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## VEGGIEAT – ANNUAL REPORT 2014

To critically evaluate vegetable acceptability through individual  
and environmental characteristics across the lifespan in  
institutional food service

PIAP-GA-2013-612326

## **Deliverable 1.2**

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# VEGGIEAT – PROJECT ABSTRACT

## KEYWORDS

Vegetables, nutrition, intake, age groups, choice architecture, sensory, institutional, consumer, recipes, conceptual model, translational research, industry, policy

## ABSTRACT

Adequate vegetable consumption is fundamental to a healthy balanced diet, however, EU compliance with dietary guidelines is poor and further research is required to overcome consumption barriers. The aim of VeggieEAT is to develop an EU platform for predictive modelling of processed vegetable intake that takes into account individual characteristics (acceptability, intake level, age groups) as well as environmental cues (choice architecture and institutional setting). This aim will be achieved through the development of consumer-oriented products (sensory analysis); the development of recipes for use by food providers (restaurants, canteens, etc.); and the benchmarking of choice architecture facilitating the consumption of vegetables. Results will be gathered and modelled to provide strategic intelligence for decision-making (by Industry) and for policy purposes (by the EU); further, this translational research will be disseminated both at scientific and consumer levels. The application of these results will contribute to operational benefits for European vegetable manufacturers (growers, processors, retailers etc), while adding to the body of knowledge regarding consumer behaviour and preferences towards vegetables. The conceptual model will translate the latest academic research results into a greater understanding of factors determining vegetable consumption while informing a commercially viable vegetable product and therefore strengthen European competitiveness. This Industry-Academia-SME collaboration will invigorate the vegetable sector in Europe while addressing in a constructive way the EU objectives of healthier eating at population level.

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## Summary of Deliverables

Del no.	Deliverable Title	Work Package no.	Person months	Nature	Dissemination level	Delivery date	Lead beneficiary
D1.1	Minutes from the kick off meeting	1	4	O	RE	2	BU
D1.2	Annual project progress report	1	4	R	PU	12, 24, 36, 48	BU
D1.3	Launch of the project web site	1	6	O	PU	4	BU
D2.1	Evaluation of sensory characteristics of processed vegetables across age groups and countries	2	5	O	PU	14	BON
D3.1	Development of preferred vegetable recipe & selection of intervention study factors - Pilot Test	3	15	O	PU	20	IPB
D4.1	Assessment of enhanced choice architecture that optimises and exploits vegetable consumption	4	30	O	PU	38	AAU
D5.1	Production of model mapping determinants of vegetable acceptability through sensory characteristics and choice architecture	5	6	O	PU	44	AAU + FI
D6.1	Final report	6	5	R	PU	48	BU
D6.2	Conference at the Royal Society for Public Health (London)	6	4	E	PU	48	BU
D6.3	Organisation of special issue of Perspectives in Public Health	6	4	P	PU	48	BU

# Introduction

## 1. Brief overview of the project

Adequate vegetable consumption is fundamental to a healthy balanced diet, however, EU compliance with dietary guidelines is poor and further research is required to overcome consumption barriers. **The aim of VeggiEAT is to develop an EU platform for predictive modelling of processed vegetable intake that takes into account individual characteristics (acceptability, intake level, age groups) as well as environmental cues (choice architecture and institutional setting).** This aim will be achieved through the development of consumer-oriented products (sensory analysis); the development of recipes for use by food providers (restaurants, canteens, etc.); and the benchmarking of choice architecture facilitating the consumption of vegetables. Results will be gathered and modelled to provide strategic intelligence for decision-making (by Industry) and for policy purposes (by the EU); further, this **translational research** will be disseminated both at scientific and consumer levels. The application of these results will contribute to **operational benefits** for European vegetable manufacturers (growers, processors, retailers etc), while adding to the body of knowledge regarding consumer behaviour and preferences towards vegetables. The conceptual model will translate the latest academic research results into a greater understanding of factors determining vegetable consumption while informing a commercially viable vegetable product and therefore strengthen European competitiveness. This Industry-Academia-SME collaboration will invigorate the vegetable sector in Europe while addressing in a constructive way the EU objectives of healthier eating at population level.

The **VeggiEAT** research programme and partnership will provide two industrial and three university partners the opportunity to move sector and country in order to provide, absorb and implement new knowledge in a professional industrial-academic environment. A current determinant of EU health is the amount of fruit and vegetables consumed by the population where it is recognised that intake is low. A wide range of factors influence this, ranging from aspects of exposure and the physical, social and cultural environment to personal aspects such as taste, food preferences and neophobia. Many of these factors change throughout life; therefore any initiative that can lead to increasing vegetable consumption across the life span contributes to address an EU public health priority. Furthermore, the challenge for the food and foodservice industry is to provide products and services that facilitate and enhance intake in all population segments. There is a growing interest in the future sustainability of current dietary patterns in light of expected climate change and an expanding global population. Although only one facet of a very complex picture, plant foods are typically associated with fewer greenhouse gas emissions than those of animal origin.

The respective industry actors, stakeholders and policy makers do not have the resources or practical intelligence to adequately respond to the societal challenge of increasing and sustaining increased vegetable intake. In addition, the importance of processed vegetables is both to increase the availability and accessibility of vegetables, tackling socioeconomic disparities and at the same time, providing the most practical solution to food services.

