Industry-Academia Partnership and Pathways (IAPP)

Grant agreement no: 2013-612326

Work Package Presentations

July, 2017

VeggiEAT Final Meeting, Copenhagen

Presentation

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Partners in alphabetic order
- Bonduelle (Lille – FR)
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- University of Copenhagen (Copenhagen – DK)
- University of Florence (Florence – IT)

Table Contents

List of Images

List of Figures

List of Tables

Presentation of Work Packages

WP1 – Management and Coordination

The objective of WP1 is to provide day to day coordination and management of all VeggiEAT activities, providing efficient support in terms of financial and human resources and linking the project to the EU Commission. The following objectives will be pursued: i) to ensure efficient management at the administrative, scientific and technical levels; ii) To ensure an integration of all activities among partners; iii) To ensure effective communication between team partners; iv) To provide an efficient link with the EU; and v) To deal with legal issues pertaining to ownership of knowledge and intellectual property rights. It is considered imperative at the outset of the project that all partners are clear as to what is expected of them not only in terms of the research and deliverables but also their administrative/accounting responsibilities. The aim here would be to reach a consensus with all Partners who through their participation could then 'take ownership' not only of their own input but of the overall project as well. This WP was led by Bournemouth University (BU).

WP2 – Consumer perception (product and sensory analysis)

The objective of WP2 is to evaluate the sensory characteristics of the vegetables that would influence its choice by different age groups. The specific objectives are from a methodological perspective -To optimize the free sorting task in regards to the kind of products (i.e. vegetables) and to the kind of consumers (i.e. age / nationality) – which will lead to the operational output: Guideline for free sorting task > tools box development, and from a knowledge perspective – To better understand consumer perception of the product sensory variations according to their characteristics (i.e. age, gender, nationality)leading to operational output: Key information / recommendations for product range rationalisation and design. Background: Processed vegetables, namely, canned and frozen, constitute a way for Europeans to meet affordably their dietary needs. In particular, canned and frozen varieties of vegetables provide a convenient way to promote intake, have a shelf life longer than their fresh counterpart and are ready to eat and easy to use in meal preparation. These features make them valuable alternatives for busy and cost-conscious consumers. Furthermore, canned and frozen vegetables offer virtually the same nutrition as fresh, with the advantage of facilitating accessibility, storage and food safety disparities. This WP addresses the following Industry challenges: Sensory product characterisation; Perception of sensory variation and acceptability according to consumer characteristics; Optimisation of sensory and consumer tests according to subject characteristics and suitable for the specific vegetable products (from a technical perspective). This WP was led by Bonduelle and University of Florence (UniFi).

WP3 – Product acceptance (Recipe development)

The objective of WP3 is to select the products and factors of the intervention study (WP4) through the development and acceptability assessment of recipes and dishes and through pilot testing of CA designs. Emotions towards the product will be coded using the FaceReader ® software. This WP was led by the Institute Paul Bocuse (IPB).

WP4 – Intervention Study

The objective of WP4 is to evaluate the determinants of vegetable acceptability and sustained consumption across age groups and institutional settings, namely school, and elderly care homes. The study will be replicated in Denmark, France, Italy and the UK, representing the main potential

market for new vegetable products in Europe. Background: Why choice architecture study? As frequent food consumption outside the home is associated with obesity and unhealthy food choices, institutional foodservice can be a potential venue for health promotion, since it constitutes the eating situation where consumers receive the majority of their nutrients. Choice architecture is a tool that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. Why captive foodscapes? In the context of VeggiEAT, "captive" foodscapes, are the public places where food is served, to a relatively homogeneous but constant group of people. These settings could be school or elder care homes, where students and residents eat regularly. Such settings provide unique opportunities as "living laboratories" where new recipes, dishes, and structures can be tested . Innovative data collection: A modified visual estimation technique will be chosen as the data collection technique for vegetable intake in order to provide the accuracy required for this study, whilst recognizing the inherent practical difficulties for measuring food consumption in real life research. The technique was developed by the United States Army and has been used extensively in a number of settings, including institutional foodservice . Visual estimation is a non-invasive technique and has been shown to be an accurate method for assessing food quantities. Where trained personnel are used, the accuracy and reliability of a modified technique can be in excess of 95%. The technique has a further advantage in that it allows not only the nutritional intake to be calculated, but also the foods which provide those nutrients, to be identified. Many of the dishes served in this type of foodservice environment, particularly the main meal components, will be pre-portioned and those freely served items, for example, peas will be served using a standard spoon or ladle. This, combined with strict control of the servery area, and the training of data collectors, will help to ensure the accuracy of the data collection procedures. Lastly, the use of specialized EU produced software for data analysis will ensure proper control for bias. The WP addresses the following industrial challenges: the identification of the most effective and efficient CA to influence the consumption levels of vegetables; Benchmarking choice architecture practices supporting vegetable consumption within food service provision, across ages and countries, Denmark, France, Italy, UK; identifying the determinants(attitude, intention)of actual consumption of processed vegetables and the acceptability of the same vegetable as a component provided within a dish preparation. This WP was led by Copenhagen University (KU).

WP5 – Model Mapping the determinants of vegetable consumption

The objective of WP5 is to model and evaluate the effect of repeated exposure to a target vegetable measured by changes in consumers; acceptability, intention, attitude and actual consumption. Why study determinants of vegetable intake? Stepping beyond the individual approach to energy intake vs. energy expenditure imbalance, there are many plausible ecological explanations, where structural factors play a prominent role. But other factors may also contribute to explain the rise in obesity levels, particularly in adolescents, such as the so-called obesogenic environment, which in itself reflects socio-economic and demographic disparities. Previous EU research on food component model development and consumer characteristics has focused on meat (e.g. FP6 Q-PorkChains or FP7 Prosafebeef), fish and seafood (FP7 SeaFood+), but not on vegetables, and little research has been carried out in living laboratories. Bournemouth, Firenze and Aalborg Universities have the confidence and experience to conduct this type of work. This WP addresses the industrial challenges: Analysis and assessment of the differences in actual consumption of dishes containing canned or frozen vegetables compared to an unexposed control group before intervention; provide evidence about the differences in consumption/intake by age groups and institutional setting that act as living laboratories; provide evidence regarding changes in attitudes, intention of consumption and acceptability of the vegetables and support with empirical evidence the most acceptable menu type item containing the target vegetables. This WP was led by Copenhagen University (KU).

WP6 - Dissemination of results

The objective of WP6 is to coordinate the collation and synthesis of the findings, resulting in specific recommendations for schools, elder care, policy and decision makers. Moreover, this WP will manage the dissemination of results, both to the media and to the scientific community. This WP will be responsible for the visibility of the consortium to the general public, the communication strategy and will also ensure that all partners will be fully included in the dissemination of the findings. WP6 will be responsible for the planning and execution of conferences and other scientific meetings; and publication in high- quality scientific journals. Scientific dissemination will include an updated database on congresses, based on the information from all partners regarding interesting forthcoming scientific events where results from the project could be presented. Active participation and presentation at European and international conferences will be promoted, and there will be proactive intelligence-gathering of suitable events. The annual Louis-Bonduelle Foundation scientific communication at the European parliament, Brussels, will be used to disseminate relevant information. Bournemouth University (BU).

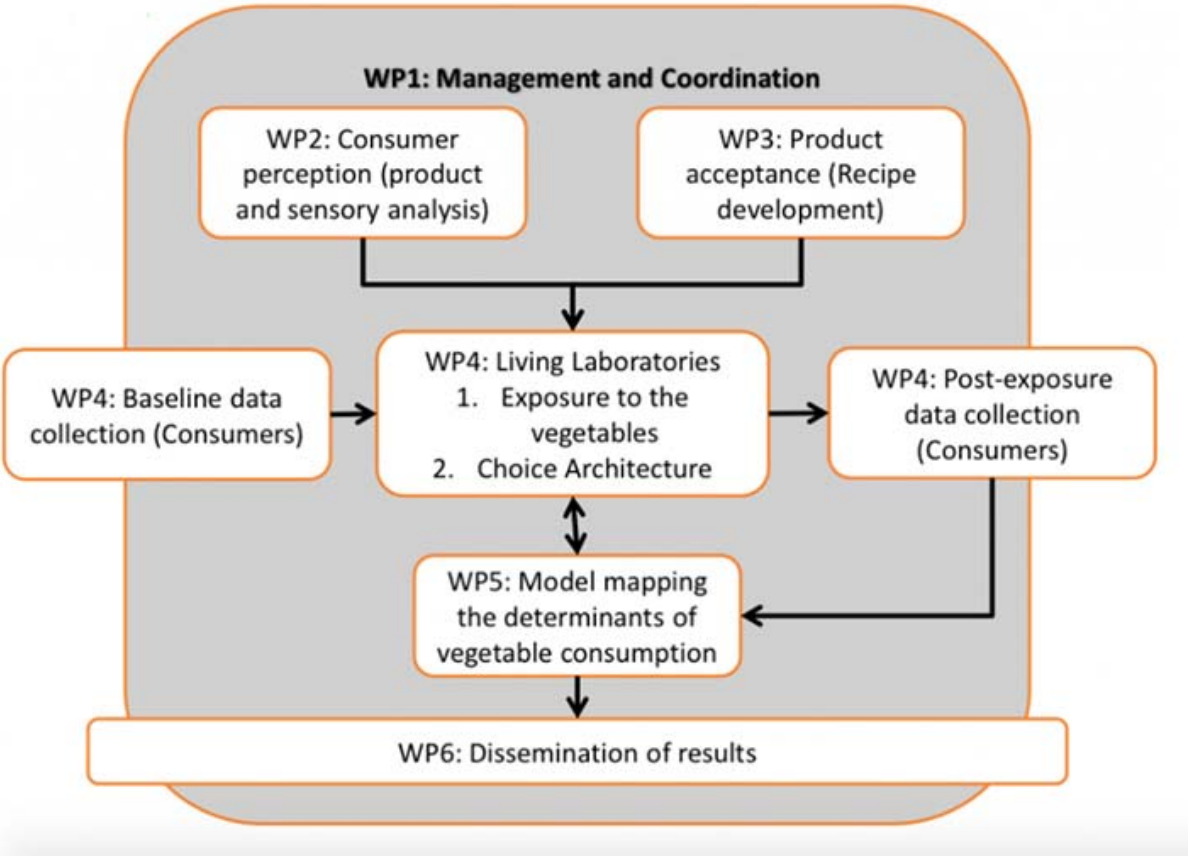


Figure 1 - Project Work Packages flow chart

Presentation of Scientific Work Packages

WP2 – Consumer perception (product and sensory analysis)
Lead by Bonduelle and University of Florence

