Promotion of novel plant-based dishes among older consumers using the 'dish of the day' as a nudging strategy in 4 EU countries

Xiao Zhou[a], Federico J. A. Perez-Cueto[a*], Quenia Dos Santos[a], Wender L.P. Bredie[a], Margarita Brugarolas Molla-Bauza[b], Vanessa Mello Rodrigues[c], Tine Buch-Andersen[a], Katherine M Appleton[d], Ann Hemingway[e], Agnès Giboreau[f], Laure Saulais[f], Erminio Monteleone[g], Caterina Dinnella[g], Heather Hartwell[c]

[a] *Department of Food Science, Design and Consumer Behaviour Section, University of Copenhagen, 1958 Frederiksberg C, Denmark*

[b] *Department of Agro-Environmental Economics, the Miguel Hernández University of Elche, 03312 Orihuela, Spain*

[c] *Foodservice and Applied Nutrition Research Group & Health and Wellbeing, Faculty of Management, Bournemouth University, Poole BH12 5BB, UK*

[d] *Research Centre for Behaviour Change, Department of Psychology, Faculty of Science and Technology, Bournemouth University, Poole BH12 5BB, UK*

[e] *Faculty of Health and Social Sciences, Bournemouth University, Poole BH12 5BB, UK*

[f] *Centre for Food and Hospitality Research, Institute Paul Bocuse, 69130 Ecully, France*

[g] *Department of the Management of Agriculture, Forestry and Food Systems, University of Florence, 50144 Florence, Italy*

[*] Corresponding author.
Email address: apce@food.ku.dk
Department of Food Science, University of Copenhagen, Rolighedsvej 26, 1958 Frederiksberg C, Denmark.

ABSTRACT: A quasi-experimental study was designed to promote novel plant-based dishes using the nudging strategy 'dish of the day' among older consumers in Denmark, France, Italy and the United Kingdom. Participants were presented with three dish options: veggie balls, meatballs and fish cakes. In the intervention situation, participants were informed that the 'dish of the day' was the novel plant-based 'veggie balls'. Thereafter, participants were asked to choose one of three dishes to intake and then fill a questionnaire. No statistically significant difference in dish choice was found between the control group and intervention group in the four countries. Males were less likely to choose the plant-based dish when compared with the females. Participants from the United Kingdom and Denmark were more likely to choose the plant-based dish when compared with participants from France. High scores of security dimension from the Human Value Scale was negatively associated with choice of plant-based dish, while high scores of the sensory dimension from Food Choice Questionnaire and high scores of the universalism dimension from Human Values Scale were positively related to the choice of the plant-based dish. The 'dish of the day' nudging approach did not influence older people's plant-based dish choice. Gender, country, and dimensions of sensory, universalism and security were critical factors influencing an older people's plant-based food choice.

Key words: Nudging; food choice; older people; plant-based dish; determinants.

1. Introduction

In the past century, life expectancy rose rapidly in Europe as well as in other parts of the world. Along with a decline in fertility rates, WHO estimated an accelerated ageing of the population (WHO, 2011; WHO, 2017): Between 2010 and 2050, the world is expected to experience a substantial growth in the number of older people aged 65 years or over from an estimated 524 million increase to nearly 1.5 billion. In Europe, people aged 65 years and above will become a large segment, accounting for 30% of the population by 2060 (European Commission, 2012). Health problems arise from ageing process such as chronic disease (Joyce, Keeler, Shang, & Goldman, 2005) and complications (Gregg, Engelgau, & Narayan, 2002) lower the quality of older people's life, weaken their appetite (Donini, Savina, & Cannella, 2003) and flavour perception (Stevens & Lawless, 1981). For instance, malnutrition as a complication affects older people's health (Saka, Kaya, Ozturk, Erten, & Karan, 2010; Volkert, 2002) and shows high frequency among older people at home or nursing homes in Europe (Committee of experts on nutrition, food and consumer health, 2008). From the perspective of food, rapid ageing brings challenges for food provision and food intake of this fast growing segment.