A competitive consortium with large know-how and expertise in vegetable 'manufacture/presentation' and public sector foodservice has been created. The research base of Bournemouth, Lyon, Firenze and Copenhagen will be used as a living laboratory to evaluate

critical features of vegetable consumption across the life span in a public sector foodservice environment to improve the competitiveness of our industrial partners and ultimately the wellbeing of European society. Within this research programme, 5 industrial, 5 SME researchers will get the opportunity to gather knowledge in academia, while 12 academic researchers (4 at AAU, 4 at FI and 4 at BU) will absorb knowledge in industry and 2 early career researchers will be recruited. The consortia will provide evidence of new markets for Bonduelle (industry) and inform chef training (Insitute Paul Bocuse, SME) while the academic partners will translate their research to facilitate better population health. The partners are:

- **Academic partners:**

The Foodservice and Applied Nutrition Research Group of **Bournemouth University (BU)**, United Kingdom, the Meal Science and Public Health Nutrition Research Group (MENU) at **Aalborg University(AAU)**, Denmark and Dipartimento di Gestione dei Sistemi Agrari, Alimentari e Forestali, (GESAAF), **University Firenze (FI)**, Italy, represent the Academia in this proposal. The relevant expertise and current research interests of these research centres lie in public sector food service, choice architecture, food sensory and consumer preferences. Furthermore, they have an interest for better nutrition and healthier lifestyles at the population level. The academic partners provide a strong innovative research base for practice focused research and have experience and expertise of conducting studies in real life situations. Furthermore BU and AAU have a well established reputation for research in public sector foodservice.

- **Industrial partner:**

**Bonduelle (BON)**; Bonduelle is a key, leading manufacturer of vegetable products and is concerned about bringing sustainable, long-term improvement to public food consumption. The Bonduelle Group is investing in nutritional research in order to prepare for the future where new developments in vegetable acceptability and presentation will be of critical importance to future product ranges. Bonduelle constantly optimises products and processes to ensure that consumers can benefit from the very latest progress in the nutritional field. Food Service represents a significant part of the turn-over of the company, 25% in Europe but further markets are desired.

- **Industrial partner (SME):**

**Institut Paul Bocuse (IPB)**; The Institut Paul Bocuse Research Centre is committed to addressing the challenges of food and nutrition in modern society. It aims to promote healthy eating, working with all the players involved in the contemporary “food chain”. This means instilling fresh meaning in the concept of food and eating and constructing new codes for eating well that integrate health, taste and cost. Recipe development and consumer acceptance is a core activity. Researchers work together with chefs in order to address the challenges of vegetable consumption. This expertise translated into recipe development forms the cornerstone of chef training for the future.

The proposed consortium represents an exceptional partnership for both early and experienced researchers to enhance their knowledge through exchange between academia and industry.

## 2. Rationale and technical objectives of the project

By promoting the shift towards a healthy and sustainable diet through consumer exposure and innovation in the food industry, **VeggiEAT** addresses European and global societal public health challenges. An increase in the levels of obesity and other diet and food-related diseases in Europe observed during the past two decades<sup>1</sup> has demanded the direct involvement of the EU government<sup>2</sup>. The **Second Action Plan for Food and Nutrition Policy 2007–2012**, specifically recommended a daily intake of more than **400 g of fruits and vegetables**, based on the current evidence favouring these foods as key components for the prevention of chronic disease<sup>3,4</sup>. An increased consumption of fruits and vegetables could reduce, at population level, the risk of obesity, hypertension, coronary heart disease (CHD) and Type 2 Diabetes. However, **the majority of Europeans do not meet these WHO recommendations** with Denmark (316g) and UK (258g) having one of the lowest fruit and vegetable intakes respectively in Europe, and children over 5 years of age having particularly poor levels and France (342g). This is despite EU policy efforts focused on increasing consumption at the population level across the lifespan. Notwithstanding, Italy has one of the best at 452g per day. Interventions have focused mostly on increasing consumer knowledge on the benefits of increasing their intake of vegetables, based on the assumption that better information would lead to healthier choices. However, numerous factors can interfere with this knowledge in the choice and intake of food. A better acknowledgement of these factors is needed in order to improve the efficiency of public health policies.

Therefore this project **VeggiEAT** is **timely** and addresses the **main question of what are the determinants of vegetable acceptability and intake particularly within a public sector foodservice setting, such as school and elder care homes. Vegetables** are one of the **most difficult categories of food to introduce into a diet**<sup>5</sup> especially within a foodservice operation. Processed fruits and vegetables, including, canned and frozen varieties provide a convenient way to help promote intake as they have a longer shelf life than their fresh counterpart, are available out of season, can take advantage of surplus or over production, can have cost advantages and are easy to use in commercial meal preparation and dish development. This latter aspect enables fruits and vegetables to be incorporated into production schedules where labour is limited or unskilled or equipment is not available. Recent research has focussed on the sensory properties of these products so as not to decrease the acceptability threshold.

Food consumer behaviour is highly complex with many external and internal influences on perception, attitude and action. The product attributes, the individual characteristics of the consumer and the eating environment all play a key role in food-related decisions. Dietary habits and food choices are the result of decisions and actions that are based on both routines that

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<sup>1</sup>World Health Organization (2007) The Challenge of Obesity in the WHO European Region and the Strategies for Response. Copenhagen: WHO Regional Office for Europe.

<sup>2</sup>Elmadfa I (2009) European Nutrition and Health Report 2009 executive summary introduction. *Ann NutrMetab* 55, 3–40.