General aim:
Contribution to the state of the art regarding vegetable sensory characteristic perception in EU citizens (adolescent and elderly)

Discrete tasks:
2.1 Product characterisation: *Sensory characterisation of vegetables by means of descriptive methods*.
2.2 Consumer test design: *Optimisation of several parameters of the free sorting task method.*
2.3 Consumer tests: *Evaluation of sensory variation discrimination according to consumer background (age, nationality) applying a free sorting test and collecting liking and questionnaire responses.*

Materials & Methods
Products:
Ten different canned pea and **eight** different canned sweetcorn samples were considered in order to cover as many of the sensory space of peas and sweetcorn as possible (i.e. diversity of size, texture, colour, flavour).

Subjects:
In total **497** adolescents (mean age 14) and **498** elderly subjects (mean age 68.75) were recruited in Denmark, France, Italy, United Kingdom.

Sensory methods:
Descriptive analysis; Free Sorting Task; Liking Test.

Questionnaires:
Food choice Questionnaire; Food Neophobia Scale; Familiarity with and Liking for vegetables; Age; Gender; Education; etc.

DATA	Analysis Of Variance ANOVA	Principal Component Analysis (PCA)	Principal Component Regression (PCR)	Partial Least Square (PLS)	Multi Dimensional Scaling (MDS)	Linear Regression (LR)	Correspondence Analysis (CA)
Descriptive Analysis	●	●	●	●			
Free Sorting Task					●		●
Liking	●	●	●			●	

Table 1- Data analysis

- **Task 2.1 – *Sensory characterisation of vegetables by means of descriptive methods***

Sensory properties of pea and sweetcorn samples were descripted by means Descriptive Analysis (DA). Details in: WP2 Final Report; Dinnella et al., *Appetite*, 2016.

The study provided:

1) a validated sensory profile of each sample.
2) the relative importance of appearance, flavour and texture attributes in discriminating products by means of perceptual maps.
3) evidences for the potential use of instrumental measurements (e.g. firmness and Nuclear Magnetic Resonance (NMR) to predict relevant sensory differences among samples.

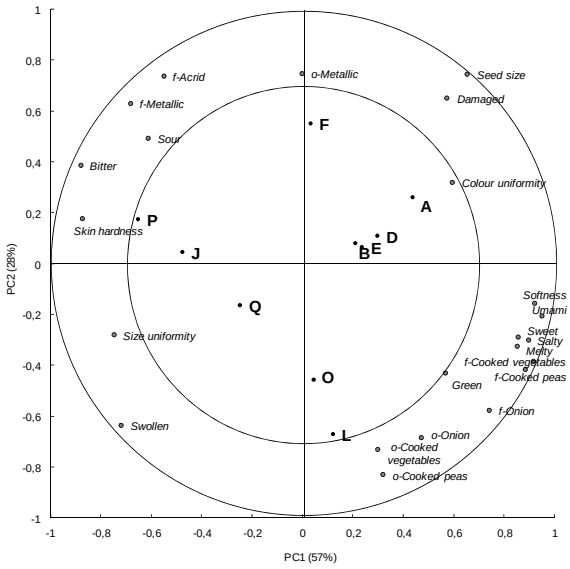


Figure 2 - Sensory properties of pea and sweetcorn samples

- **Task 2.2. – *Consumer test deisgn: Optimisation of parameters of the free sorting task method***

For both adolescent and elderly a minimum number of 50 subjects is fair when working with familiar canned vegetables such as peas. A larger panel size (70 or more) is required when working with less familiar products such as sweet corn. **See WP2 Final Report**

Independently from age, the level of familiarity with products is the main factor that affects categorization maps and the information that can be extracted from them.

Categorization maps from a familiar product can be potentially used to obtain reliable information of sensory and hedonic dimensions driving similarities among samples.

Maps obtained from a less familiar product depict mainly the sensory variability among samples.

When applied in cross country and across age studies, the free sorting task overcomes limitations of other approaches (e.g. rating methods) in which results might be strongly affected by cultural differences in the expression of responses (e.g. differences in the use of a rating scale across countries and ages).

The free sorting task is an applicable method with healthy older adults, which is able to detect differences in the categorization of stimuli even among the more aged representative of this segment of population.

See Cliceri et al, *Food Quality and Preference*, 2017.

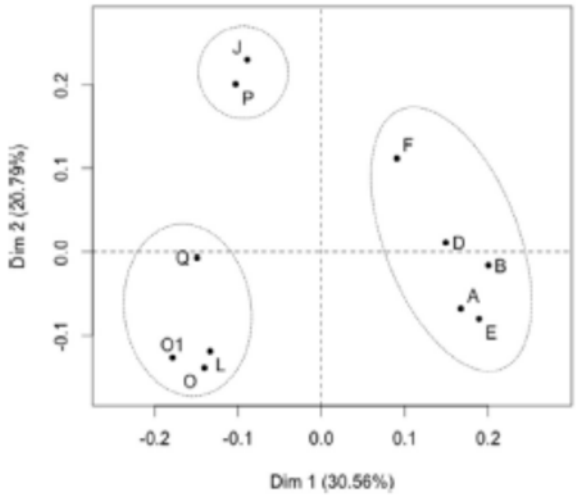


Figure 3 - Optimisation of parameters of the free sorting task method

- **Task 2.3.**

    1. ***Consumer test: sample discrimination and description by means free sorting task***

Sample grouping was consistent across countries and age with minor differences that seem mainly related to the degree of familiarity with the products.

Both elderly and adolescents showed no difficulty in eliciting terms (sensory and hedonic) describing the sample groups they formed in the sorting task.

Image 1 - Word Cloud

Appearance seems to be less relevant for elderly than for adolescent in discriminating samples. Old respondents tend to focus their attention more on texture and hedonic terms.

The oppositions sweet vs bitter; richness in flavour vs lack of taste, were always associated with hedonic terms and drove product discrimination independently from countries and age groups.

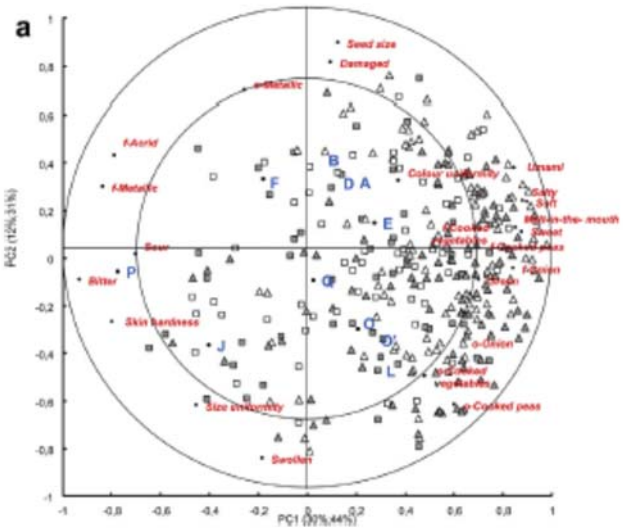
The term “bad taste” was found to be associated with sensory attributes like “acrid” or “metallic”.

The negative hedonic expression “bad texture” was found to be associated with the sensory attribute “softness” in sweet corn samples and “hardness” in pea samples.

- **Task 2.3.**
  2. ***Consumer test: sensory drivers of actual liking for pea and sweetcorn samples***

Combining Descriptive Analysis data with Liking data individual differences in liking for pea and sweetcorn samples and in sensory drivers of liking across age and countries were identified.

See: Dinnella et al., *Appetite*, 2016; Castagna et al 2017 (in preparation – under internal review);



Applied methodology:
Internal Preference Mapping by means Principal Component Regression:
X matrix = liking score
Y matrix = descriptive sensory data

Figure 4 – Principal Component Regression

Canned Product	Sensory Input	Main Sensory Drivers	
		liking	disliking
Peas	Appearance	Green intensity	
	Flavour	Sweetness Saltiness Cooked peas Cooked vegetables Cooked onion Umami*	Sourness Bitterness Metallic Acrid
	Texture	Softness Melt in the mouth*	Skin Hardness
Sweet corn	Appearance	Yellow intensity Seed size	
	Flavour	Sweetness	Saltiness Sourness Bitterness Acrid Astringency
	Texture	Crunchiness Thickness	Softness

* = In elderly only

- **Task 2.3.**
  3. ***Consumer test: liking for and familiarity with named vegetables in elderly and adolescents across Europe***

A strong positive connection between familiarity and self-reported liking for named vegetables was find.

The most familiar and most liked vegetables across countries are characterized by innately liked sensations, such as sweet and umami taste, delicate flavour and bright appealing colour.

