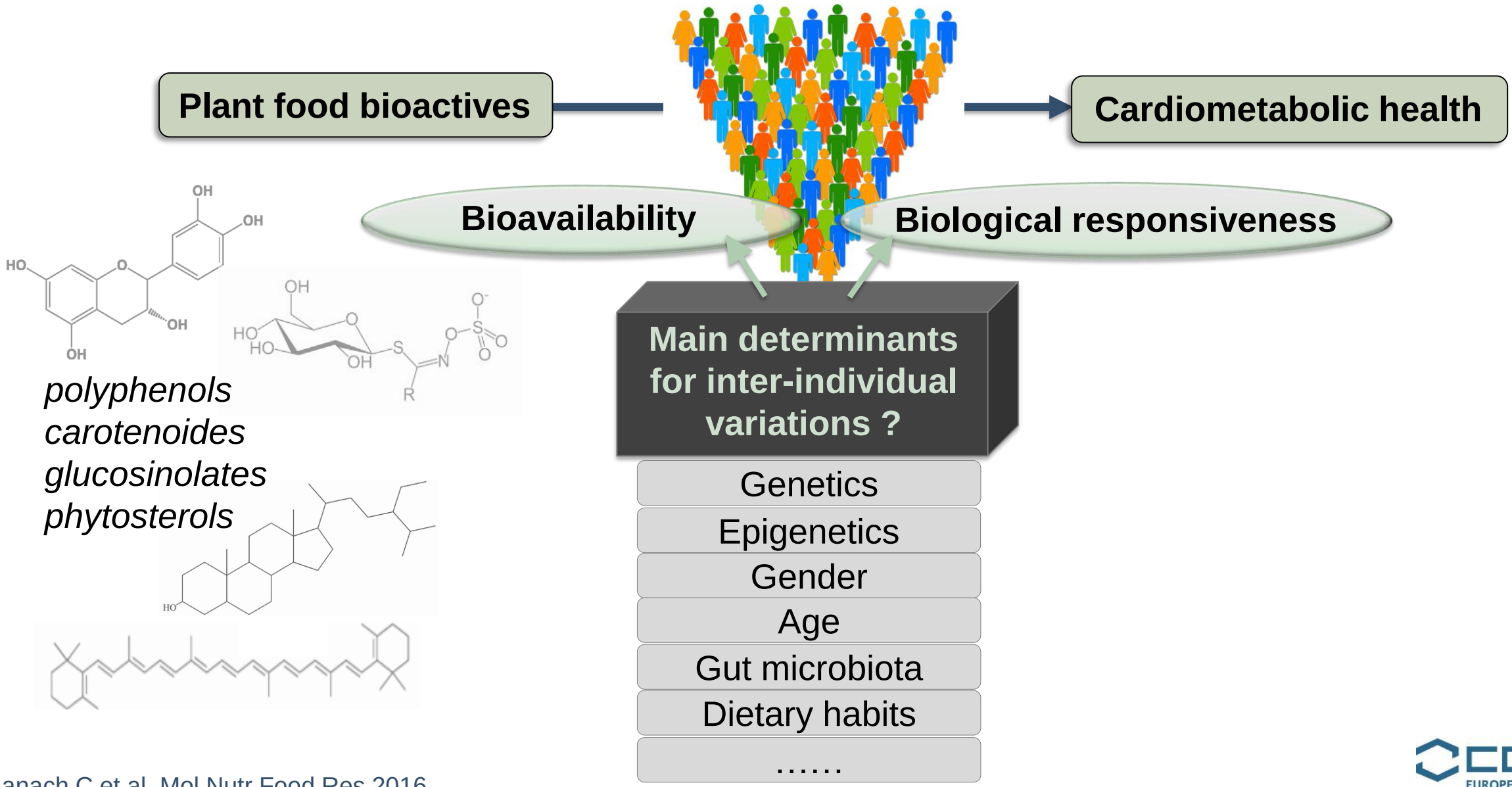
Population versus individual dietary needs

The efficacy by which dietary interventions influence health is currently mainly determined by taking population-based approaches that can favourably shift disease risk factors in the entire population, but…

…many of the large RTCs have effectively demonstrated that only 40% of a cohort responds to dietary interventions

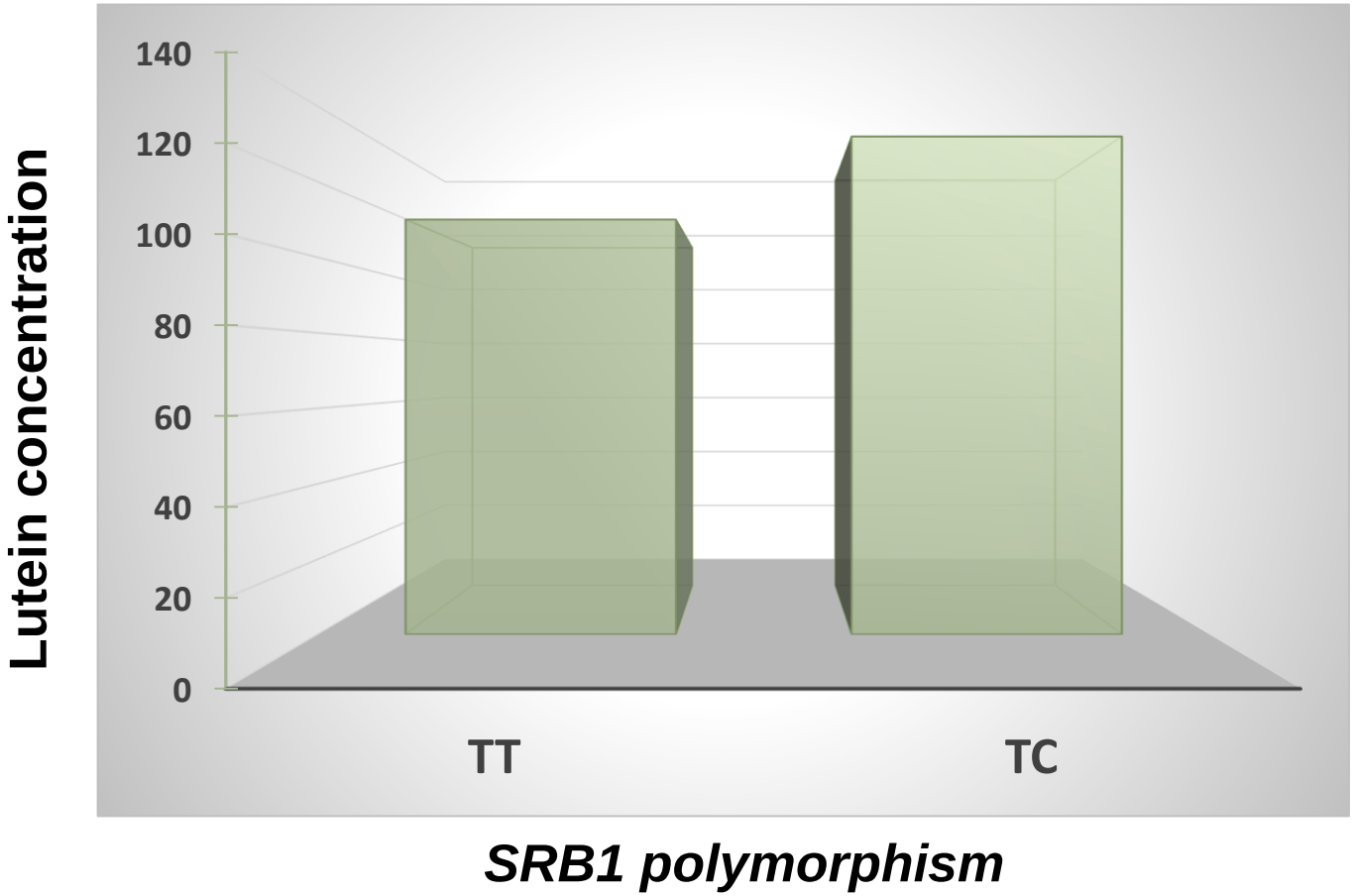
Could we, somehow, overcome and indeed benefit from individual variability in responses to interventions?