<sup>3</sup>Jeurnink, SM., Buchner, FL., Bueno-de-Mesquita, HB et al. (2012) Variety in vegetable and fruit consumption and the risk of gastric and esophageal cancer in the European prospective investigation into cancer and nutrition. *Int J Cancer*, 131(6):E963-E973

<sup>4</sup>Cooper, AJ., Sharp, SJ., Lentjes, MAH et al. (2012) A Prospective Study of the Association Between Quantity and Variety of Fruit and Vegetable Intake and Incident Type 2 Diabetes. *Diabetes Care*, 35(6):1293-1300

<sup>5</sup>MorizetD, (2012) Le comportement alimentaire des enfants de 8 à 11 ans: facteurs cognitifs, sensoriels et situationnels, PhD thesis, France, Université Claude Bernard, Lyon 1.

require very little active decision-making and reflective, elaborate decision-making where choice options are carefully considered. The dual process theories (DPTs) describe these two routes as automatic/heuristic and reflective/systematic processing of information available in choice situations. Choice architecture (CA) describes the way in which decisions are influenced by how choices are presented in those situations<sup>6</sup>. VeggiEAT will consider the non-reflective automatic pathways in order to facilitate the choice of vegetables by consumers. Choice architecture is often used interchangeably with other terms such as nudging, libertarian paternalism and behavioural economics. Choice architecture is a tool that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives<sup>7</sup>. Within public health nutrition this could mean altering the environment in foodservice provision such as product placement or labelling or even encouraging consumers to sit together for their meal (social facilitation).

This project will provide the evidence base and innovation to inform practice through a choice architecture approach, taking into account the three key dimensions of food choice: the product (measure of vegetable acceptance), the individual (behavioural measures across age group and country) and the eating situation (behavioural measures across institutions). The feasibility and acceptability of embracing this strategy to improve vegetable intake has never been evaluated before and especially across foodservice sectors. Furthermore, a lack of comparable consumer data is evident, making this pan-European study unique. **Thus the main goal of the study is to increase knowledge and understanding of the determinants of vegetable acceptability (liking), consumption/intake, through sensory characteristics and aspects of the eating environment across all age groups and institutional settings.**

This goal will be achieved by pursuing the following **specific objectives** within three overlapping research and partnership programme areas of **product and sensory analysis, recipe development and consumer behaviour**:

**01** To evaluate the sensory characteristics, including acceptability of processed vegetables (frozen and canned) across age groups and countries (where the vegetables will be used as the 'vehicle' to assess vegetables at large). **(D2.1)**

**02** To select the preferred recipes/dishes incorporating the vegetable as its component part. **(D3.1)**

**03** To identify enhanced choice architecture variables that optimizes and exploits vegetable consumption. To interpret and evaluate consumer preferences towards vegetable consumption and hence identify further determinants of vegetable acceptability and sustained intake across countries (Denmark, France, Italy, UK), age groups and institutional settings (schools and elder care). **(D4.1)**

**04** To evaluate and model the effect of selected choice architectural interventions measured by changes in consumers' attitude, intention and consumption of processed vegetables within public sector foodservice settings, such as schools and elder care homes in Denmark, France, Italy and the UK. **(D5.1)**

**05** To provide a platform, promote, inform and educate the general public and industry competitiveness within the European business climate. To develop methods for wider applicability and to aid design of potentially more effective measures to improve, enhance efficacy and cost effectiveness when promoting vegetable intake. **(D1.3, D6.1, D6.2, D6.3)**

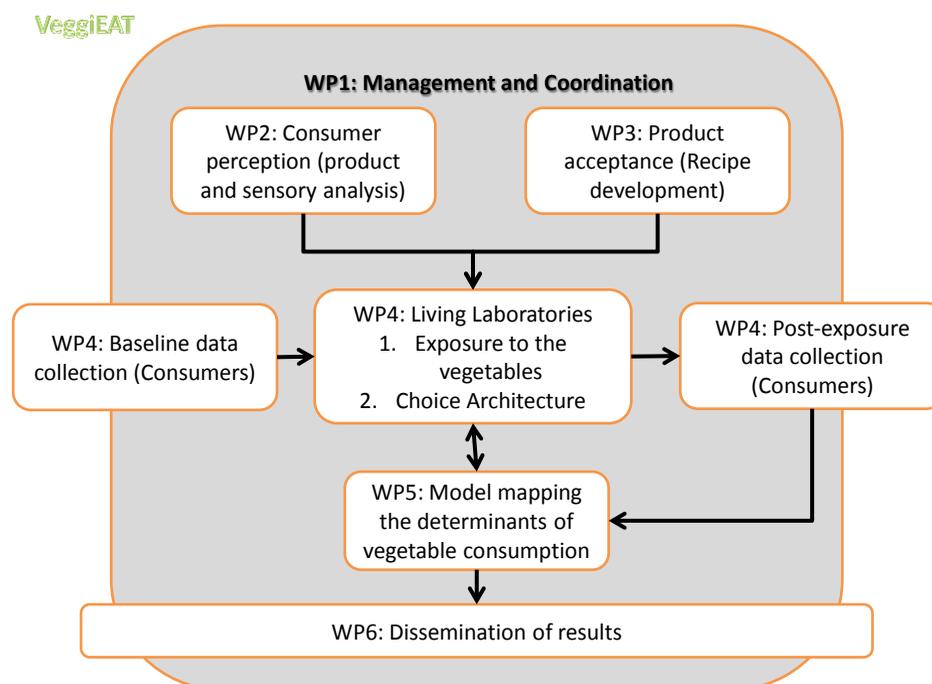
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<sup>6</sup>Thaler RH and Sunstein CR (2008). Nudge: Improving decisions about health, wealth, and happiness. New Haven: Yale University Press.

### 3. Workpackages

The work plan of the project is organised in six work packages as shown in Figure 1.