Repeated exposure, could provide an effective way for increasing vegetable acceptance, while taking advantage of both innately liked vegetable sensory properties and country specific gastronomic traditions.[a]

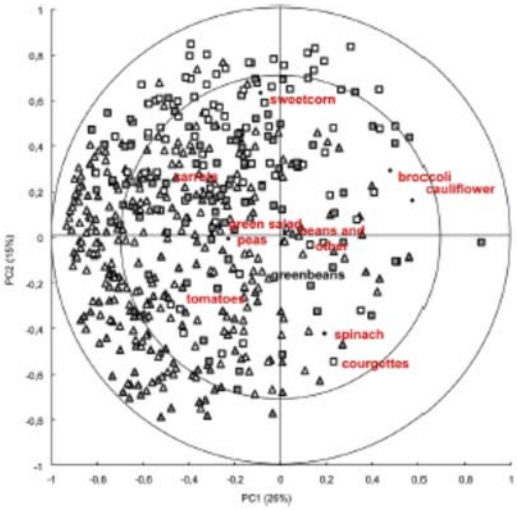


Figure 5 - Principal Component Regression

[a] Details in: WP2 Final Report; Dinnella et al., *Appetite*, 2016. Castagna et al. In preparation – under internal review

Contribution to the state of the art regarding vegetable sensory characteristic perception in EU citizens

Both *between* (stated liking) and *within* (actual liking) product approaches were applied to explore the determinants of vegetable acceptability among elderly and adolescents.

The differences found between stated and actual liking in both elderly and adolescent suggest:

1. the role of expectations for specific sensory properties in hedonic responses to any given vegetable such as typical aroma and flavour
2. the hedonic valence of some tastes, such as saltiness, and texture descriptors is dependent on the context and cannot be considered to be reliable predictors of vegetable liking or disliking *per se*.
3. it appears difficult to understand the role of flavor and texture in vegetable acceptance without collecting liking and sensory data from actual tasting experimental sets.

Outputs

- ✓ Identification of the most appropriate methodology for sensory analysis
- ✓ Identification of specific product characteristics favoured by consumers.
- ✓ Contribution to the state of the art regarding vegetable sensory characteristic perception in EU citizens **(D2.1)**
- ✓ Publication in high quality journals and presentation at international conferences and additional dissemination
- ✓ Through workshops. Paper submitted to peer-reviewed journals analyzing sensory characteristics by age groups

Papers published in peer review scientific journals
Dinnella, C., Morizet, D., Masi, C., Cliceri, D., Depezay, L., Appleton, K.M., Giboreau, A., Perez-Cueto, F.J., Hartwell, H. and Monteleone, E., (2016). Sensory determinants of stated liking for vegetable names and actual liking for canned vegetables: A cross-country study among European adolescents. *Appetite*, *107*, 339-347.
Cliceri, D, Dinnella, C.,Depezay, L., Morizet, D., Giboreau, A., Appleton, K. M., Hartwell, H. & Monteleone, E. (2017). Exploring salient dimensions in a free sorting task: a cross-country study within the elderly population. *Food Quality and Preference*, 60, 19-30.
Appleton, K.M. , Dinnella, C., Spinelli, S., Morizet, D., Saulais, L., Hemingway, A., Monteleone, E., Depezay, L., Perez-Cueto, F,J, Hartwell, H. A high quantity of vegetables and a high variety of vegetables regularly consumed are predicted by different food choice motives in older adults from France, Italy and the UK. Submitted to ***Nutrients***
Remy-Castagna, E., Appleton K.M., Monteleone, E., Depezay L.,Morizet, D., Giboreau A., Perez-Cueto F. J.A., Hartwell H., & Dinnella C. Sensory determinants of liking for vegetables: a cross-country study among European elderly. To be submitted to ***Food Quality and Preference***
Conference Papers
EUROSENSE 2014 "Teenagers sensory perception of and liking for processed vegetables" PANGBORN 2015 "Exploring sensory and hedonic dimensions in free sorting task: a cross-country study on elderly population" PANGBORN 2015"Neophobia in elderly and adolescent European populations: the effect on hedonic response to vegetables" PANGBORN 2015 "Sensory drivers of liking for canned peas and sweet corn by adolescents and elderly people in different European countries: Results of VeggiEAT project" FENS 2015 "Neophobia in elderly and adolescent Europeans: a way to understand liking for vegetables" EUROSENSE 2016 "Consumer perception of canned vegetables: A Cross-age comparison in a Pan-European study"

Table 2 – Papers published in peer review scientific journals

WP3 – Product acceptance (Recipe development)
Lead by the Institut Paul Bocuse

Objectives and Tasks

The objective of WP3 was to select the recipes and factors of the intervention study (WP4) through 3 tasks:

Figure 6 – Tasks from Work Package 3

- **Task 3.1. – Recipe Development**

Image 2- Recipes developed

- **Task 3.2. Selection of recipes**

1. **Experts' evaluation and selection for the consumer test**

Image 3 - Caterina Dinella (U-Firenze) & Armando Perez-Cueto (U-Copenhagen) testing the recipes at the Institut Paul Bocuse

2. **Consumers' test**

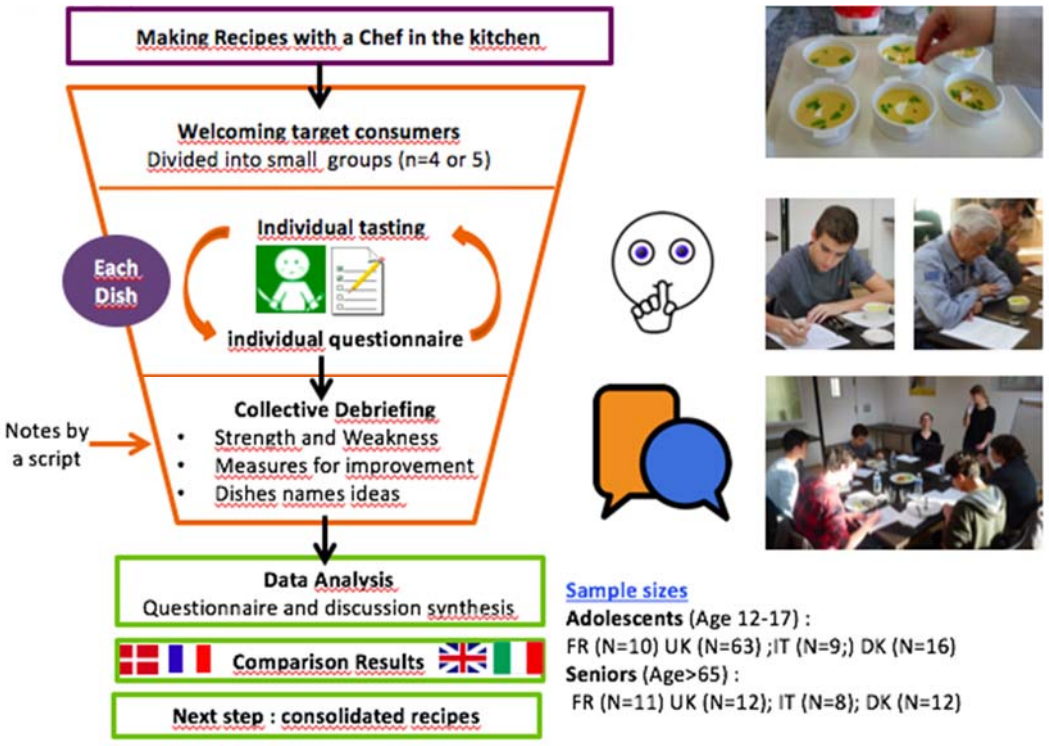


Figure 7 - Consumer test flow chart

3. Consumer selection

Image 4 - Recipes selected

CONCLUSION – Corn Soup
→ Both age groups enjoyed it in the three countries

ADOLESCENTS

Velouté de maïs

Thick Corn Velouté with croutons on top

SENIORS

Consommé/Velouté maïs-paprika

Thick tasty Corn Velouté with pepper

CONCLUSION – Veggie Burguer
→ Adolescents enjoyed it in the UK and FR, not in IT
→ Seniors didn't really like it

Mentionned Veggie Burger

Burger végétarien

Veggie burger served with sweet potato chips

Hamburger végétal

Thin veggie steak in a burger with sauce cheese and oignons served with sautéed mushrooms

- **Task 3.3. - Selection of intervention factors**

Experimental Context

- Location : Experimental Restaurant (Living Lab), Food and Hospitality Research Center, Institut Paul Bocuse.
- Type of restaurant : Self-service
- Price: 10€ for starter/dish/main course (excluding beverages)
- Consumption occasion : lunch, Monday to Friday, 2 weeks of test (10 days)
- Participants: 293 participants, general population.

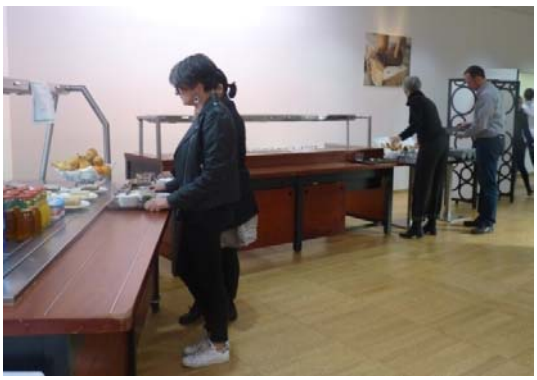


Image 5 - Experimental context

Pilot study 'Nudging vegetable consumption'
Experimental Restaurant (Living Lab), Institut Paul Bocuse.

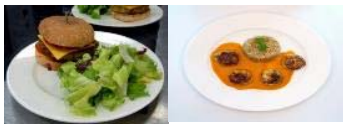
Objective :
➔ Investigate the determinants of the efficiency of defaults to increase the consumption of a dish rich in vegetable (vegetable burger).