Intakes of healthy food can prevent or alleviate chronic diseases (Boeing et al., 2012; Takahashi et al., 2012; Woodside, Young, & McKinley, 2013), especially intakes of plant-based foods, such as vegetables, fruits, grain and legumes, which are associated with the cognitive performance of older people (Nurk et al., 2010). Among plant-based foods, vegetables have apparent advantages with high fibre and low sugar contents (Slavin & Lloyd, 2012). Although large numbers of studies have investigated healthy eating on older people, few studies aimed to increase older people' vegetables intakes (Appleton, Hemingway, & Saulais, 2016). Therefore, it is of importance to search effective strategies to promote plant-based food intake, and finally, to improve the health status and quality of life among older people.

According to the epidemiological report, minor modification of diets towards a healthier way facilitates to reduce the risk of disease and age-related frailty (Trichopoulou, Costacou T, Bamia C, & Trichopoulos, 2003; Trichopoulou et al., 2015). Even if the changes are made in one's later life, it still has a positive effect on older people's physical condition and quality of life (Jankovic et al., 2014; Trichopoulou et al., 2005; Trichopoulou et al., 2007). Therefore, strategies with the aim of changing older peoples' choice towards healthier food can be highly promoted. Currently, dietary

education, meal service and multicomponent strategies have been applied to promote older people's healthy eating (Zhou et al., 2018). For instance, nutritional dietary education has shown positive outcomes on older people's dietary behaviour by raising their understanding and knowledge regarding healthy eating (Bandayrel & Wong, 2011). However, older people' eating habits may return to the original level once the interventions are concluded, because they require long-term duration and continuous assessment.

People's eating behaviour is very complicated, and multiple aspects may influence people's vegetable intake, ranging from interior elements (e.g. individual food preference, knowledge and beliefs, etc.) to exterior elements (e.g. society and surrounding environments, etc.) (Shatenstein et al., 2013). Each day, people will face around 250 food-related choices (Wansink & Sobal, 2007). How to change older people's food choice towards a healthier way is a critical issue to promote healthy eating among older people. As an emerging strategy, nudging approach has received extensive attention in the field of behavioural science (Hansen, Skov, & Skov, 2016), and it has been applied to change people's behaviour on health, wealth and happiness (Olstad, Vermeer, McCargar, Prowse, & Raine, 2015; Thorndike, Riis, Sonnenberg, & Levy, 2014). Hausman and Welch (2010) define the concept of nudges as: 'Nudges are ways of influencing choice without limiting the choice set or making alternatives appreciably more costly in terms of time, trouble, social sanctions, and so forth.' Nudge interventions mainly convers three aspects: (1) slightly change choice conditions to influence individual choices; (2) identify rationality failures and make good use of them; (3) mitigate the adverse effect of rationality failures (Mongin & Cozic, 2018).

Recently, nudging strategies has been introduced to change people's diet-related behaviour (Boyland & Halford, 2013) and motivate them to make a healthier food choice (Broers, De Breucker, Van den Broucke, & Luminet, 2017; Bucher et al., 2016; Stroebele-Benschop, Depa, & de Castro, 2016). There is reason to believe that nudging could be applied to influence older people's food choice and promote their' healthy eating (Hansen, Skov, & Skov, 2016).

Moreover, with the rising use of catering facilities, food-away-from-home makes up a larger proportion of food consumption (Bes-Rastrollo et al., 2010; Kearney, Hulshof, & Gibney, 2001; O'Dwyer, McCarthy, Burke, & Gibney, 2005; Orfanos et al., 2009). Incorporating the nudging method into catering sectors can be an opportunity to improve consumers' eating behaviour (Friis et al, 2017; Lachat et al., 2011). Default as an important nudging strategy influences much of people's food choice (House of Lords, 2011). For instance, the use of a default vegetarian menu or recommendations of vegetarian dish could increase people's plant-based dish choice (Bacon &

Krpan, 2018; Campbell-Arvai, Arvai, & Kalof, 2014). 'Dish of the day', as a default option in menu is commonly used by the food service management to draw consumer's attention and promote the dish (Leenaert, 2012). Additionally, when customers are hungry, they are more likely to choose the default option (Giesen, Geyskens, Goukens, & Havermans, 2013). Therefore, applying the concept of 'dish of the day' into the meal service sector may generate opportunities to promote older consumers' outside-home healthy eating. However, only a few nudging methods were found to promote healthier food choice specifically addressed towards older people. Majority of such interventions were based on a crossover design and failed to provide a robust measurable effect size (Appleton et al, 2016; Bucher et al, 2016; Hansen et al, 2016; Nørnberg et al, 2016; Skov et al., 2013).