#### Work Package Overview



**Figure 1: Work Plan** Components

#### **Work Package 1 – Management**

**Workpackage 1; Management and Coordination;** The objective of WP1 is to provide day to day coordination and management of all VeggieEAT activities, providing efficient support in terms of financial and human resources and linking the project to the EU Commission. This WP will be led by BU and deliverables include; Minutes from the kick off meeting (D1.1); Annual project report (D1.2); Launch of project web site (D1.3).

**Deliverables completed;** The web site is live at [www.veggieat.eu](http://www.veggieat.eu) (**Deliverable 1.3**) (**Annex 1**) and this is where minutes from the kick off meeting have been posted (**Deliverable 1.1**) and the annual project report (**Deliverable 1.2**). A promotional leaflet has been produced to compliment the website (**Annex 2**). Social media has also been used to maximise public engagement through a twitter account and in addition the research blog hosted by Bournemouth University has been actively populated with research updates (<http://blogs.bournemouth.ac.uk/research/>). Veggieeat featured in the BU Festival of Learning (<http://blogs.bournemouth.ac.uk/research/category/festival-of-learning/>), June 2014 where David Willets MP, the UK Minister for Universities and Science visited the project. At the same time a Marie Curie ambassador day was run for local school children and they reported that it was one of the best days they had experienced and would like to be invited again to participate in further activity. Press releases have been published and attention has been received from both British and French press. The first in a series of short films based on the field research has been developed and posted on BU 'YouTube' (<http://www.youtube.com/user/bournemouthuni>)

and on the project web site. The film was produced in conjunction with, and filmed by, students based in BU's Media School. **Secondments;** The secondments are progressing well and according to plan. The multi-disciplinary and inter-sectoral approach of the project creates a win-win-situation for all partners as well as spill-over effects and long term collaboration. Cultural Integration has been paramount and secondees have had the opportunity to learn a new language. Through the integration of ESRs and ERs into already functioning interdisciplinary work groups knowledge transfer is happening inherently. During the project's networking events in the host organisations all secondees are using the opportunity to present their research work and disseminate project results.

**Workpackage 2; Consumer perception -product and sensory analysis:** The objective of WP2 is to evaluate the sensory characteristics of vegetables that would influence its choice by different age groups. 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 is led by Bonduelle and includes 3 tasks: **Task 2.1 (product characterisation):** Consists of the sensory characterisation of vegetables by means of descriptive methods, their instrumental characterisation: Firmness, RMN and the study of the link between sensory and instrumental data. **Task 2.2 (consumer test design):** Optimisation of several parameters of the free sorting task method (e.g. nb of product, test instructions). **Task 2.3 (consumer tests):** Evaluation of sensory variation discrimination according to consumer background (age, gender, nationality) applying a free sorting test and collecting liking and perceived freshness responses.

During the first year the following activities were accomplished leading to completion of **Deliverable 2.1:**

a) product selection and their sensory characterization (**Task 2.1**): Two vegetables have been chosen as models: peas -very familiar vegetable in Europe and used in a variety of dishes, and sweet corn -less familiar and used in fewer dishes. For each vegetable, ten product varieties already available in the European market were selected to cover a large part of the sensory space. The product and varieties selection was based on the sensory data from Bonduelle internal panel. The sensory profile of selected samples was obtained by means of Descriptive Analysis. This test was run at UNIFI. A specific sensory vocabulary was defined to characterise samples in relation to appearance, flavour and texture attributes. Statistically validated intensity data for each attribute and each sample were obtained demonstrating sensory characterization of each variety in each product and similarities and differences among samples within each product (perceptual map). The collection of instrumental (Firmness and RMN) data on samples related to sensory properties will be conducted in parallel with WP3.

b) consumer test design (**Task 2.2**): A questionnaire aimed at collecting socio-demographic (age, gender, Family Affluence Scale) food habits and socio-cognitive (food choice questionnaire, neophobia scale) data from children and elderly was designed. Furthermore questions on preference for and consumption of vegetables were included. Pilot studies were run in France, UK and Italy to test the questionnaire.

c) consumer tests (**Task 2.3**): A procedure for sorting methodology was tested and validated in a pilot test run at Bonduelle with both children and elderly subjects. Consumer tests were then run with children over 12 years and elderly over 65 years in France, UK, Italy and Denmark. For each vegetable and each age group 100 subjects were recruited in each country. During the test session, participants were first asked to taste each sample and rate their liking on a 9-point scale. Then they were asked to complete the questionnaire. Finally they performed a free labelled sorting task with the same samples that they evaluated before. Data analysis, based on

both univariate and multivariate approaches, was conducted in order to elucidate two main issues: 1) the inter-individual differences in vegetable sorting and liking; 2) the relationship between individual characteristics with vegetable perception. Results demonstrate that consumer perception of and liking for canned vegetables vary across age and countries. Furthermore, within each country and age group, personal traits (e.g. neophobia) and attitudes affect sensory responses. The analysis of the relationship between consumer responses and sensory properties provided important information to develop consumer-oriented recipes for use by food providers (restaurants, canteens, etc.) in order to facilitate the consumption of vegetables from a population level.

Data collection in France, Italy and Denmark involved Early Career researchers and was used as part of their masters' project.

#### 4. Conferences and abstracts



#### Teenagers' sensory perception of and liking for processed vegetables

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Adequate vegetable consumption is fundamental to a healthy balanced diet. However, even if a large part of the population is aware about their health benefits (Hawkes C., 2013), consumption remains below recommendations in most European countries (Schatzer et al., 2009).

Numerous factors influence vegetable acceptance and among them the sensory preferences play a determining role in the young population (Cooke et al., 2003). In spite of their importance, these factors have received little attention until now.