3 choices – target dish : **Vegetable burger with salad**
Dishes presented as a full offer or as default + alternatives

- Self-service
- 10€ for starter/dish/main course (excluding beverages)
- Lunch. Monday to Friday, 2 weeks of test (10 days)
- 293 participants
- Choice, consumed quantites, liking scores

Choices of main course:


34% 66%


52% 23% 25%

Default : Burger – 1 alternative


60% 40%

Default : Burger - 2 alternatives


35% 53% 12%

Default : Meat balls


27% 73%

Conclusions

We observe **an impact of defaults** on choices.

- The effect is stronger with **less preferred dishes.**
- Dishes selected as defaults **are not least appreciated** nor consumed .
- The effect is **stronger with increased number of alternatives**

Perspectives

→ Intervention:

Dish of the day as a choice architecture tool to promote choices of healthier dishes (and consumption)

→ Research:

- Knowing and taking into account the specificities of foodservice contexts

Outputs

1. **Project deliverable**
   - D3.1 – Selected and tested recipes for WP4

2. **Papers in international journals**
   - Saulais L., Giboreau A., Perez-Cueto F.A. , Dinnella C. , Depezay L. , Appleton K. , Hartwell H. (in revision) *Using default options to nudge vegetable consumption: an experimental investigation of status quo bias in food choices,* Food Policy.
   - Saulais L., Perez Cueto F. A., Depezay L., Hartwell H., Monteleone E., Giboreau A. (2016) Nudging vegetable consumption: an investigation of defaults as a choice architecture tool for foodservice, Appetite 107:691.
   - Friis R., Skov L.R., Olsen A., Appleton K.M., Saulais L., Dinnella C., Hartwell H., Depezay L., Monteleone E., Giboreau A. & Perez-Cueto F.J.A. (2017) Comparison of three nudge interventions (priming, default option, and perceived variety) to promote vegetable consumption in a self-service buffet setting, PLOS One. 12(5), 1-16.

3. **Poster in international conferences**
   - Saulais L., Perez Cueto A., Depezay L., Hartwell H., Monteleone E., Giboreau A. (2016) *Nudging vegetable consumption: an investigation of defaults as a choice architecture tool for foodservice*, 40th Anniversary Meeting of the British Feeding and Drinking Group, London, UK, 7th-8th April 2016.

4. **Oral Communications**
   - Giboreau A. , Saulais L., Perez Cueto A., Monteleone E., Depezay L., Hartwell H. (2017) *Nudging the elderly - a behavioural approach to encourage healthy and sustainable food choice.* 12th Pangborn Conference, Providence USA, Aug 20-24th 2017.
   - Saulais L. (2017) *Investigating food decisions: what can we learn from living lab experiments?* nutriCARD – nutriCARD lecture, Friedrich-Schiller-Universität Jena, Germany, June 28th, 2017
   - Saulais L. (2017) *Using Behavioural Economics to design more sustainable food choice environments*, 6th E3S Symposium –Challenges for Sensory and Consumer Science in a Changing Society. Paris, May 10th 2017
   - Saulais L. (2017) *Living lab experiments as a tool to investigate food choice biases and interventions*, International Research Symposium Food Choice Environments to promote healthy and sustainable eating behaviours, Institut Paul Bocuse, February 2-3, 2017

- Saulais L. (2016) *Choice architecture for the promotion of health and sustainability: ethical concerns in foodservice*, Online Symposium on Ethics in Foodservice, Food Decisions Research Laboratory and Rock Ethics Institute, Penn State University, December 9th, 2016.
- Saulais L. (2016) *Behavioral Economics: What does it have to do with what I order?* , ENABLE Cluster Workshop FOOD 2030 - Die Zukunft der Ernährung im Zeitalter der Konnektivität, Technische Universität München, Garching, Germany. December 1st, 2016.
- Saulais L. (2016) *Understanding environmental factors influencing food choice in the foodservice industry*, Tackling Obesity Seminar, Food Matters Live, London, UK, 22-24 November 2016
- Saulais L. (2016) *Nudging vegetable consumption: A field investigation of status quo bias in food choices*, Séminaire de recherche de l'Institut Paul Bocuse, Ecully, France, 11 mars 2016

WP4 – Intervention Study
Lead by University of Copenhagen

Objectives of WP4

To evaluate the effect of nudging through the dish of the day on the consumption of the VeggiEAT dish in comparison to 2 alternative dishes by adolescents and active old consumers in Denmark, France, Italy and the United Kingdom, between December 2016 and May 2017.

Results by country:

1. **Denmark**

- **Adolescents**

	Total (n=94)	Control (n=49)	Intervention (n=45)
Sex (% female)	48.8	61.0	46.0
Age (years)			
Mean (SD)	14.8	14.8	14.9
Range	13-17	14-17	13-17
People who declared to be Vegetarian (%)	9.6	2.0	7.0

Table 3 - Socio-demographic sample characteristics by group

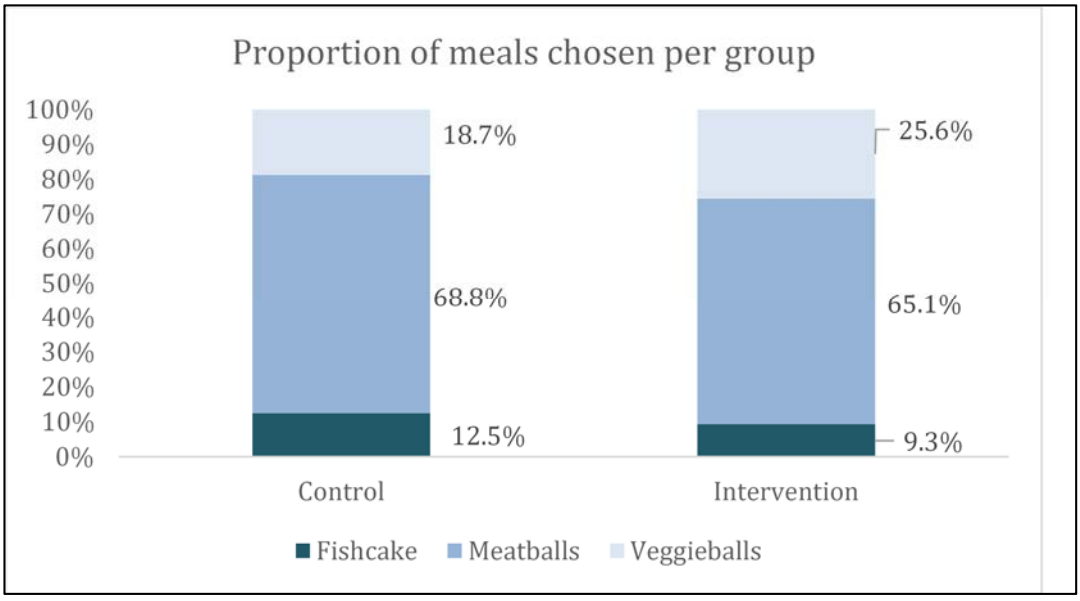


Figure 8 – Proportion of meals chosen per group

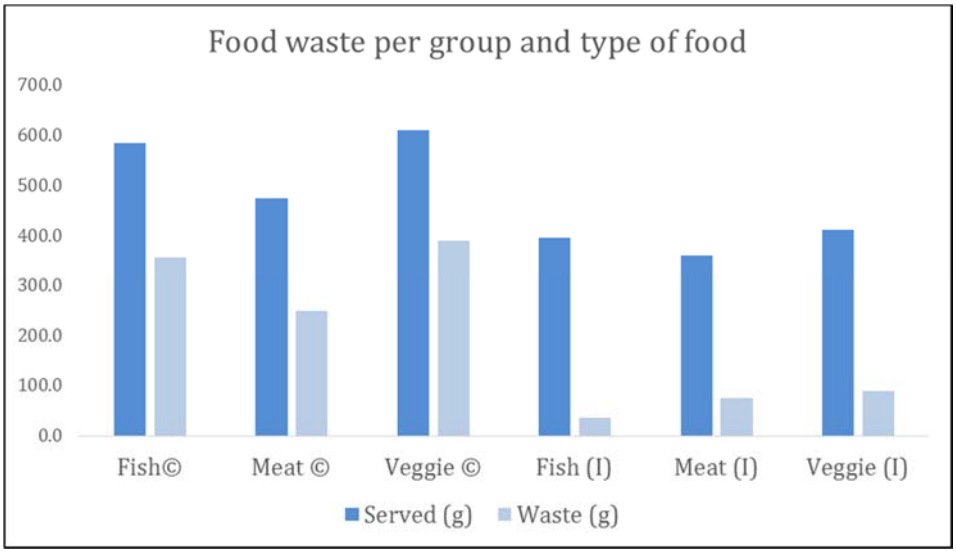


Figure 9 – Food waste per group and type of food

- **Active old people**

	Total (n=97)	Control (n=48)	Intervention (n=49)
Sex (% female)	67.0	65.0	69.0
Age (years)			
Mean (SD)	73.9 (6.4)	73.2(6.8)	74.7 (6.0)
Range	65-89	65-87	65-89
People who declared to be Vegetarian (%)	1	2	0