In addition, potential determinants of older people's food choice could facilitate the promotion of their healthy eating. Individual characteristics, knowledge and attitudes were found to be associated with older peoples' eating behaviour (Briley, 1989; Payette & Shatenstein, 2005; Shatenstein et al., 2013). However, few of studies were found to investigate the determinants of plant-based food choice among older people.

Considering the above issues, the present study was conducted within the frame of the VeggiEAT project. Briefly, the project consisted of the promotion of plant-based dishes by identifying personal drivers for vegetable consumption in adolescents and older consumers and by further using nudges to make easier the plant-based choices (considered here as healthier).

The objectives of the present study were to investigate the effect of a nudging strategy ('dish of the day') on plant-based dish choice compared with a control setting, and explore which determinants influence plant-based dish choice among European older people. This study reports data from four VeggiEAT participants' countries: Denmark, France, Italy and the United Kingdom.

2. Methods

2.1 Participants and recruitment

Urban dwellers aged 65 years and above were recruited in cities from four European countries (Denmark, France, Italy and the United Kingdom). Older people with dementia or other neurological complications were excluded in this study with the consideration that cognitive impairment may hinder their ability to answer the questionnaires and involvement in the data collection. In Denmark, the recruitment was done through phone calls to the senior activity centres

and through emails to the University of Copenhagen's consumer panel. Finally, 97 participants agreed to participate in the study. In France, participants were recruited by emails to the internal consumer database of Institute Paul Bocuse, as well as online advertisements. A total of 118 participants in France enrolled in this experiment. In Italy and the United Kingdom, recruitment was conducted via email to key people responsible for lunch clubs in Florence, and key people responsible for senior care centres and lunch clubs in Bournemouth, and finally 46 and 87 participants signed up for the study in Italy and the United Kingdom respectively.

2.2 Study procedure

A quasi-experimental study was designed to investigate the impact of a 'dish of the day' nudge intervention on older people's dish choice. The data collection occurred from December 2016 to May 2017, at lunchtime. All recruited participants provided written informed consent and ethical approval was obtained from appropriate authorities among the VeggiEAT project countries.

In Denmark, the data collection was held at senior activity centres, senior clubs, and at the University of Copenhagen. In France, older people were invited for lunch at the living lab of the Institute Paul Bocuse, a real restaurant designed as a platform for data collection. In Italy, the data was collected at the club located at Pian di Mugnone (Florence). In the UK, the data collection was held at a restaurant located at Bournemouth University.

At the beginning of this experiment, each participant was assigned a randomly generated identification number and randomly allocated to the control group and intervention group, and they were blinded to the purpose of this experiment. Participants were then asked to complete two questionnaires (appendix A and B), one before the meal (with personal information and a hunger scale) and one after the meal (with a Likert scale to evaluate their liking of the dish and other potential determinants of food choice). Three choices of dish were presented as equal opportunities in the control situation: fish cakes dish, meat balls dish, and veggie balls dish, but in the intervention situation, the veggie balls dish was termed as 'dish of the day'. In both situations, the veggie balls dish was displayed between the two alternative dishes. For the test session, participants were asked to choose one dish from the menu and then fill out a questionnaire. The veggie balls dish consisted of vegetable 'polpettes' (balls) incorporating peas and sweet corn, developed at the Institute Paul Bocuse, France, in a previous stage of the VeggiEAT Project. The alternative dishes were traditional meatballs (made with beef) or fish cakes (made with white minced fish). All the dishes were served with rice, salad and tomato sauce. All dishes involved in this study were cooked

following the same recipe and served for free in the different countries. Socio-demographic characteristics, participants dish choices and diet related data were collected and analysed after the meal.

2.3 Definition of variables

Considering the complexity of eating behaviour and the possible determinants of plant-based dish choice, the following variables were selected for this study: gender, country, group (intervention group or control group), state of hunger, adherence to Mediterranean diet, food neophobia, attitudes towards nudging, food choice motives and human values.

According to previous research, females were associated with higher intake of vegetables and fruits, and they cared more about healthy eating and nutrition related knowledge (Appleton, McGill, & Woodside, 2009; Baker & Wardle, 2001; Donkin et al., 1998). Thus, this variable was included in this study to investigate the gender effect on participants' dish choice.