This study aims to better understand teenagers' perceptions of vegetable sensory properties and to evaluate how these sensory characteristics influence their liking. Two vegetables have been chosen as models: peas -very familiar vegetable in Europe and used in a variety of dishes, and sweet corn -less familiar and used in less dishes. For each vegetable, ten product varieties already available in the European market were selected on the basis of descriptive sensory tests to cover a large part of the sensory space. An one hour test session was organized with 100 teenagers from 12-to-16years old for each vegetable. During the test session, participants were first asked to taste each sample and rate their liking on a 9-point scale. Then they were asked to fill in a questionnaire relating to demographics, personal traits (attitudes to food, neophobia...), vegetable familiarity and liking. They finally performed a free labelled sorting task with the same samples that they evaluated before. Results will be discussed following two main issues: 1) the individual differences in vegetable sorting and liking; 2) the relationship between individual characteristics with vegetable perception. Tests with teenagers and older people are being conducted in Denmark, France, Italy and the UK.

This study is part of the VeggiEAT project (2013-2017) funded by the European commission and aimed to increase understanding of the determinants of processed vegetables acceptability and consumption in teenagers and elderly ([www.veggiEAT.eu](http://www.veggiEAT.eu)).

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## VeggiEAT – increasing vegetable consumption through foodservice.

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### Abstract

*Adequate vegetable consumption is fundamental to a healthy balanced diet, however, EU compliance with dietary guidelines is poor and further research is required to overcome consumption barriers. **The aim of VeggiEAT is to develop an EU platform for predictive modelling of processed vegetable intake that takes into account individual characteristics (acceptability, intake level, age groups) as well as environmental cues (choice architecture and institutional setting).** This aim will be achieved through the development of consumer-oriented products (sensory analysis); the development of recipes for use by food providers (restaurants, canteens, etc.); and the benchmarking of choice architecture facilitating the consumption of vegetables. Results will be gathered and modelled to provide strategic intelligence for decision-making (by foodservice operators) and for policy purposes (by the EU). This paper describes the first stage of sensory analysis and consumer characteristics of consumption in France and the UK.*

## Key Words

Vegetables, sensory, consumer, recipes, foodservice

**Theme** - *Sectoral Futures*

## Introduction

Preventing obesity is a societal challenge which requires sustained behaviour change and partnership between government, academia, the private sector and civil society. There is a scarcity of research in the area of out-of-home eating especially in real-life settings, while there is a growing interest in the future sustainability of current dietary patterns in light of increasing population obesity and related disease.

Although, healthier catering initiatives have been developed, robust evaluation of how these inform, widen or restrict consumer choice and hence effect consumer behaviour change have not been explored (Bagwell, 2014) and have not been considered within the debate of eating out. Previous interventions have focused mostly on increasing consumer knowledge on the benefits of improved food choice based on the assumption that better information would lead to healthier choices (Hoefkens et al, 2011). Numerous factors, usually overlooked, may play a more important role in the choice and intake of food other than simple information. A better acknowledgement of these factors is needed in order to improve the efficiency of public health policies. Foodservice can contribute in a significant way to a more holistic development of improved public health. In fact, this comes as a necessity, as the disease burden associated with poor food choice is becoming increasingly important in societies across Europe, and sustainable improved food habits need to be considered to maximize both social and economic benefits.

By promoting the shift towards a healthy and sustainable diet through consumer exposure and innovation in the food industry, VeggiEAT ([www.veggieat.eu](http://www.veggieat.eu)) addresses European and global societal public health challenges. An increased consumption of vegetables could reduce, at population level, the risk of obesity, hypertension, coronary heart disease (CHD) and Type 2 Diabetes (WHO, 2007).

Vegetables are one of the most difficult categories of food to introduce into a diet especially within a foodservice operation. Limited research has been conducted on this topic and there has never been a study which has considered the 'life span' as a population group and compared across age demographics in a real life eating situation. This poster describes the first research stage in a four year project where the evidence base will be provided to inform practice through a product (measure of vegetable acceptance) and individual (behavioural measures across age group and country) approach. Different intervention programmes addressing unhealthy consumption have adopted different strategies with variable success but previous action has not been focused on the foodservice industry despite this sector providing 40% of all meals served outside the home and being identified as influencing and encouraging an obesogenic environment.

## Methodology

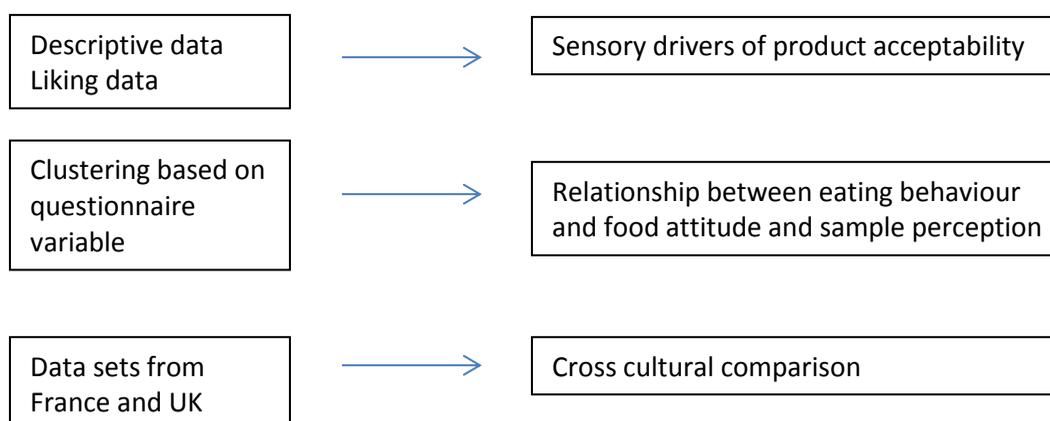
The objective of this study is to evaluate the sensory characteristics of the vegetables that would influence its choice by different age groups. From a knowledge perspective we will be able to better understand consumer perception of the product sensory variations according to their characteristics (i.e. age, gender, nationality) and therefore make recommendations for foodservice menu design.