Table 4 - Socio-demographic sample characteristics by group

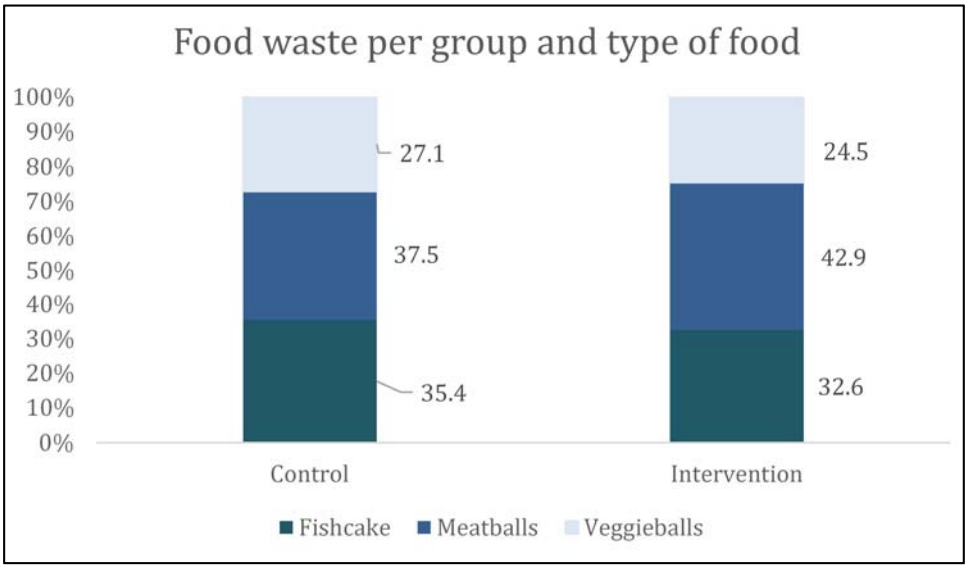


Figure 10 – Proportion of meals chosen per group

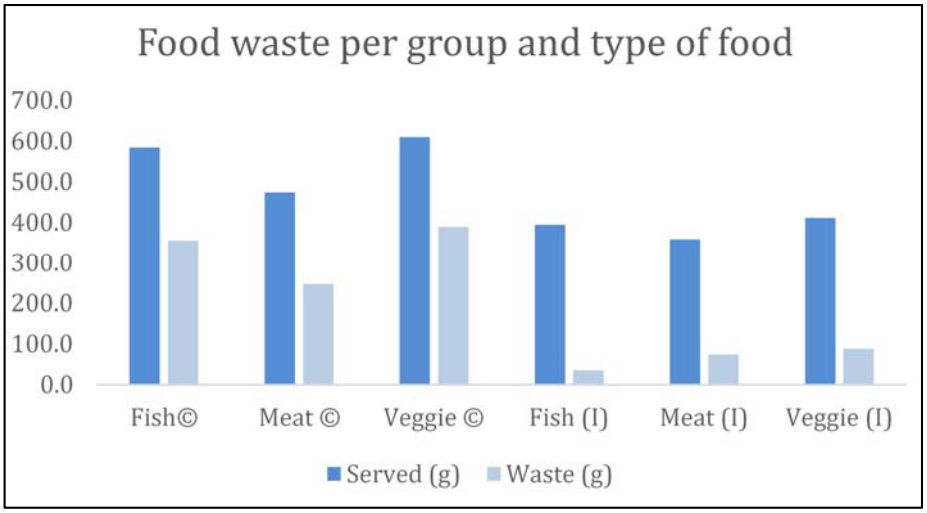


Figure 11 – Food waste per group and type of food

Image 6 – Data collection in Denmark

2. France

- **Adolescents**

	Total (n=112)	Control (n=53)	Intervention (n=59)
Sex (% female)	50	56,6	44,1
Age (years)			
Mean (SD)	17,1 (1.17)	17,2 (1.09)	17,0 (1.24)
Range	16-19	16-19	16-19
People who declared to be Vegetarian (%)	2,70%	3,80%	1,80%

Table 5 – Socio-demographic sample characteristics by group

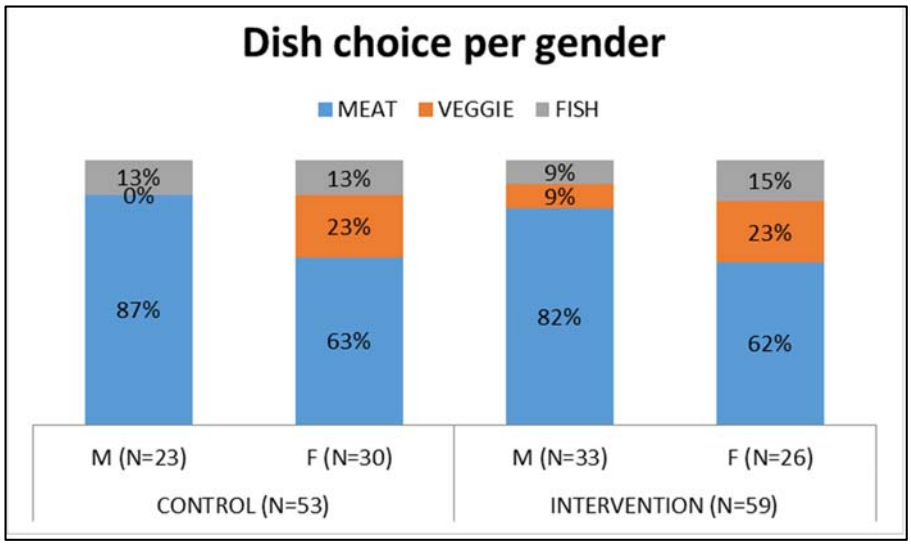


Figure 12– Dish choice per gender

- **Active old people**

	Total (n=114)	Control (n=56)	Intervention (n=58)
Sex (% female)	60,50%	58,90%	62,10%
Age (years)			
Mean (SD)	71.1 (5.2)	71.0 (4.9)	71,3 (5.5)
Range	65-89	65-83	65-89
People who declared to be Vegetarian (%)	2,00%	2,00%	2,00%

Table 6 – Socio-demographics sample characteristics by group

Choice	Total (n=114)	Control (n=56)	Intervention (n=58)
Meat balls	39%	34%	43%
Veggie balls	11%	9%	12%
Fish cakes	51%	57%	45%

Table 7 – Dish choice per condition

3. Italy

- **Adolescents**

	Total (n=88)	Control (n=43)	Intervention (n=45)
Sex (% female)	40	31	45.5
Age (years)			
Mean (SD)	15.4	15.0	15.6
Range	14-16	14-16	14-16
People who declared to be Vegetarian (%)	1.7	0	2.2

Table 8 - Socio-demographic sample characteristics by group

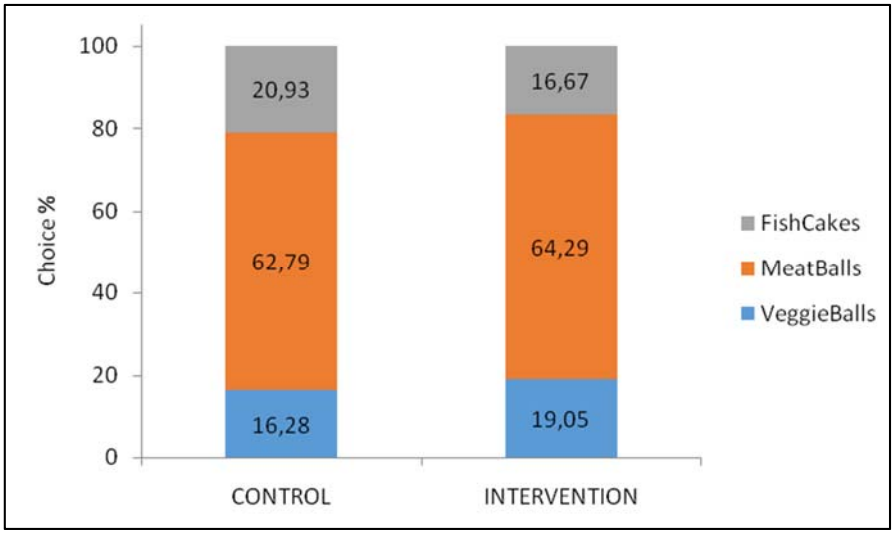


Figure 13 - Proportion of meals chosen per group

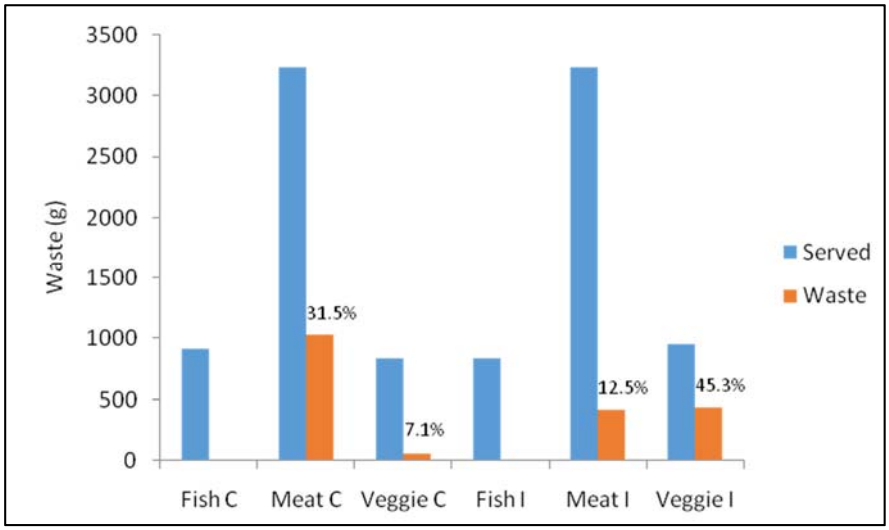


Figure 14 - Food waste per group and type of food

- **Active old people**

	Total (n=47)	Control (n=24)	Intervention (n=23)
Sex (% female)	55.3	54.1	56.5
Age (years)			
Mean (SD)	70.7(5.9)	71.7 (5.6)	69.7 (6.3)
Range	65-87	65-82	65-87
People who declared to be Vegetarian (%)	0	0	0