Inter-individual variation in response to eating plant food bioactives

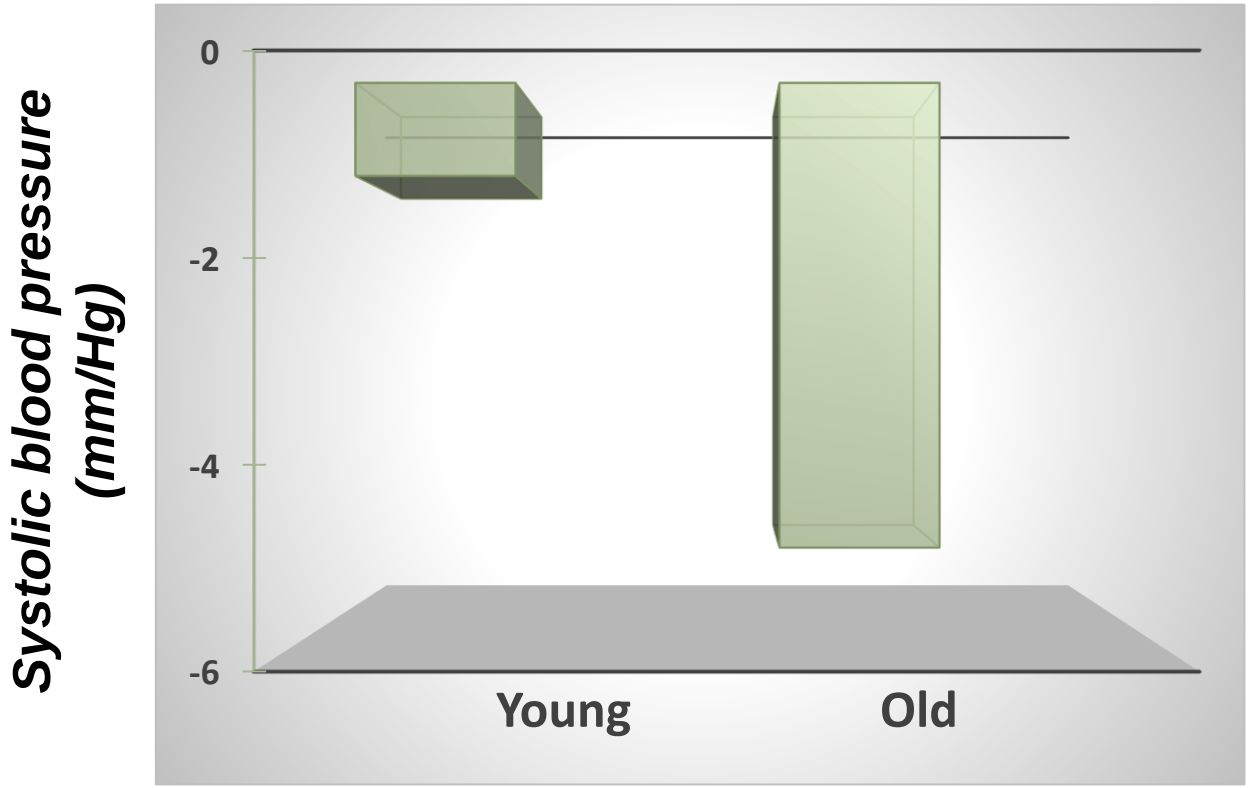


Manach C et al, Mol Nutr Food Res 2016

Lutein status depends on variants in genes encoding proteins involved in carotenoid absorption

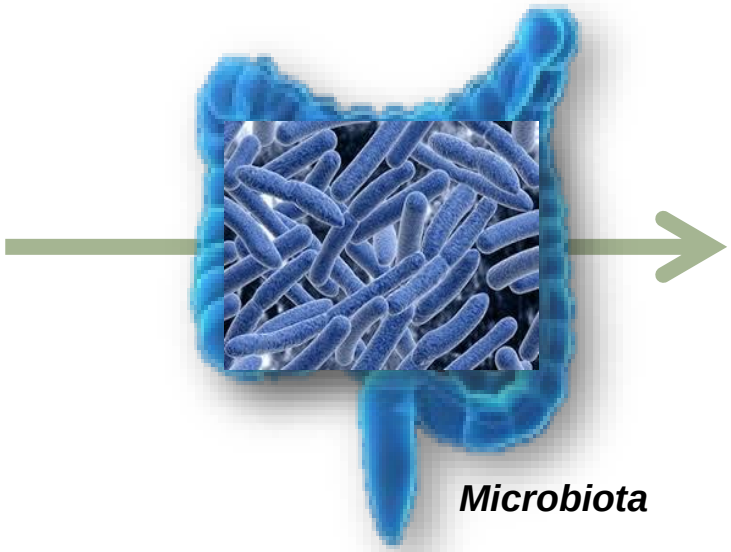


Age-dependant differences in the hypotensive effect induced by cocoa flavanol intake



Production of active metabolites from soy isoflavones depends on gut microbiota

soy



Microbiota

30% equol producers

health benefits of soy-based diets may be greater in equol-producers than in equol nonproducers

POSITIVe: Essentials for health claims

1.- FOOD SCIENCE - Characterisation of food/constituent

- Full characterisation of the bioactives present in food and food products
- Effects of manufacturing/processing effects (stability)

2.- Establishing the BIOAVAILABILITY & METABOLISM of the compound(s)

- Clarify digestion, absorption, metabolism
- Identify the molecule(s) involved in the beneficial effects