Country was included as explanatory variable in the analysis because people's eating habits varies among different countries (Appleton et al., 2017). The United Kingdom, Denmark, France and Italy were coded as 1, 2, 3, and 4 respectively for data analysis.

Participants with or without the intervention may have a different response in dish choice. Therefore, group was considered as a variable to account for the possible effect on older participants' dish choice.

State of hunger was self-rated by participants prior to the meal, using a 10-point hunger scale (Omichinski, 1992), which varies from 1 to 10 (1: being extremely hungry and 10: being extremely full). This scale is found in questionnaire 1 (appendix A)

The Mediterranean diet as a dietary pattern is a rich source of plant-based food. Participants with higher adherence to this dietary pattern were expected to be more prone to choose a plant-based dish. Each question from the Mediterranean diet adherence scale was scored 0 or 1 (Martínez-González et al., 2012). Two questions focus on eating habits and the remaining items concentrate on food consumption frequency. This scale is found in question 4 of the questionnaire 2 (appendix B).

Motives for food choice were measured using the Food Choice Questionnaire (Steptoe, Pollard & Wardle J, 1995). It is a tool consisting of 24 items and covering 8 dimensions. Each item is scored from 1 to 4 with four options—'not at all important', 'a little important', 'moderately important' and 'very important'. Dimensions in this questionnaire include sensory, natural, mood,

health, price, weight, familiarity and convenience. This scale is found in question 6 of the questionnaire 2 (appendix B).

Human values reference to ‘what is important to people in their lives and the goals they strive to attain’ (Schwartz et al., 2015). In this study, human values were included to test which dimension was associated with older people’s plant-based dish choice. The measurement was based on a 21-item scale ranging from ‘very much like me’ to ‘not like me at all’ scoring 0-6 points. This scale was developed by Schwartz (Schwartz, 2003) and covers 10 human values dimensions: self-direction, power, universalism, achievement, security, stimulation, conformity, tradition, hedonism and benevolence. This scale is found in question 7 of the questionnaire 2 (appendix B).

Food neophobia is defined as ‘a reluctance to eat and/or avoidance of novel foods’ (Pliner, Hobden, & Hobden, 1992). In this study, the dish with veggie balls was a novel dish and it was specifically developed for this experiment, thus it is expected that food neophobia could play a role in the choice of the plant-based dish. It was measured using a 10-item food neophobia scale (Pliner, Hobden, & Hobden, 1992). Each item was responded to a 7-point Likert scale ranging from ‘disagree strongly’ to ‘agree strongly’. This scale is found in question 8 of the questionnaire 2 (appendix B).

Attitudes towards nudging were assessed on a 5-point Likert scale consisting of 10 statements on hypothetical scenarios, which were related to the concept of nudging for food choice behaviour (Dolan et al., 2012; Nørnberg et al., 2016). Each statement was measured with five options ranging from ‘disagree strongly’ to ‘agree strongly’. This scale is found in question 12 of the questionnaire 2 (appendix B).

2.4 Data analysis

Pearson’s chi-square test and binary logistic regression were computed in this study. Primarily, the difference of dish choice between the intervention group and control group across four different countries was assessed by chi-square test. If results showed no statistically significant difference between groups, choice of dish was recoded as a plant-based dish versus an animal-based dish. Then binary logistic regression model was applied to test the relationship between participants’ dish choice and all other independent variables.

Regarding the logistic regression model, univariate binary logistic regression was primarily run to detect which dimensions from Food Choice Questionnaire and Human Values Scale was statically significant in relation to the plant-based dish choice. Then backward selection was used

for multivariable logistic regression by incorporating independent variables such as gender, attitudes towards nudging, Mediterranean diet adherence, food neophobia, state of hunger and previously detected dimensions. Spearman correlations between variables were tested to avoid multicollinearity. In order to avoid overfitting of the model, the rationale developed by Peduzzi, Concato, Kemper, Holford, and Feinstein (1996) was applied to calculate the maximum number of included independent variables based on the sample size and the proportion of positive cases (percentage of participants who chose the plant-based dish). Cronbach's alpha was used to measure the internal consistency of the Human Value Scale (Cortina, 1993). A p value of <0.05 was used to define statistical significance. Missing data were imputed through mean imputation. All analyses were run in SPSS 24.0 (IBM, New York, U.S.).