Table 9 - Socio-demographic sample characteristics by group

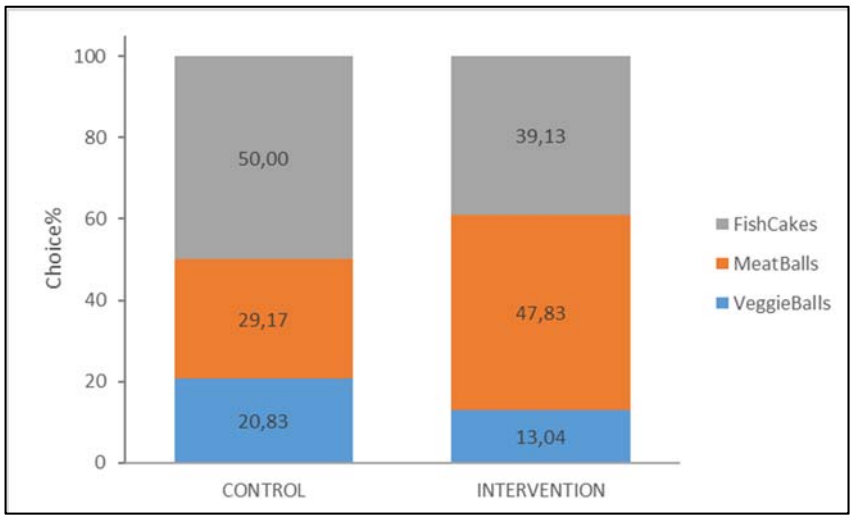


Figure 15 - Proportion of meals chosen per group

Image 7 - Data collection in Italy

4. United Kingdom

- **Adolescents**

	Total (n=86)	Control (n=43)	Intervention (n=43)
Sex (% female)	48.8	44.2	53.5
Age (years)			
Mean (SD)	17.1	17.0	17.1
Range	16-19	16-19	16-19
People who declared to be Vegetarian (%)	5.8	9.3	2.3

Table 10 - Socio-demographic sample characteristics by group

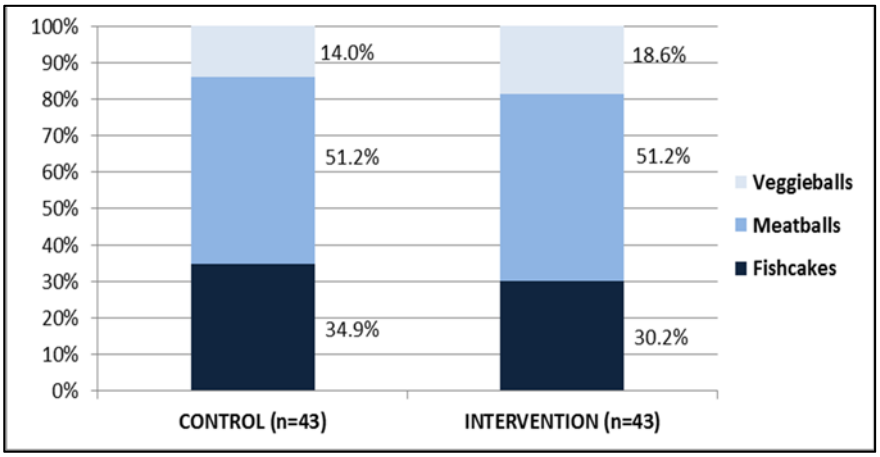


Figure 16 - Proportion of meals chosen per group

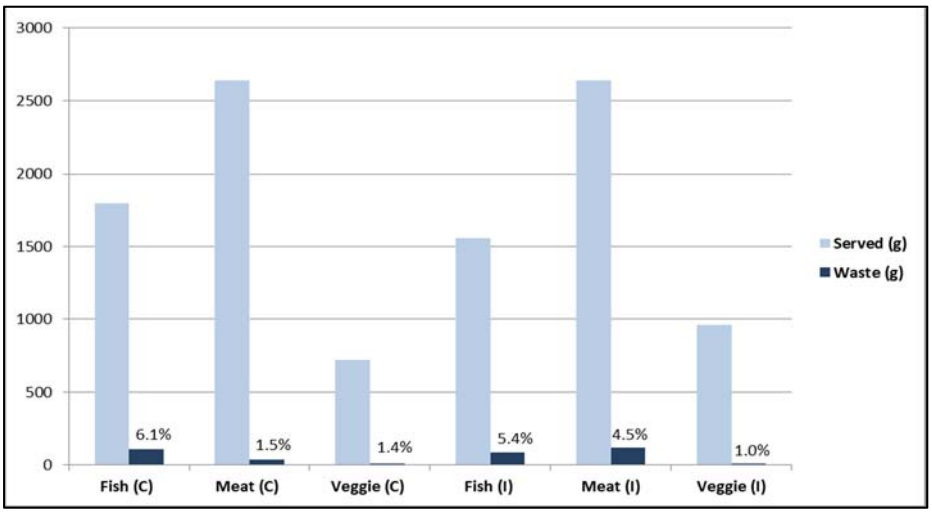


Figure 17 - Food waste per group and type of food

- **Active old people**

	Total (n=87)	Control (n=43)	Intervention (n=44)
Sex (% female)	62.1	60.5	63.6
Age (years)			
Mean (SD)	71.5 (4.9)	70.6 (4.3)	72.3 (5.4)
Range	65-84	65-82	65-84
People who declared to be Vegetarian (%)	2.3	2.3	2.3

Table 11 - Socio-demographic sample characteristics by group

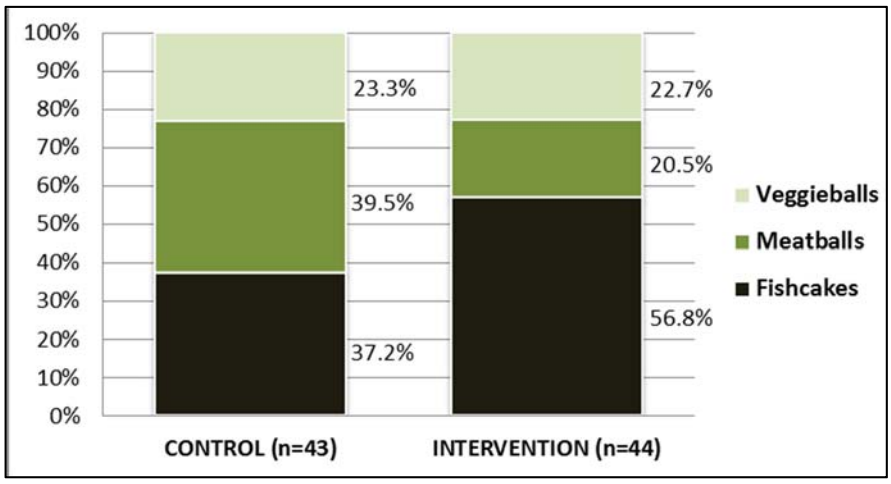


Figure 18 - Proportion of meals chosen per group

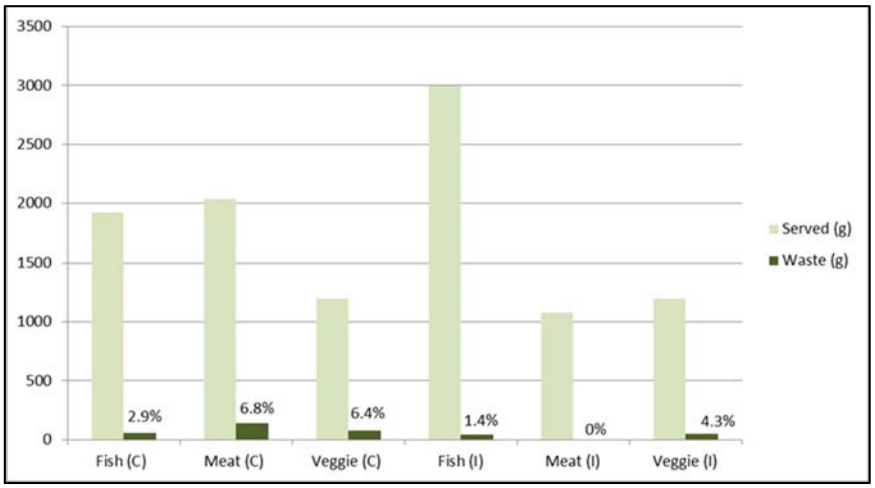


Figure 19 - Food waste per group and type of food

Image 8 – Data collection in the United Kingdom

	Intervention (n=61)	Control (n=55)	P value
Choice of the dish			
Meat balls	44 (72.0)	41 (74.0)	0.94
Veggie balls	9 (15.0)	7(13.0)	
Fish cakes	8 (13.0)	7 (13.0)	
Gender			
Male	34 (56.0)	24 (44.0)	0.19
Female	27 (44.0)	31 (56.0)	
Adherence to Mediterranean Diet			
Low adherence	41 (67.0)	33 (60.0)	0.41
High adherence	20 (33.0)	22 (40.0)	
Hunger			
Little hungry	58 (96.0)	48 (87.0)	0.18
Very hungry	3 (4.0)	7 (13.0)	
Liking of the dish			
Low liking	28 (46.0)	20 (36.0)	0.29
High liking	33 (54.0)	35 (64.0)	
Frequency of eating out			
Rarely	34 (56.0)	31 (56.0)	0.94
Frequently	27 (44.0)	24 (44.0)	
Food Neophobia			
Low food neophobia	14 (23.0)	6 (11.0)	0.08
High food neophobia	46 (77.0)	48 (89.0)	
Attitudes toward Nudging			
Less positive atittude	22 (36.0)	17 (31.0)	0.55
More positive attitude	39 (64.0)	38 (69.0)	

Case study: Danish adolescents

Control group rated higher the dishes

Table 12 - Proportional comparison with (%) of variables between intervention and control groups (Denmark – Adolescents, Control Group rated higher the dishes)