3.- HUMAN STUDIES: Comprehensive review and meta-analyses

- Identify and demonstrate effects on specific Metabolic and Cardiovascular variables in humans

4.- PRECLINICAL STUDIES: plausible mechanisms

- Mechanisms of action by which the compound(s) can exert the metabolic and cardiovascular effects

ESTABLISH A CLEAR RELATIONSHIP BETWEEN THE CONSUMPTION AND AN EFFECT

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- Clarify digestion, absorption, metabolism
- Identify the [illegible] effects

Identify human efficacy in specific subgroups: FACTORS INVOLVED

Review and meta-analyses

[illegible] metabolic and Cardiovascular

va[illegible]

4. PRECLINICAL STUDIES: plausible mechanisms

- Mechanisms of action by which the compound(s) can exert the metabolic and cardiovascular effects

ESTABLISH A CLEAR RELATIONSHIP BETWEEN THE CONSUMPTION AND AN EFFECT

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PROVIDING EXPERTISE IN:

1. **FOOD SCIENCE & CONSTITUENTS CHARACTERISATION**
2. **BIOAVAILABILITY & METABOLISM**
3. **HUMAN CLINICAL TRIALS**
4. **MECHANISTIC STUDIES**

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1. Inter-individual variation in bioavailability

Absorption, distribution, metabolism and excretion of plant bioactives

2. Personal requirements: who needs what?

Inter-individual variation in the biological responsiveness to plant bioactives

3. Academia and industry – how can we work together?

Inter-individual variation in bioavailability

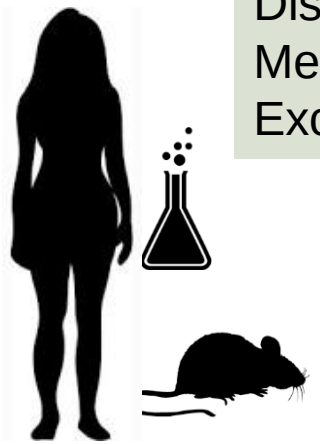
8 compound subgroups

- Carotenoids
- Anthocyanins
- Lignans/Phenolic acids
- Tannins
- Flavanones
- Flavonols
- Catechins
- Phytosterols

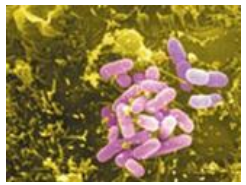


Genetic variation

Absorption
Distribution
Metabolism
Excretion



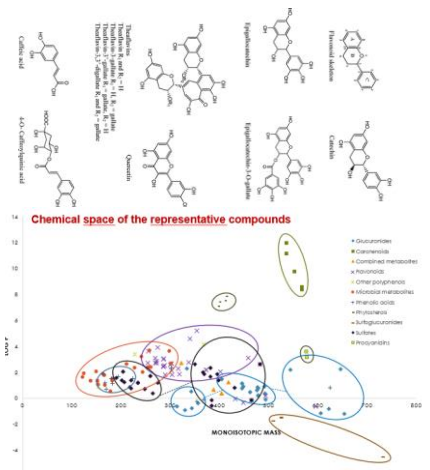
Microbiome variation



***In silico* models**

Analytical methodology

Metabolomics



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POSTIVe OBJECTIVES

1. Database existing knowledge on **interindividual variation in ADME** (absorption, distribution, metabolism, excretion) of selected plant bioactives

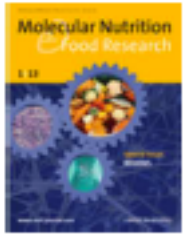
2. Identify **candidate genes** likely to affect ADME with between-subject differences

3. Compile knowledge on how **gut microbiota** impact ADME and related interindividual variability

4. To assess the **usefulness of metabolomics** for a better assessment of individuals' exposure to plant food bioactive metabolites

Inter-individual variability of carotenoid bioavailability and tissue concentrations

Mol Nutr Food Res. 2017 Jan 19. doi: 10.1002/mnfr.201600685.

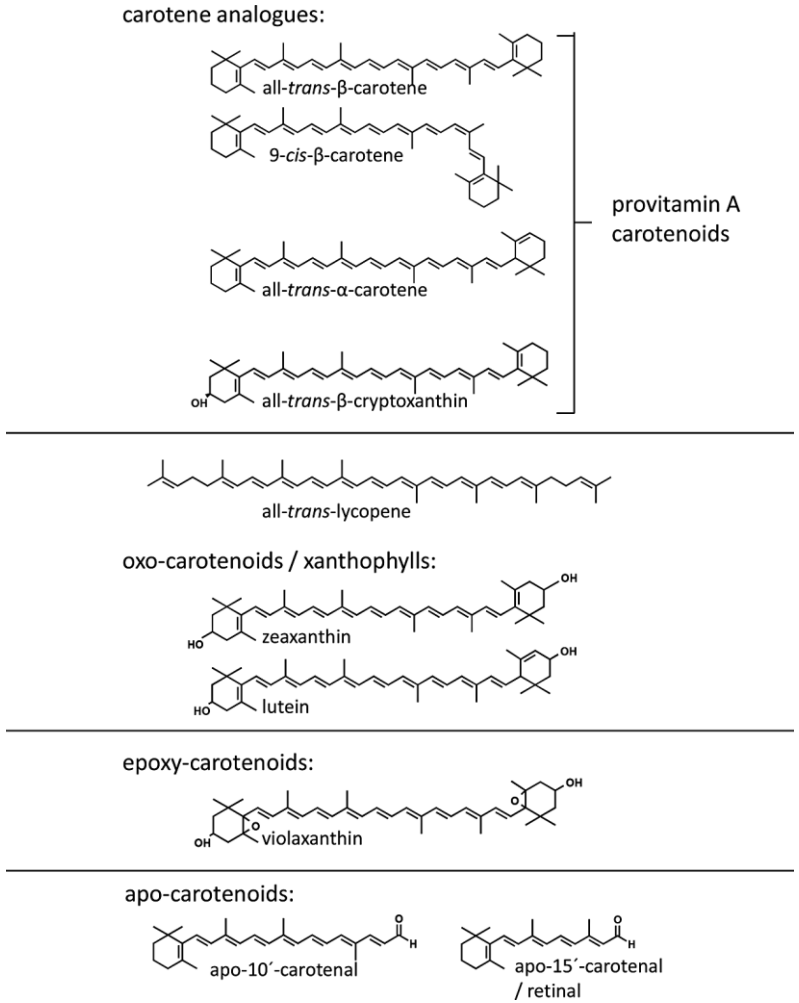


Host-related Factors Explaining Interindividual Variability of Carotenoid Bioavailability and Tissue Concentrations in Humans

Torsten Bohn[1,*], Charles Desmarchelier[2], Lars O. Dragsted[3], Charlotte S. Nielsen[3], Wilhelm Stahl[4], Ralph Rühl[5,6], Jaap Keijer[7], Patrick Borel[2]