3. Results

3.1 Participants' characteristics

Table 1 shows the socio-demographic characteristics, eating habits and eating out frequency among older people in the four countries. Participants' age ranged from 65 to 89 years and there was a higher frequency of women. The percentage of vegetarians was less than 2.5% across all four countries, and in Italy, none of the participants were vegetarian. More than half of the participants chose to eat out once a week or less. In Italy and France, only a small proportion of participants reported eating food-away-from-home every day while in Denmark and the United Kingdom, none of them stated this information.

Table 1

Socio-demographic characteristics, eating habits and eating out frequency of participants by country

Variables	Denmark (n=97)	France (n=118)	Italy (n=46)	United Kingdom (n=87)
Gender (%)				
Female	67.0	60.5	56.5	62.0
Male	33.0	39.5	43.5	38.0
Age (years) Mean (SD)	73.9 (6.4)	71.1 (5.2)	70.7 (6.0)	71.5 (4.9)
range	65-89	65-89	65-87	65-84
Vegetarian (%)	1.0	2.0	0	2.3
Frequency of eating out (%)				
Never	10.3	18.1	26.1	12.7
Once a week or less	68.0	66.4	60.9	58.6
2 days a week	18.6	13.8	4.3	26.4
3-4 days a week	3.1	0.9	6.5	2.3
Every day	0	0.8	4.3	0

3.2 Participants' dish choice

Table 2 shows the results of dish choice between the intervention and control groups in each country. No statistically significant differences were found in dish choice between groups and across countries.

Table 2

Comparison of dish choice between groups across four countries

Country	Choice of Dish	Intervention Group n (%)	Control Group n (%)	Pearson Chi-Square Value	P Value
Denmark	Meat balls	21 (42.9)	18 (37.5)	0.291	0.865
	Veggie balls	12 (24.5)	13 (27.1)		
	Fish cakes	16 (32.7)	17 (35.4)		
France	Meat balls	25 (41.7)	19 (32.8)	2.281	0.320
	Veggie balls	8 (13.3)	5 (8.6)		
	Fish cakes	27 (45.0)	34 (58.6)		
Italy†	Meat balls	9 (39.1)	6 (26.1)	0.940	0.734
	Veggie balls	4 (17.4)	5 (21.7)		
	Fish cakes	10 (43.5)	12 (52.2)		
United Kingdom	Meat balls	9 (20.5)	17 (39.5)	4.426	0.109
	Veggie balls	10 (22.7)	10 (23.3)		
	Fish cakes	25 (56.8)	16 (37.2)		

*Statistically significant ($P < 0.05$);

† Fisher's Exact Test because 33.3% of the cells have expected counts less than 5

Since no statistically significant differences were found in dish choice between the control and intervention groups in all countries, the veggie balls dish was then renamed as a plant-based dish and the other two types of dishes were renamed as an animal-based dish and grouped together. Data from the four different countries were combined for further analysis. Potential determinants of the plant-based dish choice were analysed by applying binary logistic regression models.

3.3 Association between each dimension of Food Choice Questionnaire and choice of plant-based dish

Table 3 illustrates the univariate logistic regression model regarding the association between each dimension of Food Choice Questionnaire and choice of plant-based dish. Although no dimensions were found to be significantly associated with the participants' choice of the plant-based dish, the p value regarding the convenience and sensory dimensions were close to the critical point, which indicated a marginal trend toward significance. Considering the possible bias caused by univariate analysis (Sun, Shook, & Kay, 1996; Bursac, Gauss, Williams, & Hosmer, 2008), sensory and convenience dimensions were finally incorporated to the multivariable logistic regression model as the potential determinants of plant-based dish choice.

Table 3

Odds ratios and 95% CI in the univariate logistic regression model investigating each dimension of the Food Choice Questionnaire in association with participants' choice of plant-based dish

Variables	Questions	Estimate	OR for plant-based dish	95% CI	P value
Convenience	(3,8,16)	-0.312	0.732	(0.530; 1.011)	0.058
Sensory	(1,5,24)	0.525	1.690	(0.997; 2.865)	0.052
Natural	(4, 9, 14)	0.036	1.037	(0.736; 1.462)	0.836
Mood	(12, 15, 19, 20)	0.198	1.219	(0.870; 1.709)	0.250
Health	(2,13,18,22)	0.314	1.369	(0.861; 2.177)	0.185
Price	(10,23)	0.000	1.000	(0.730; 1.371)	0.999
Weight	(6,11,21)	0.015	1.015	(0.733; 1.406)	0.927
Family	(7,17)	-0.226	0.798	(0.583; 1.091)	0.157