In June 2014, children over 12years (n=100) and older people over 65years (n=100) in France and the UK will be invited to taste samples of peas and sweet corn. These two vegetables were selected because peas are a familiar and well liked vegetable whereas sweet corn is less so and in fact in France is considered by older people only suitable as chicken food. Notwithstanding from a nutritional perspective as a food it has merits, it is high in fibre and low in fat while relatively inexpensive to purchase.

Subjects will be first exposed to an acceptability liking test for the two samples and then asked to perform a labelling free sorting task where perceived similarities and differences among the samples can be noted. A questionnaire will then be administered to determine demographic and individual characterisation of food consumption. Testing will take place in a canteen and will replicate as far as possible a real life eating situation. The sample (70g) will be presented in polystyrene covered cups and served at a temperature of 63°C. Tastings will be observed and captured on film.

## Results

Results will lead to strategic guidance for foodservice operators regarding the sensory properties required to enhance dishes through including vegetables. Data will be presented at the conference according to the themes of sensory drivers and the relationship to eating behaviour and attitude.



## Discussion

Given the high costs of obesity and comorbidities in terms of health care expenditure and quality of life, prevention strategies are paramount. In Western Europe obesity has risen by 9-15% in the last 10 years and where a correlation has been made between eating out and this data (Benelam, 2009). The positive association between the rise in consumption of food prepared outside the home and the increasing prevalence of obesity is a major health and wellbeing societal challenge. Processed vegetables, namely, canned and frozen, constitute a way for Europeans to meet affordably their dietary needs and at the same time provide a food source which is low in saturated fat and calories. 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 as well as useful commodities for chefs. Furthermore, canned and frozen vegetables offer virtually the same nutrition as fresh, with the advantage of facilitating accessibility, storage and food safety disparities.

There is a continuing need for research that identifies specific ways for improving vegetable consumption and translating this into new product development and new markets. Processed vegetables constitute a way for Europeans to meet affordably their dietary needs. They also provide a convenient way to promote intake, especially in a foodservice situation. There is a strong need at the European level to promote the consumption of vegetables as a public health issue but also to improve foodservice operation.

## References

Bagwell S. (2014) Healthier catering initiatives in London, UK: an effective tool for encouraging healthier consumption behaviour? *Critical Public Health*, 24, 35-46.

Benelam B (2009) Calories on the menu, *Nutrition Bulletin*, 34, 289-290.

Hoefkens, C., Lachat, C., Kolsteren, P., Van Camp, J. and Verbeke, W. (2011), Posting point-of-purchase nutrition information in university canteens does not influence meal choice and nutrient intake, *The American Journal of Clinical Nutrition*, Vol. 94 No.2, pp. 562-70.

World Health Organization (2007) *The Challenge of Obesity in the WHO European Region and the Strategies for Response*. Copenhagen: WHO Regional Office for Europe.

## Acknowledgements

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## III World Congress of Public Health Nutrition

www.nutrition2014.org

**III WORLD CONGRESS OF PUBLIC HEALTH NUTRITION**  
II LATIN AMERICAN CONGRESS OF COMMUNITY NUTRITION  
X CONGRESO DE LA SOCIEDAD ESPAÑOLA DE NUTRICIÓN COMUNITARIA (SENC)

Las Palmas de Gran Canaria. SPAIN  
**9-12 November**  
Congress

Banjul. GAMBIA  
**5-7 November**  
Pre-Congress Workshops

PUBLIC HEALTH NUTRITION: THE CORE OF INTERNATIONAL COOPERATION FOR DEVELOPMENT

### Session Title:

#### Choice architecture (nudging) and Public Health Nutrition

Chairman: Assoc. Prof. F.J.A. Pérez-Cueto, Aalborg University

#### Program

##### **The role of choice architecture (nudging) in Public Health Nutrition**

Perez-Cueto FJA<sup>1</sup>

<sup>1</sup>Department of Development and Planning, Aalborg University-Copenhagen

Despite large investments performed by governments and societies to tackle the food-related chronic disease epidemiology, very little success has been achieved, particularly in terms of healthier lifestyles (eating, physical activity). Large population campaigns and education programs have been successful in increasing awareness, knowledge, in creating attitudes and values towards healthy eating and healthy lifestyles, but actual behavioural change has not been achieved. In this paper we revise critically the theoretical basis underneath previous interventions, and propose dual process theory as an alternative paradigm in the study of public health nutrition, and we propose choice architecture (or nudging) as a potential success factor for future interventions.

##### **Self-estimation vs. self-served vegetable and whole grain consumption**

Nørnberg T<sup>1</sup>; Houlby L<sup>1</sup>; Jørgensen L<sup>1</sup>; He C<sup>2</sup>; Perez-Cueto FJA<sup>2</sup>

<sup>1</sup>Integrated Food Studies, Aalborg University-Copenhagen.

<sup>2</sup>Department of Development and Planning, Aalborg University-Copenhagen

**Objective:** The objective of this experimental study was to assess the accuracy of self-estimation of the amount of vegetables and whole grain in a self-served meal in a laboratory setting.