Overview of host (non-dietary) factors proposed to influence intra-and interindividual differences regarding carotenoid ADME:

Age, alcohol, asthma, BMI, Gender, Helicobacter pylori infection, HIV, hyperthyroidism, low zinc status, blood lipids, drug intake, malaria, menstrual cycle, microbiota, physical activity, race/ethnicity, smoking as well as SNPs known (or speculated) to influence carotenoid metabolism



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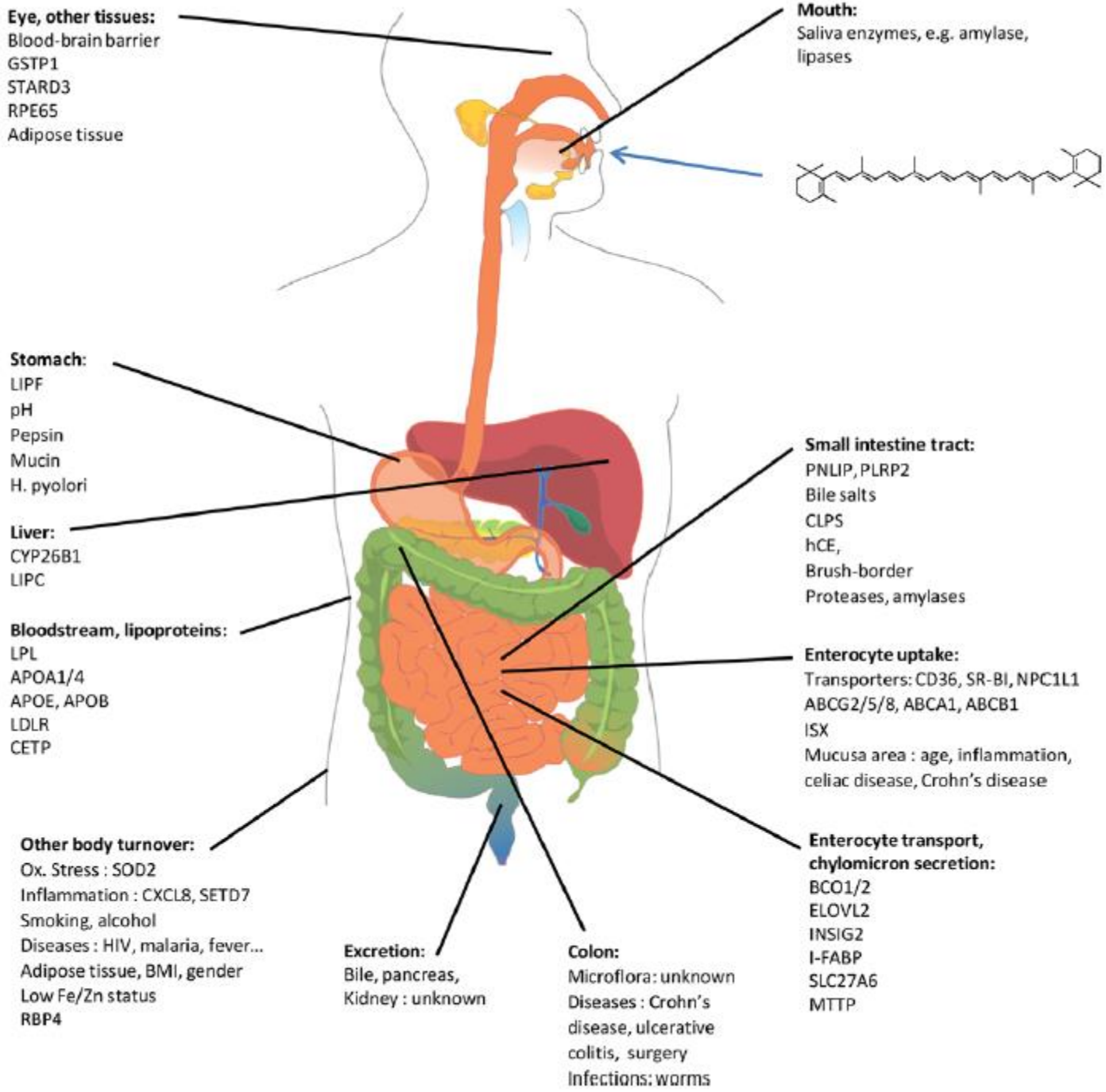

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Personal requirements – who needs what?

Plant food bioactives

Cardiometabolic risk

Meta-analysis
of published RCT

focus on inter-individual variability

Analysis individual data
for variability

Studies by POSITIVe members
Contacting other authors

Nutrients **2017**, *9*(2), 117; doi:10.3390/nu9020117

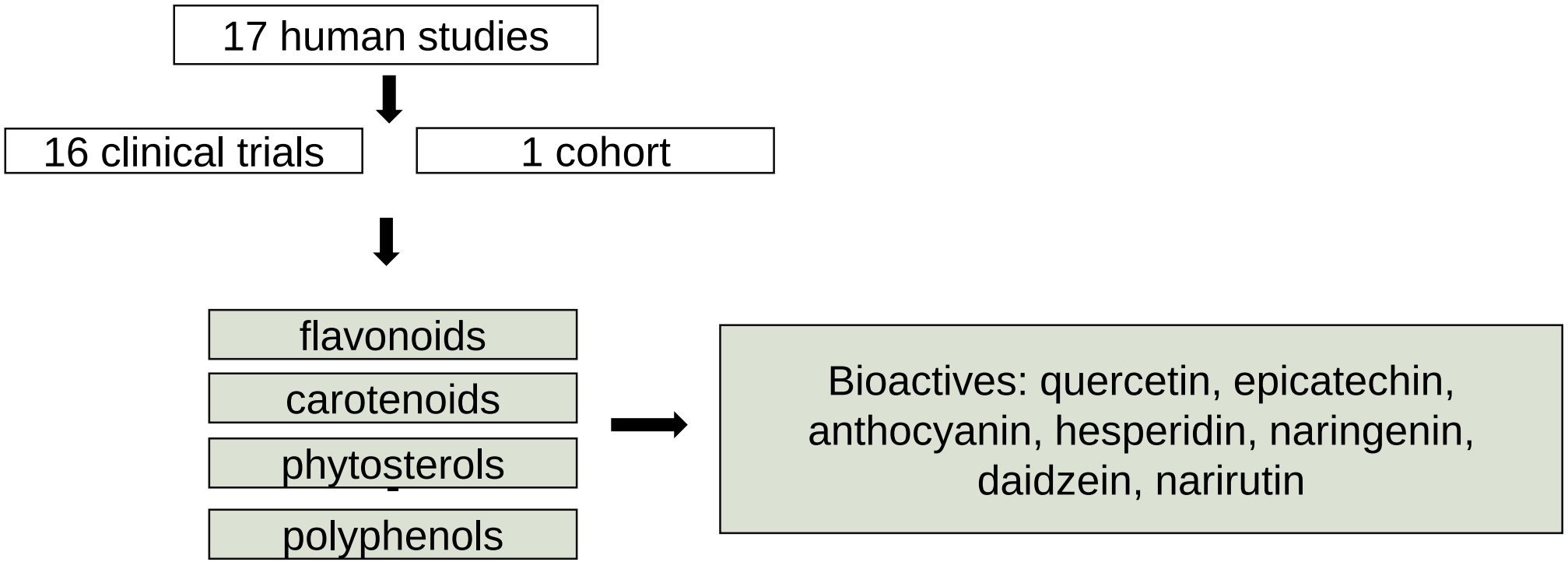
Impact of Flavonols on Cardiometabolic Biomarkers: A Meta-Analysis of Randomized Controlled Human Trials to Explore the Role of Inter-Individual Variability