	Intervention (n=61)	Control (n=55)	P value
Choice of the dish			
Meat balls	44 (72.0)	41 (74.0)	0.94
Veggie balls	9 (15.0)	7(13.0)	
Fish cakes	8 (13.0)	7 (13.0)	
Gender			
Male	34 (56.0)	24 (44.0)	0.19
Female	27 (44.0)	31 (56.0)	
Adherence to Mediterranean Diet			
Low adherence	41 (67.0)	33 (60.0)	0.41
High adherence	20 (33.0)	22 (40.0)	
Hunger			
Little hungry	58 (96.0)	48 (87.0)	0.18
Very hungry	3 (4.0)	7 (13.0)	
Liking of the dish			
Low liking	28 (46.0)	20 (36.0)	0.29
High liking	33 (54.0)	35 (64.0)	
Frequency of eating out			
Rarely	34 (56.0)	31 (56.0)	0.94
Frequently	27 (44.0)	24 (44.0)	
Food Neophobia			
Low food neophobia	14 (23.0)	6 (11.0)	0.08
High food neophobia	46 (77.0)	48 (89.0)	
Attitudes toward Nudging			
Less positive atittude	22 (36.0)	17 (31.0)	0.55
More positive attitude	39 (64.0)	38 (69.0)	

Case study: French adolescents

Table 13 - Proportional comparison with (%) of variables between intervention and control groups (France- Adolescents)

	Intervention (n=43)	Control (n=42)	P value
Choice of the dish			
Meat balls	28 (65.0)	26 (62.0)	
Veggie balls	8 (19.0)	7(17.0)	0.82
Fish cakes	7 (16.0)	9 (21.0)	
Gender			
Male	23 (53.5)	28 (67.0)	0.21
Female	20 (46.5)	14 (33.0)	
Adherence to Mediterranean Diet			
Low adherence	25 (58.0)	30 (71.0)	0.19
High adherence	18 (42.0)	12 (29.0)	
Hunger			
Little hungry	38 (88.0)	38 (91.0)	0.26
Very hungry	5 (12.0)	4 (9.0)	
Liking of the dish			
Low liking	33 (77.0)	28 (68.0)	
High liking	10 (23.0)	13 (32.0)	0.38
Frequency of eating out			
Rarely	39 (91.0)	39 (93.0)	
Frequently	4 (9.0)	3 (7.0)	0.28
Food Neophobia			
Low food neophobia	11 (26.0)	17 (40.5)	0.14
High food neophobia	32 (74.0)	25 (59.5)	
Attitudes toward Nudging			
Less positive atittude	13 (30.0)	13 (31.0)	
More positive attitude	30 (70.0)	29 (69.0)	0.94

Case study: Italian adolescents

Table 14 - Proportional comparison with (%) of variables between intervention and control groups (Italy- Adolescents)

	Intervention (n=43)	Control (n=43)	P value
Choice of the dish			
Meat balls	22 (51.0)	22 (51.0)	
Veggie balls	8 (19.0)	6 (14.0)	0.80
Fish cakes	13 (30.0)	15 (35.0)	
Gender			
Male	20 (46.5)	24 (56.0)	0.38
Female	23 (53.5)	19 (44.0)	
Adherence to Mediterranean Diet			
Low adherence	24 (56.0)	29 (67.0)	0.26
High adherence	19 (44.0)	14 (33.0)	
Hunger			
Little hungry	34 (79.0)	33 (77.0)	0.79
Very hungry	9 (21.0)	10 (23.0)	
Liking of the dish			
Low liking	7 (16.0)	5 (12.0)	
High liking	36 (84.0)	38 (88.0)	0.53
Frequency of eating out			
Rarely	36 (84.0)	37 (86.0)	
Frequently	7 (16.0)	6 (14.0)	0.76
Food Neophobia			
Low food neophobia	8 (19.0)	8 (19.0)	1.00
High food neophobia	35 (81.0)	35 (81.0)	
Attitudes toward Nudging			
Less positive atittude	9 (21.0)	11 (26.0)	
More positive attitude	34 (79.0)	32 (74.0)	0.60

Case study: British adolescents

Table 15 - Proportional comparison with (%) of variables between intervention and control groups (UK- Adolescents)

	Intervention (n=49)	Control (n=48)	P value
Choice of the dish			
Meat balls	21 (42.9)	18 (37.5)	
Veggie balls	12 (24.5)	13 (27.1)	0.86
Fish cakes	16 (32.6)	17 (35.4)	
Gender			
Male	15 (30.6)	17 (35.4)	0.61
Female	34 (69.4)	31 (64.6)	
Adherence to Mediterranean Diet			
Low adherence	38 (77.5)	29 (60.4)	0.06
High adherence	11 (22.5)	19 (39.6)	
Hunger			
Little hungry	39 (79.6)	35 (72.9)	0.43
Very hungry	10 (20.4)	13 (27.1)	
Liking of the dish			
Low liking	14 (28.6)	11 (22.9)	
High liking	35 (71.4)	37 (77.1)	0.52
Frequency of eating out			
Rarely	48 (98.0)	46 (95.8)	
Frequently	1 (2.0)	2 (4.2)	0.37
Food Neophobia			
Low food neophobia	10 (20.4)	7 (14.58)	0.45
High food neophobia	39 (79.6)	41 (85.4)	
Attitudes toward Nudging			
Less positive atittude	16 (32.7)	10 (20.8)	
More positive attitude	33 (67.3)	38 (79.2)	0.18

Fisher Test was used when 50% of the cells have expected counts less than 5.

Case study: Danish adolescents

Table 16 - Proportional comparison with (%) of variables between intervention and control groups (Denmark – adolescents)

	Intervention (n=60)	Control (n=58)	P value
Choice of the dish			
Meat balls	25 (42.0)	19 (33.0)	
Veggie balls	8 (13.0)	5 (8.0)	0.31
Fish cakes	27 (45.0)	34 (59.0)	
Gender			
Male	23 (39.0)	23 (40.0)	0.94
Female	36 (61.0)	35 (60.0)	
Adherence to Mediterranean Diet			
Low adherence	24 (40.0)	25 (43.0)	0.73
High adherence	36 (60.0)	33 (37.0)	
Hunger			
Little hungry	55 (92.0)	50 (88.0)	0.48
Very hungry	5 (8.0)	7 (12.0)	
Liking of the dish			
Low liking	44 (73.0)	43 (75.0)	
High liking	16 (27.0)	14 (25.0)	0.79
Frequency of eating out			
Rarely	59 (98.0)	55 (98.0)	
Frequently	1 (2.0)	1 (2.0)	0.50
Food Neophobia			
Low food neophobia	7 (12.0)	11 (20.0)	0.21
High food neophobia	53 (88.0)	44 (80.0)	
Attitudes toward Nudging			
Less positive atittude	20 (33.0)	22 (39.0)	
More positive attitude	40 (67.0)	34 (61.0)	0.50

Fisher Test was used when 50% of the cells have expected counts less than 5.

Case study: French active older people

Table 17 - Proportional comparison with (%) of variables between intervention and control groups (France – active older people)

	Intervention (n=23)	Control (n=24)	P value
Choice of the dish			
Meat balls	9 (39.0)	7 (29.0)	
Veggie balls	4 (17.0)	5 (21.0)	0.77
Fish cakes	10 (44.0)	12 (50.0)	
Gender			
Male	10 (43.5)	10 (42.0)	0.61
Female	13 (56.5)	14 (58.0)	
Adherence to Mediterranean Diet			
Low adherence	8 (35.0)	5 (21.0)	0.28
High adherence	15 (65.0)	19 (79.0)	
Hunger			
Little hungry	20 (87.0)	19 (79.0)	0.23
Very hungry	3 (13.0)	5 (21.0)	
Liking of the dish			
Low liking	4 (17.0)	7 (29.0)	
High liking	19 (83.0)	17 (71.0)	0.34
Frequency of eating out			
Rarely	20 (87.0)	22 (92.0)	
Frequently	3 (13.0)	2 (8.0)	0.31
Food Neophobia			
Low food neophobia	7 (30.0)	8 (33.0)	0.83
High food neophobia	16 (70.0)	16 (67.0)	
Attitudes toward Nudging			
Less positive atittude	10 (43.5)	8 (33.0)	
More positive attitude	13 (56.5)	16 (67.0)	0.47

Fisher Test was used when 50% of the cells have expected counts less than 5.

Case study: Italian active older people

Table 18 - Proportional comparison with (%) of variables between intervention and control groups (Italy – active older people)

	Intervention (n=44)	Control (n=43)	P value
Choice of the dish			
Meat balls	9 (20.0)	17 (40.0)	
Veggie balls	10 (23.0)	10 (23.0)	0.10
Fish cakes	25 (57.0)	16 (37.0)	
Gender			
Male	16 (36.0)	17 (40.0)	0.76
Female	28 (64.0)	26 (60.0)	
Adherence to Mediterranean Diet			
Low adherence	10 (23.0)	17 (40.0)	0.09
High adherence	34 (77.0)	26 (60.0)	
Hunger			
Little hungry	37 (84.0)	32 (74.0)	0.26
Very hungry	7 (16.0)	11 (26.0)	
Liking of the dish			
Low liking	23 (52.0)	16 (37.0)	
High liking	21 (48.0)	27 (63.0)	0.15
Frequency of eating out			
Rarely	43 (98.0)	43 (98.0)	
Frequently	1 (2.0)	1 (2.0)	0.50
Food Neophobia			
Low food neophobia	12 (27.0)	3 (7.0)	0.01
High food neophobia	32 (73.0)	40 (93.0)	
Attitudes toward Nudging			
Less positive atittude	16 (36.0)	21 (49.0)	
More positive attitude	28 (64.0)	22 (51.0)	0.23

Fisher Test was used when 50% of the cells have expected counts less than 5.