**Methodology:** To compare actual food selection measures with individual estimates of serving sizes an intelligent buffet was used in order to obtain precise measurements on a self-served meal among a convenience sample of 58 participants recruited at a university in Copenhagen, Denmark. The intelligent buffet is a novel device facilitating data collection in a non-intrusive manner. Self-estimated amounts were assessed through a self-administered quantitative questionnaire.

**Results:** The study showed significant differences between self-estimated and actual portion sizes ( $P < 0.001$ ). The mean self-estimated weight of a vegetable serving was  $218(\pm 134)$  g, of a whole grain serving it was  $36(\pm 34)$  g, while the actual mean weights were  $74(\pm 44)$  g and  $10(\pm 9)$  g respectively. In addition the data analysis showed that there was no significant correlation between estimated and actual weights ( $P > 0.05$ ).

**Key findings:** The results indicate that the respondents' ability to accurately assess the serving size of vegetables and whole grain in a self-served meal based on the Danish Dietary Guidelines does not correspond with the actual amount. This may have implications for consumer interpretation of dietary recommendations for nutrition interventions in Denmark.

**Key words:** Dietary recommendations, Self-serving, whole grain, Health campaigns, 5 a day, fruit and vegetables.

### **An update: choice architecture as a means to change eating behaviour in self-service settings : a systematic review**

Skov LR<sup>1</sup> & Perez-Cueto FJA<sup>1</sup>

<sup>1</sup> Department of Development and Planning, Aalborg University-Copenhagen

**Objective:** The primary objective of this review was to investigate the current evidence-base for the use of choice architecture as a means to change eating behaviour in self-service eating settings, hence potentially reduce calorie intake. The review was published in *Obesity Reviews*, 14(3), 187-196. This update was made for the III World Congress of Public Health Nutrition.

**Methodology:** 12 databases were searched systematically for experimental studies with predefined choice architectural interventions in the period June 2011 – March 2012. The 12 included studies were grouped according to type of interventions and underwent a narrative synthesis. An update of the review was conducted during the summer of 2014.

**Results:** The evidence indicates that (i) health labelling at point-of-purchase is associated with healthier food choice, whilst (ii) manipulating the plate and cutlery size has an inconclusive effect on consumption volume. Finally, (iii) assortment manipulation and (iv) payment option manipulation was associated with healthier food choices. The majority of studies were of very weak quality and future research should emphasise a real life setting and compare their results with the effect of other more well-established interventions on food behaviour in self-service eating settings.

**Key findings:** An increasing interest in the topic of choice architecture and nudging has increased the scientific output since the last review. There is a clear limitation in the lack of clear definitions and theoretical foundation.

**Key words:** Choice architecture, Nudging, Eating behaviour, Health, Dual Process Theory.

## **Nudging young Danish men to eat more vegetables – a food laboratory pilot experiment**

Kongsbak IG<sup>1</sup>; Skov LR<sup>2</sup>; Nielsen BK<sup>1</sup>; Wichmann M<sup>1</sup>; Schaldemose HS<sup>1</sup>; Atkinson L<sup>1</sup>; Ahlmann FK<sup>1</sup>; Perez-Cueto FJA<sup>2</sup>

<sup>1</sup> Integrated Food Studies, Aalborg University-Copenhagen.

<sup>2</sup> Department of Development and Planning, Aalborg University-Copenhagen

**Objective:** This study assessed the combined effect of two choice architectural nudges as a means to increase fruit and vegetable consumption among male university students.

**Methodology:** This single one-day lunch meal study was conducted in a Food Scape Laboratory. A control group (n=32) and an intervention group (n=33) were recruited to attend an ad libitum self-serve buffet at two different timeslots. Two choice architectural nudges were applied in the intervention group; the fruit and vegetables were placed at the beginning of the buffet and separated in eight separate bowls to increase visual variety. The self-served amount (g) of food components was measured using high intelligence equipment.

**Results:** The amount (g) of self-served fruit and vegetables was significantly higher in the intervention group ( $p = .005$ ). The total energy consumed (kJ) was significantly lower in the intervention group ( $p = .01$ ), while there was no significant difference in the total amount (g) of self-served food between the two groups ( $p = .326$ ).

**Key Findings:** This study found convincing evidence for the combined effect of two choice architectural nudges as a means to increase the amount of self-served fruit and vegetables among male university students. Based on these findings it is suggested that choice architecture could be used as a supplement to already existing strategies in the promotion of public health nutrition.

**Key words:** Choice architecture, Nudging, Fruit and vegetables, Food Scape Laboratory, Eating behaviour, Dual Process Theory

## **Choice architectural nudge interventions to promote vegetable consumption based on automatic processes decision-making**

Skov LR<sup>1</sup>; Friis R<sup>2</sup>; Andersen PM<sup>2</sup>; Olsen A<sup>3</sup>; Perez-Cueto FJA<sup>1</sup>

<sup>1</sup> Department of Development and Planning, Aalborg University-Copenhagen

<sup>2</sup> Human Nutrition Studies, University of Copenhagen

<sup>3</sup> Department of Food Science, University of Copenhagen

**Objective:** To test the effectiveness of three types of choice architectural nudges to promote vegetable consumption among Danish people. The experiment aims at providing evidence on the influence of automatic processing system in the food choice situation in an all you can eat buffet serving.

**Methodology:** Experimental cross-over design study in the FoodScape Lab, comparing control to exposure of three nudges: Nudge 1: Natural green – priming vegetable-choosing behaviour. Nudge 2: Having a pre-weighed (200g) fixed salad as default to the main course, and Nudge 3: presenting each component of the salad separately to increase choices compared to a pre-mixed salad.