Regina Menezes [1], Ana Rodriguez-Mateos [2], Antonia Kaltsatou [3], Antonio González-Sarrías [4], Arno Greyling [5], Christoforos Giannaki [6], Cristina Andres-Lacueva [7], Dragan Milenkovic [8], Eileen R. Gibney Julie Dumont [9,10], Manuel Schär [11], Mar Garcia-Aloy [7], Susana Alejandra Palma-Duran [12], Tatjana Ruskovska [1] Viktorija Maksimova [13], Emilie Combet [12] and Paula Pinto [1,14,*]

- Flavonol consumption significantly decreases plasma levels of total cholesterol, LDL cholesterol and triglycerides, and increases plasma levels of HDL cholesterol
- Flavonol consumption significantly decreased systolic and diastolic blood pressure, and decreased plasma glucose levels
- **Subgroup analysis revealed a more pronounced effect of flavonol intake in Asian populations and subjects diagnosed with disease or dyslipidaemia, compared to healthy subjects.**

DATA FUSION: studying inter-individual variability by analyses of combined datasets

Objective: aim to assemble a large database in order to study the factors related to interindividual variation in cardiometabolic biomarkers in response to plant food bioactives



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How are the expected outcomes of the COST Action perceived/prioritised by the stakeholders and end-users within and outside the COST Action?

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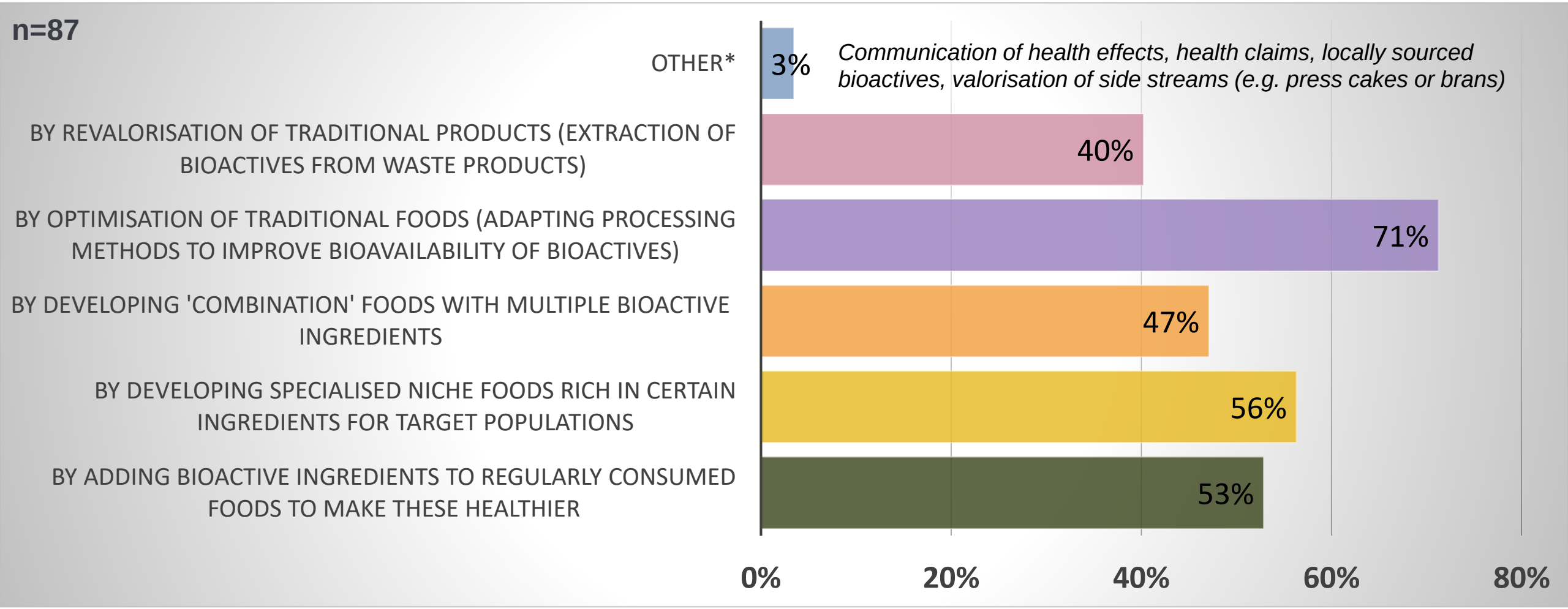
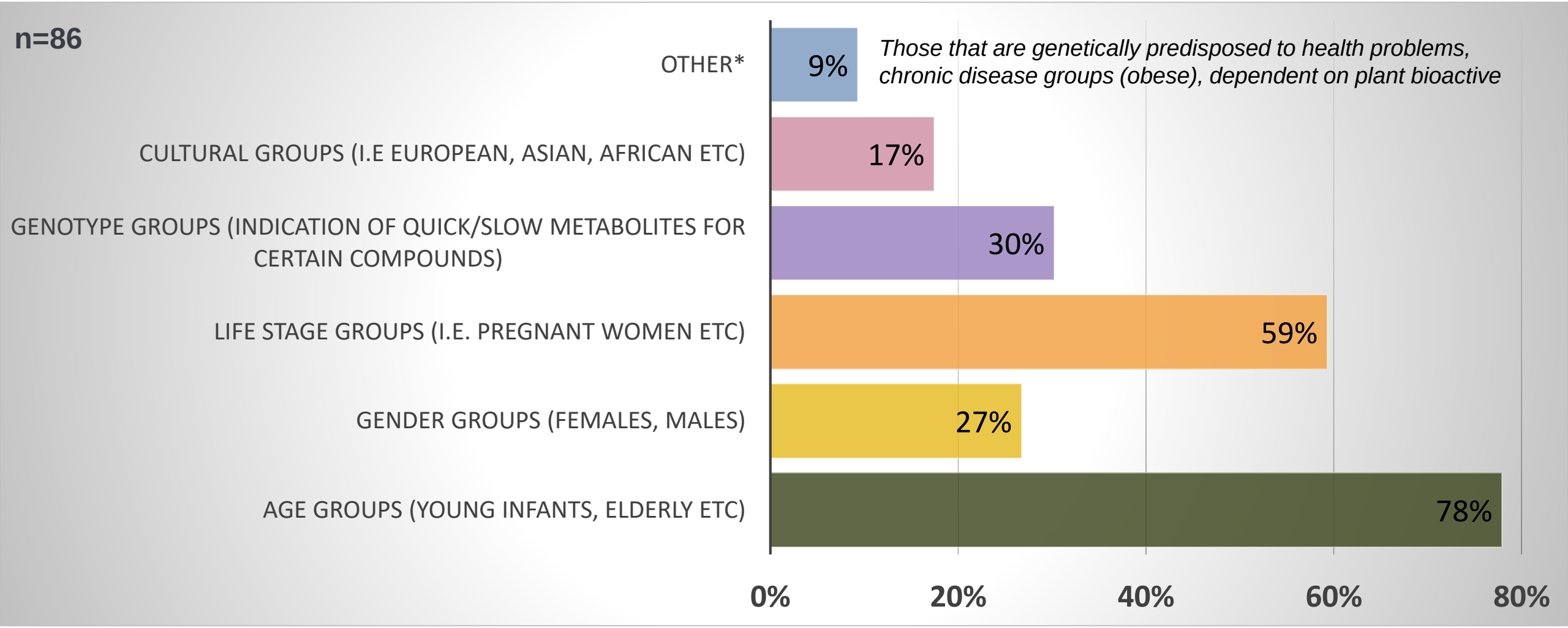
How can improved knowledge on the efficacy of plant bioactives enhance the development of new functional/customised foods?