Case study: British active older people

Control group more neophobic

Table 19 - Proportional comparison with (%) of variables between intervention and contol groups (UK – active older people)

General Conclusions

Denmark: The higher number of vegetarian meals chosen in the intervention adolescent group could be attributed to the higher prevalence of vegetarians. Nudging by 'dish of the day' did not work for the older population.

France: Did not work for female adolescents - choices of the male population were affected by the intervention however for older subjects gender effect not observed.

Italy: The 'nudge' method appeared not to be successful for both the adolescent and older group.

UK: The 'nudge' method appeared to be successful for the adolescent age group but not for the older to be persuasive for choice of vegetarian option.

Conclusions:

- The results are inconclusive;
- Future nudging studies for these populations are needed to find the best strategy to move adolescents and active older people food habits towards a healthier pattern.

Advisory Board feedback – Professor John Edwards

- "I am not clear that the results prove that nudging simply does not work; this particular nudge and the way it was presented/administered was not sufficiently robust to produce a significant result. If the signs had been more prominent, if this nudge was done in a different way, by, for example the server telling diners about the choice – would the results have been different?"

- "Other nudges might well work. Where, for example, meals are paid for, price manipulation, the inclusion of a 'free beverage' might well produce entirely different results. The choice of nudge is therefore paramount. The present results validate the methodology, what is needed is further funding to extend this work."

WP5 – Model Mapping the determinants of vegetable consumption
Lead by University of Copenhagen

Objective

→ To model and evaluate the effect of repeated exposure/familiarity to a target vegetable measured by changes in consumers; acceptability, intention, attitude and actual consumption.

Choice of the dish by group

- **Adolescents**

Intervention x Control: all countries (chi-square test)

	Intervention (n=190)	Control (n=188)	P value
Choice of the dish			
Meat balls	122 (64.0)	122 (65.0)	0.57
Veggie balls	36 (19.0)	29 (15.0)	
Fish cakes	32 (17.0)	37 (20.0)	

Table 20 - Proportional comparison with (%) of choice of dish between intervention and control groups in all adolescents.

No differences were found!

- **Active old people**

	Intervention (n=176)	Control (n=173)	P value
Choice of the dish			
Meatballs	64 (37.0)	61 (35.0)	0.96
Veggieballs	34 (19.0)	33 (19.0)	
Fish cakes	78 (44.0)	79 (46.0)	

Intervention x Control: all countries (chi-square test)

Table 21 - Proportional comparison with (%) of choice of dish between intervention and control groups in all active older people.

No differences were found!

Preliminary model using control group *versus* intervention group

→ Since no differences were found in the choice of the dishes between control and intervention groups in all countries;

→ The dishes were recoded as “animal-based dish” (meat balls + fish cakes) and ”plant-based” dish (veggie balls) ⟹ dependent variable.

→ Different models were developed for trying to predict why people chose the animal-based or plant-based dish.

Preliminary model using all subjects: Logistic Regression

The following formula:

$$N = 10\,k / p$$

Establishes the sample size needed (N) according to the number of independent variables we want to add to the regression. Where: P is proportion of positive cases in the population (% that chose the plant-based dish), and K is the number of covariates to be included.

In our case:

Adolescents
381= 10k/0.17

Active older people
349= 10k/0.17

K= 6 covariates (maximum) can be included with our sample size.

Results: Logistic regression by age group per country

- It was not possible to run the analysis **per country** due to the **small sample sizes** (less than 100 people by age group per country), which exaggeratedly inflates the confidence intervals.
- **To avoid this problem and have a robust model, the analyses were ran considering all countries together, by age group.**

Results: Logistic regression with all adolescents

Variables	Estimate	OR for plant-based dish	95% CI	P value
Gender‡	-1.07	0.34	(0.18; 0.63)	0.0006
Mediterranean Score	0.09	1.09	(0.94;1.27)	0.23
Food Neoophobia	0.01	1.01	(0.96; 1.06)	0.58
Nudging scale	0.07	1.08	(1.03 ;1.12)	0.0003
Self-efficacy	-0.01	0.98	(0.93: 1.03)	0.50
Hunger scale	-0.19	0.82	(0.63; 1.08)	0.16

‡ Reference category: Female

Table 22 - Odds ratios and 95% CI for some independent risk factors associated with the choice of plant-based dish in adolescents

→ Boys were 66% less likely to choose the plant-based option;
→ The adolescents who scored higher in the nudging scale were 8% more likely to choose the plant-based option.

Food Choice Questionnaire (Question 6): Indicate the level of importance you assign to each of these food characteristics:

Variables	Estimate	OR for plant-based dish	95% CI	P value
Health	0.75	2.12	(1.19; 3.77)	0.01
Natural	0.59	1.81	(1.17; 2.79)	0.007

Table 23 - Odds ratios and 95% CI for health and natural dimensions of FCQ associated with the choice of plant-based dish in adolescents

→ Adolescents who scored higher in the health dimension of FCQ (Is nutritious; is high in fiber; contains a lot of vitamins and minerals and Keeps me healthy) were 112% more likely to choose the plant-based option;
→ Adolescents who scored higher in the natural dimension of FCQ (Contains natural ingredients; contains no additives; contains no artificial ingredients) were 81% more likely to choose the plant-based option.

Human Values Scale (Question 7): How each person is or is not like you (highest point in this scale is "Not like me are all" – the opposite of what each person thinks about him/herlself)

Variables	Estimate	OR for plant-based dish	95% CI	P value
Power	0.33	1.4	(1.07; 1.82)	0.01
Universalism	-0.40	0.66	(0.44; 1.01)	0.05

Table:

Table 24 - Odds ratios and 95% CI for power and universalism dimensions of Human-Values scale associated with the choice of plant-based dish in adolescents

→ Adolescents who scored higher in the power dimension of Humans Values Scale (It is important to him/her to be rich. He or she wants to have a lot of money and expensive things; It is important to him/her to be in charge and tell others what to do. He/ She wants people to do what he/she says) were 40% more likely to choose the plant-based dish.

→ Adolescents with higher score in the universalism dimension of the Humans Value Scale (He/ She thinks it is important that every person in the world be treated equally. It is important to him/her to listen to people who are different from him/her. He/she strongly believes that people should care for nature. Looking after the environment is important to him/her) were 34% less likely to choose the plant-based option. However this was borderline (p=0.05)

Self-estimated health and social norms (Question 10): How much you agree or disagree with…

Variables	Estimate	OR for plant-based dish	95% CI	P value
Social	0.16	1.18	(1.04; 1.34)	0.01
Health	0.18	1.20	(1.08; 1.33)	0.007

Table 25 - Odd ratios and 95 % CI for social norms and self-estimated health associated with the choice of plant-based dish in adolescents

→ Adolescents with higher scores in social norms scale were 18% more likely to choose the plant-based option, and the ones with higher scores in self-estimated health were 20% more likely to choose the plant-based option.

Results: Logistic regression with active older people

Variables	Estimate	OR for plant-based dish	95% CI	P value
Gender‡	-0.47	0.61	(0.34; 1.11)	0.11
Mediterranean Score	-0.01	0.98	(0.86; 1.11)	0.76
Food Neoophobia	-0.02	0.99	(0.96; 1.03)	0.87
Nudging scale	-0.01	0.98	(0.95; 1.01)	0.39
Self-efficacy	-0.01	0.98	(0.93; 1.03)	0.45
Hunger scale	-0.12	0.88	(0.61; 1.27)	0.50

‡ Reference category: Female

Table 26 - Odds ratios and 95% CI for some independent risk factors associated with the choice of plant-based dish in active older people

→ No differences were found in relation to these variables.

Food Choice Questionnaire (Question 6): Indicate the level of importance you assign to each of these food characteristics:

Variables	Estimate	OR for plant-based dish	95% CI	P value
Convenience	-0.38	0.68	(0.49; 0.94)	0.02
Sensory	0.64	1.90	(1.11;3.26)	0.01

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Table 27 - Odds ratios and 95% CI for health and natural dimensions of FCQ associated with the choice of plant-based dish in elderly

→ People with higher score in the convenience dimension of the FCQ ("Takes no time to prepare" ; "It´s easy to prepare" and "Can be cooked very simply") were 32% less likely to choose the plant-based option;

→ People with higher score in the sensory dimension of FCQ ("Tastes good"; "smells nice " and " has a pleasant texture") were 90% more likely to choose the plant-based option.

Human Values Scale (Question 7): How each person is or is not like you (highest point in this scale is "Not like me are all" – the opposite of what each person thinks about him/herlself)

Variables	Estimate	OR for plant-based dish	95% CI	P value
Security (5,14)	0.31	1.37	(1.05; 1.78)	0.01
Universalism (3,8,19)	-0.45	0.63	(0.43;0.92)	0.02

Table 28 - Odds ratios and 95% CI for power and universalism dimensions of Human-Values scale associated with the choice of plant-based dish in elderly

→ People with higher score in the security dimension of the Humans Value Scale ("It´s important to him/her to live in secure surroundings" and "It`s important to him/her that the government ensure his/her safety against all threats.) were 37% more likely to choose the plant-based option.

→ People with higher score in the universalism dimension of the Humans Value Scale (He/ She thinks it is important that every person in the world be treated equally. It is important to him/her to listen to people who are different from him/her. He/she strongly believes that people should care for nature. Looking after the environment is important to him/her) were 37% less likely to choose the plant-based option.

So what?

Familiarity seemed to be an important driver for the choice of the animal-based dishes

Conclusions

Further study:

- Sub groups: males
- Larger samples: structural equation modelling?
- Social and motivational nudges seem to meet lower acceptability than those nudges that target the choice task specifically e.g. health attributes