**Results:** A total of 92 people (dropout rate=21%) partook in the study (60.2% female) with an average age of 26.5. Nudge 1 (N=27) found a significant decrease in total energy consumption due to high decrease in meat consumption ( $p < 0.001$ ) but no significant change in vegetable intake ( $p = 0.16$ ). Nudge 2 (N=33) found a significant increase in vegetable consumption ( $p = 0.018$ )

while Nudge 3 (N=32) found no impact on vegetable intake ( $p=0.56$ ) but a decrease in total energy intake due to a decrease in meat intake ( $p<0.001$ ).

**Key Findings:** Only the Nudge that had a default portion size of vegetable had the intended impact of increasing vegetable consumption. This emphasises the importance of portion sizes in out of home eating as well as underlines the effect of the one-unit bias. The remaining two nudges were not successful in increasing vegetable intake, but promoted health by decreasing total energy intake which suggests that visual variety of fruit and greens prompts a *healthy-eater* subconscious behaviour.

**Key words:** Nudging, Choice architecture, experimental behavioural nutrition, Dual Process Theory

### **Attitudes towards choice architectural nudge interventions to promote vegetable intake among Danish adolescents**

Houlby L<sup>1</sup>; Nørnberg TR<sup>1</sup>; Skov LR<sup>2</sup>; Perez-Cueto FJA<sup>2</sup>

<sup>1</sup> Integrated Food Studies, Aalborg University, Copenhagen.

<sup>2</sup> Department of Development and Planning, Aalborg University, Copenhagen

**Objective:** The objective of this study was to investigate the attitudes towards choice architectural nudge interventions aiming to increase vegetable intake among Danish teenagers in a school context, and which factors influence these attitudes.

**Methodology:** Cross-sectional data were collected through an online quantitative questionnaire, which was developed, validated and distributed to assess factors associated with attitude towards choice architectural nudge interventions. Data analysis included descriptive statistics, factor analysis and structural equation modelling. A total of 408 respondents (78% female) with a mean age of 18( $\pm 1.3$ ) spread throughout Denmark provided sufficient responses.

**Results:** The structural equation model revealed that healthy buffet habits and opinions of where the responsibility of healthy eating lies had the strongest positive association with attitude towards choice architectural nudge interventions. Also, social norms were positively associated with the outcome. Perceived vegetable intake and buffet habits attaching importance to animal welfare and organic food had a negative association.

The descriptive analysis found that the respondents were generally positive towards less intrusive nudges and displayed a more negative attitude towards those targeting their self-image. Further, the respondents considered it to be acceptable for the school to attempt to intervene with their health-related behaviour, but essentially they saw it as neither the school's obligation nor responsibility.

#### **Key findings:**

Healthy buffet habits and opinions of where the responsibility of healthy eating lies were found to have the strongest positive association with attitude towards choice architectural nudge interventions. In general, the respondents were predominantly positive towards the use of less intrusive choice architectural nudge interventions, while negative attitudes were expressed towards nudges targeting the respondents' self-image.

**Key words:** School, Adolescent, Choice architecture, Nudging, Fruit and vegetables, Food Scape Laboratory, Eating behaviour, Dual Process Theory

## **Acknowledgements**

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## 5. Media and press

<b>Source</b>	<b>Date</b>	<b>Language</b>
Bournemouth Echo	11/11/13	English
Perspectives in Public Health	Jan 2014, 134, 3-4	English
BBC South Today (TV)	06/06/14	English

## Annex 1 Veggieat Website

The screenshot shows the VeggieEAT website in a Windows Internet Explorer browser window. The browser's address bar displays the URL <http://microsites.bournemouth.ac.uk/veggieat/>. The website's header features the VeggieEAT logo, which consists of a carrot icon followed by the text "veggieEAT" in a green, sans-serif font. To the right of the logo is the European Union flag and a small text box stating: "This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no". Below the logo is a horizontal navigation menu with the following items: Home, About, Research, Partners, Media, and Contact Us. The main content area is flanked by two vertical green panels with a repeating pattern of small orange carrots. The central text reads: "Welcome to the project website of VeggieEAT". Below this text is a horizontal orange line and an illustration of various vegetables: a head of broccoli, a green pea pod, three red onions, a yellow ear of corn, and a head of green cabbage. To the right of the main text, there is a paragraph: "Here you can find all the relevant information and latest news from this 4 year EU-funded research partnership (running from October 2013 to September 2017)". Below this paragraph is a green button labeled "Find out more". Underneath is a section titled "LATEST NEWS" with a green box containing the text: "New pan European project was kicked off at Aalborg University, Copenhagen". Below this box is a small date icon and the text "October 28, 2013". The browser's status bar at the bottom shows "Local intranet | Protected Mode: Off" and the system tray displays the time "13:10" and date "28/03/2014".



## Promoting healthy eating across Europe



[www.veggieat.eu](http://www.veggieat.eu)

# veggIEAT

Only one in ten children and less than a third of adults are eating their recommended 'five a day' according to the latest Government figures.

In an attempt to raise these numbers, Bournemouth University's Professor Heather Hartwell is leading a Marie Curie funded project to promote healthy eating across Europe and encourage more vegetable intake in school children and the elderly.



## The outcomes of the research are expected to:



Play a major contribution to EU Consumer Policy strategy and to the Action Plan on Food and Nutrition Policy



Bring benefits for European vegetable manufacturers, as it will add essential knowledge regarding consumer behaviour.

VeggiEAT is an industry- academia partnership led by BU, working with academic partners Aalborg University and the University of Florence, and industrial/SME partners Bonduelle and the Institute Paul Bocuse Research centre.



For more information about the project, please visit:

[www.veggieat.eu](http://www.veggieat.eu)