For which population subgroups would it be worthwhile to development new functional/customised foods based on improved knowledge on the efficacy of plant bioactives?



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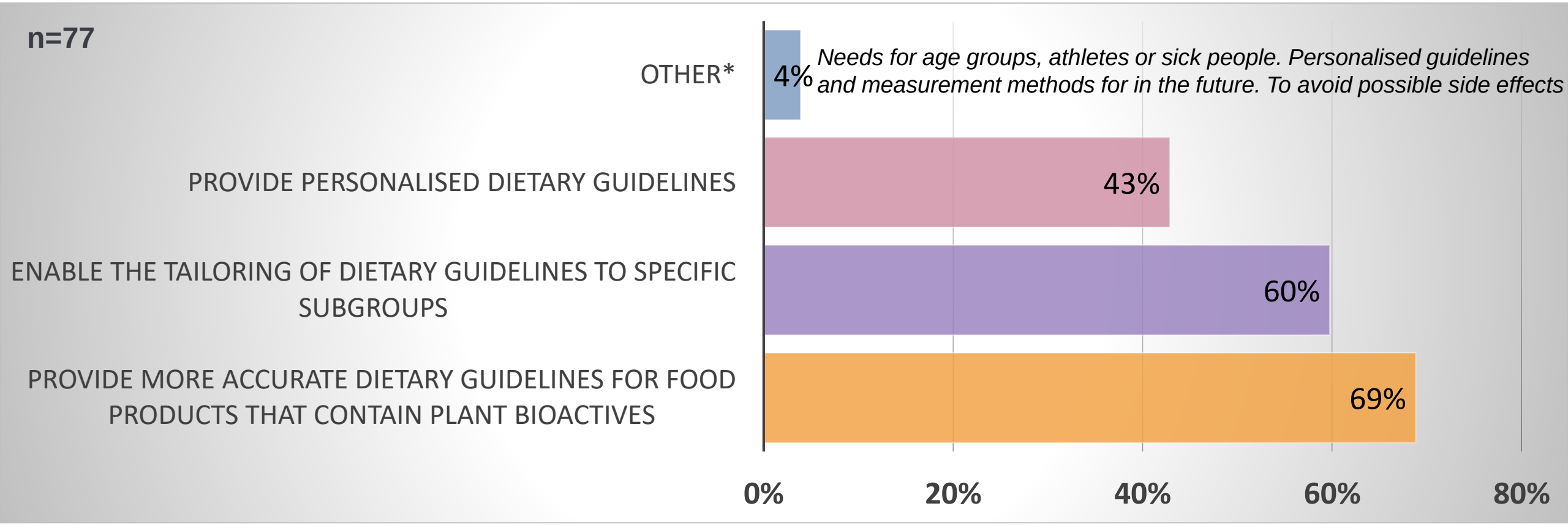
How could improved knowledge on the efficacy of plant bioactives to improve health for population subgroups improve dietary recommendations?



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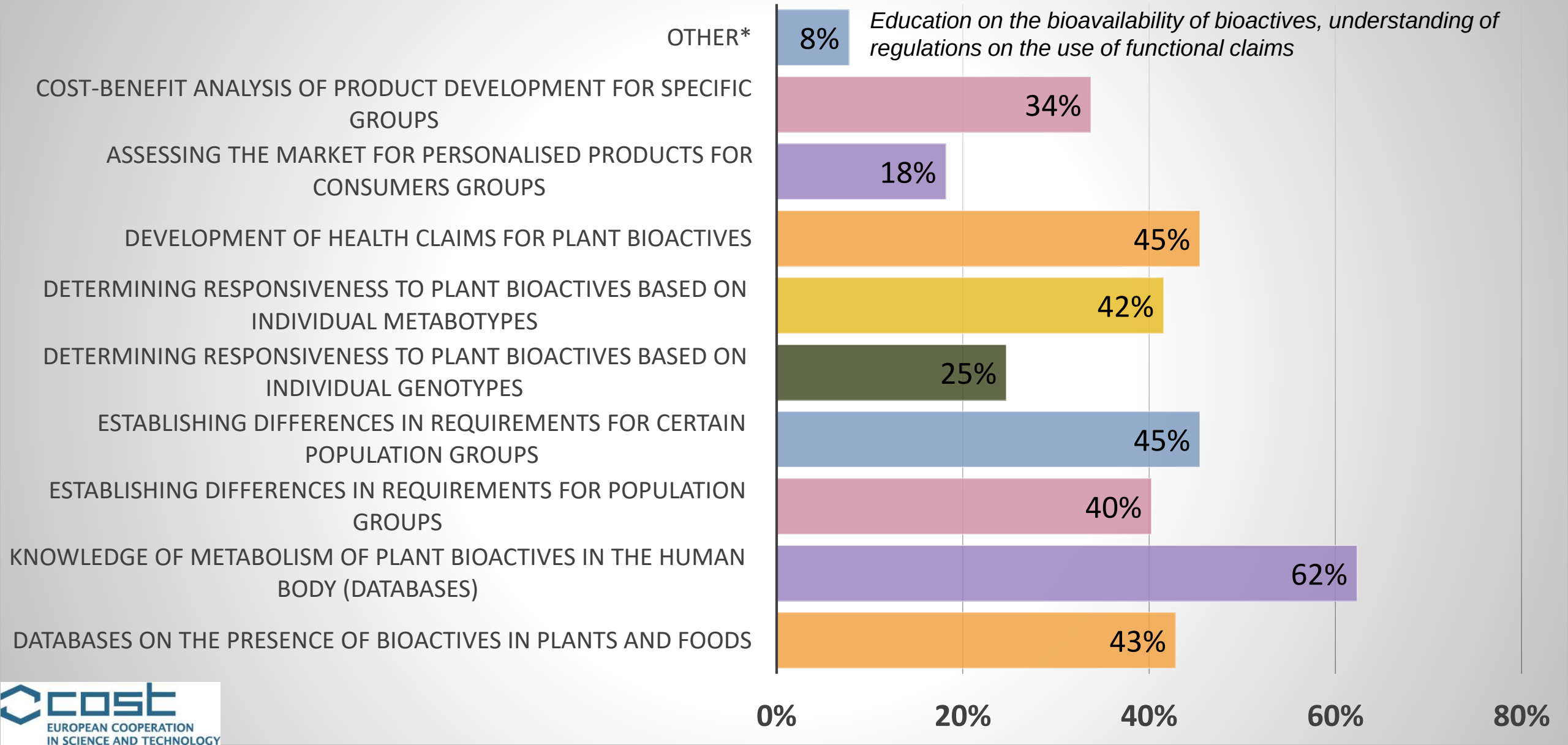
Where do you think the knowledge gaps and needs are in relation to the field of efficacy of plant bioactives?