*Statistically significant ($P < 0.05$); OR=odds ratios

3.4 Association between each dimension of Human Values Scale and choice of plant-based dish

Table 4 shows the results of the univariate logistic regression analysis investigating each dimension of the Human Values Scale in association with plant-based dish choice. A full scale Cronbach's alpha of 0.78 indicated a relatively high internal consistency. Security and universalism

were found significantly related to the participants' plant-based dish choice. Cronbach's alpha for Security was 0.57 and for universalism was 0.63. The security score and participants' plant-based dish choice showed a reverse association while universalism score and the same dish choice presented a positive relationship. For the security dimension, participants with higher scores were 30% less likely to choose the plant-based dish. Regarding the universalism dimension, participants with higher scores were 65.8% more likely to choose the plant-based option.

Table 4

Odds ratios and 95% CI in univariate logistic regression model investigating each dimension of Human Values Scale in association with participants' choice of plant-based dish

Variables	Questions	Estimate	OR for plant-based dish	95% CI	P value
Universalism	(3,8,19)	0.506	1.658	(1.125; 2.445)	0.011*
Security	(5,14)	-0.357	0.700	(0.538; 0.910)	0.008*
Power	(2,17)	0.123	1.131	(0.866; 1.476)	0.365
Hedonism	(10,21)	-0.105	0.900	(0.683; 1.186)	0.454
Achievement	(4,13)	-0.138	0.871	(0.663; 1.143)	0.318
Stimulation	(6,15)	0.229	1.257	(0.961; 1.645)	0.096
Self-direction	(1,11)	-0.076	0.927	(0.674; 1.274)	0.641
Tradition	(9,20)	-0.071	0.931	(0.686; 1.264)	0.649
Conformity	(7,16)	-0.140	0.869	(0.662; 1.143)	0.316
Benevolence	(12,18)	0.191	1.211	(0.828; 1.770)	0.323

*Statistically significant (P < 0.05); OR=odds ratios

3.5 Determinants of participants' choice towards plant-based dish

All of the candidate independent variables to be included in the multivariable logistic regression model were checked for multicollinearity through Spearman´s correlations as they were not normally distributed (data were not shown). Included variables were either uncorrelated or negligibly correlated as all the correlation coefficients were lower than 0.3, indicating that they can be used together in the same model (Hinkle, Wiersma, & Jurs, 2003).

Table 5 shows the result of the multivariable logistic regression using the backward selection. Compared with females, males were 47.4% less likely to choose the plant-based dish. When France was defined as reference, the United Kingdom and Denmark had a 198.7% and 173.2% higher likelihood of choosing the plant-based dish respectively. An increase of 1 unit on the security dimension of the Humans Values Scale led to a 37.3% lower likelihood of choosing the plant-based dish. On the other hand, an increase of 1 unit on the sensory dimensions of the Food Choice

Questionnaire and on the universalism dimensions of the Human Values Scale leads to a 83.5% and 56.1% higher likelihood of choosing the plant-based dish respectively.

Table 5

Odds ratios and 95% CI in multivariable logistic regression model associated with participants' choice of plant-based dish

Variables	Estimate	OR for plant-based dish	95% CI	P value
Gender[a]	-0.642	0.526	(0.283; 0.978)	0.042*
Country[b]				
France	Ref	Ref	Ref	Ref
Denmark	1.005	2.732	(1.265; 5.901)	0.011*
The United Kingdom	1.094	2.987	(1.320; 6.763)	0.009*
Italy	0.637	1.891	(0.695; 5.147)	0.212
Sensory	0.607	1.835	(1.024; 3.291)	0.042*
Universalism	0.445	1.561	(1.038; 2.349)	0.033*
Security	-0.467	0.627	(0.469; 0.837)	0.002*

a Reference category: Female; b Reference category: France; *statistically significant (P < 0.05); OR=odds ratios; Ref= reference

4. Discussion

This study investigated the effect of nudging on older people's dish choice through a 'dish of the day' strategy and identified the potential determinants of plant-based dish choice in four EU countries. The majority of participants had the habit of eating out-of-the-home once a week or less and only a small proportion of participants declared to be vegetarian. The number of participants who chose the plant-based dish was similar to those who chose fish cakes and meatballs. Five variables were significantly associated with participants' plant-based choice including gender, country, an importance given to sensory factors, universalism factors and security-based factors. Females and participants from the United Kingdom and Denmark (compared with France) were more willing to choose the plant-based dish. The more importance participants gave to sensory and universalism factors, the more they chose the plant-based option. On the contrary, those who rated security higher were less willing to make the same choice.