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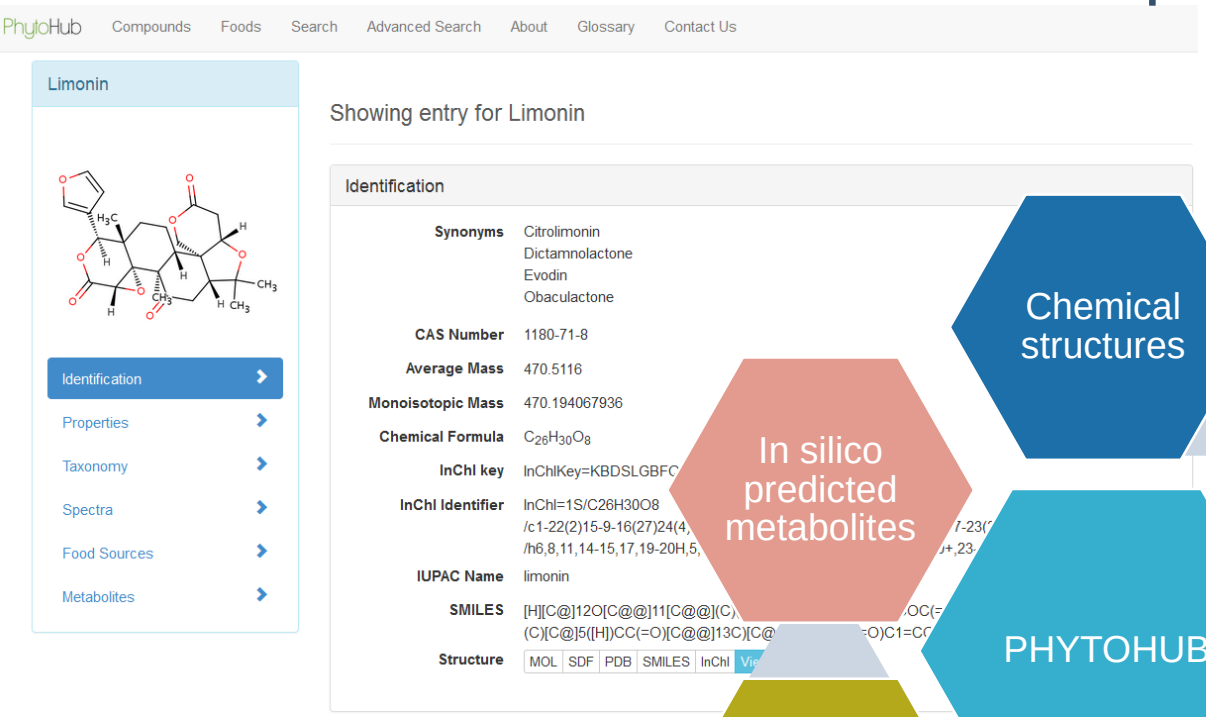
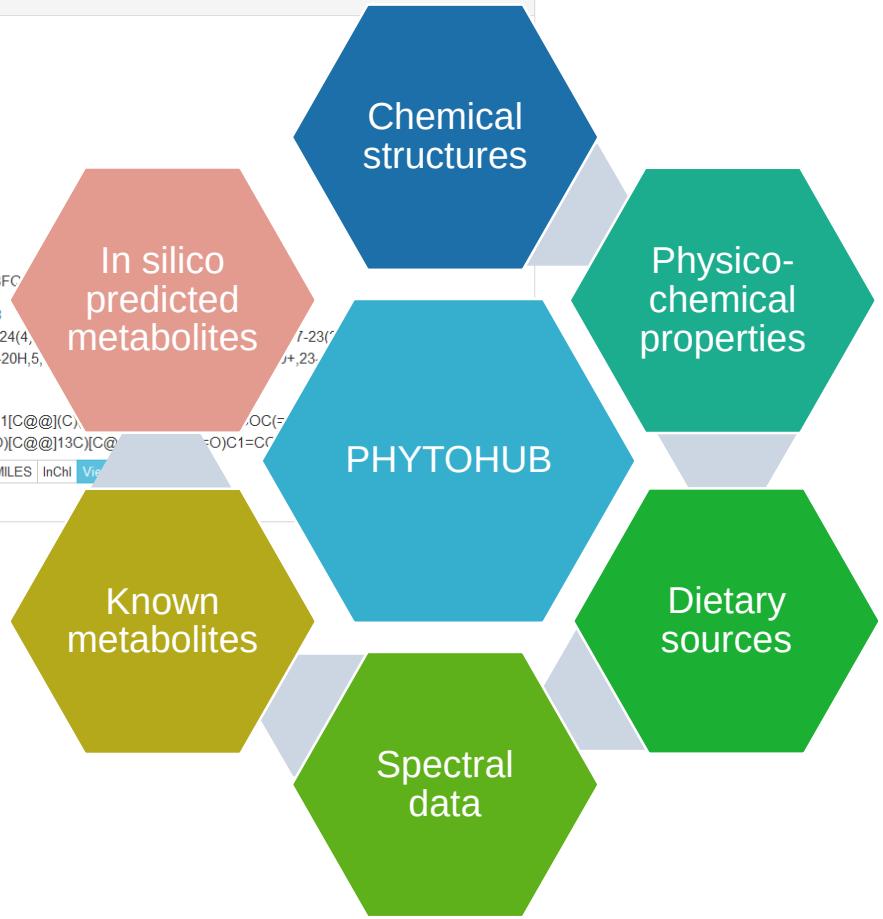
POSITIVe CONTRIBUTION TO PHYTOHUB

www.phytohub.eu





957 food phytochemicals
371 known metabolites
320 food sources
>4500 spectra
215 articles

- Data on metabolism manually extracted from the literature by experts
- Complete data traceability
- Back-end system with >20 curators
- Predicted metabolism and biological effects will be added

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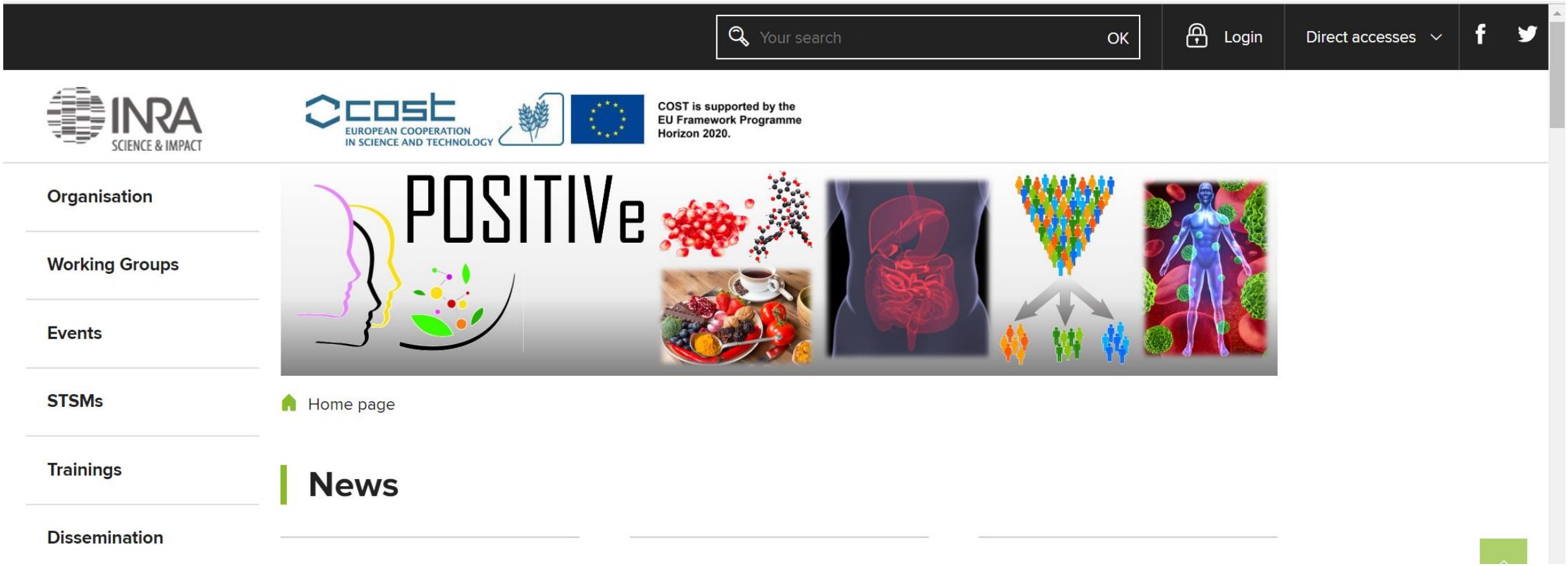
POSITIVe on WWW

https://www6.inra.fr/cost-positive



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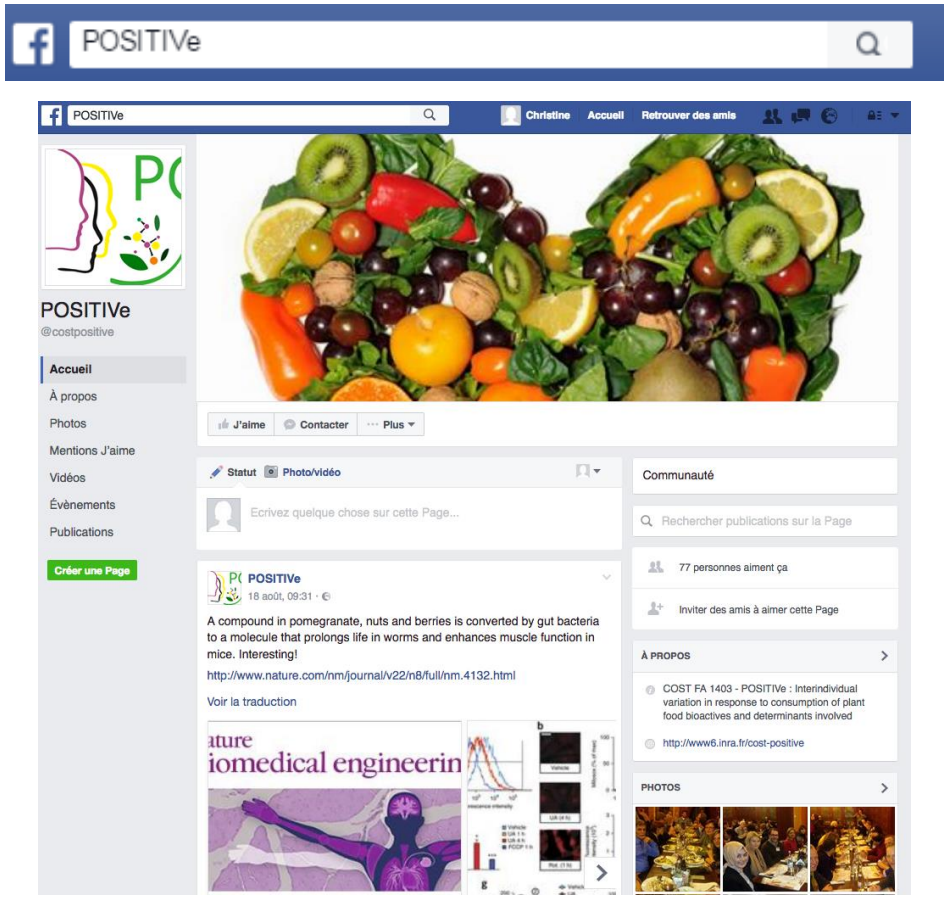
POSITIVe on social media

FACEBOOK

https://www.facebook.com/costpositive/



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