Previous studies have shown that changing eating patterns towards a healthier diet can improve people's nutrition condition (Chernoff, 2001). Nudging as both a money-saving and a time-saving strategy has been widely used to promote people's healthy behaviour (Skov, Lourenço, Hansen, Mikkelsen, & Schofield, 2013). However, the effects of nudging intervention on healthy eating vary in different operations. Some of studies showed that nudging could promote healthy eating (Dubbert,

Johnson, Schlundt, & Montague, 1984; Feldman, Mahadevan, Su, Brusca, & Ruzsilla, 2011; McDaniel, Hunt, Hackes, & Pope, 2001) while some couldn't (Buscher et al., 2001; Feldman, Mahadevan, Su, Brusca, & Ruzsilla, 2011). For instance, Feldman et al. (2011) investigated the effect of nutritional menu labelling on older people's meal selection, and they didn't find substantial effect on facilitating healthier meal choice, however, boxing menu items successfully encouraged older people to choose the meal with heathy items. Considering the differences of nudging designs and specific intervention operations, results may be influenced by multiple factors like stimuli, sample design, social interaction and environment.

In this study, 'dish of the day' was selected as a nudging method to influence older people's dish choice, however, no evidence was found for an increase in participants' choice of a plant-based dish (veggie balls dish). Although previous studies have proven that default option increase consumers' choice of plant-based food, the strategies were different from 'dish of the day' in this study. Campbell-Arvai and Kalof (2014) investigated the effect of default menu on consumer's meat-free dish choice, and result showed positive effect on consumer's healthy dish choice. Different from this study, they provided the default menu closely to the consumers and put the second menu option far away from consumers, which increase the possibilities of choosing vegetables dish. In this study, the 'dish of the day' —veggi balls dish were treated equally with the other two dishes, which may lower people's attention on the default dish. In addition, lack of detailed information about 'dish of the day' may make the plant-based dish unappealing. Bacon and Krpan (2018) found that menus with recommendations and introductions of vegetarian dish increased the dish choice among infrequent vegetarian food eaters when compared with a menu separating the place of vegetarian dish from other dish options. Therefore, an explanation to the present study's findings could be that the way the nudge was not implemented sufficiently, and probably if we would have provided a detailed introduction, with a picture or nutritional value of this dish and provide more in-depth information regarding the advantages and dynamics of 'dish of the day', older consumers may have increased their choice of the target plant-based dish.

In addition, dish samples or social interactions might influence the function of 'dish of the day'. Compared with the plant-based dish, animal-based dishes are more popular, more familiar and more traditional in these four EU countries, therefore, older people may regard it as an easier and inertial choice when they were presented with the choices, and could explain the success of the fish-based option. The plant-based dish in this study was made of peas, beans and corn, which is not a common vegetable dish in these four EU countries. For instance, if the dish formulation were

adjusted, changing to a more familiar presentation and raw material, it might facilitate older people's dish choice towards the target one. Furthermore, social interaction may be another potential reason that influenced participants' dish choice as they were able to sit together for lunch (Stroebele-Benschop, Depa, & de Castro, 2016). Perhaps, if we adjust the subliminal cues, environment or we combine previous effective strategies together (Schröder & Lyon, 2013; Van den Broucke, & Luminet, 2017), nudging strategies of promoting older people's healthy eating may be more successful.

Beyond investigating the nudging effect, we also identified the potential determinants influencing older people's plant-based dish choice. Logistic regression results showed that participants from the United Kingdom and Denmark more often tried the plant-based dish when compare with participants from France. Among these four different countries, the United Kingdom had the largest number of vegetarians, which may drive older people's eating behaviour towards plant-based food, because vegetarians avoid animal related products and have a plant-based dietary habit (Phillips, 2005). Although fewer vegetarians were found in Denmark when compared with France, potential flexitarians in Denmark may contribute to the increased likelihood of choosing the plant-based dish as flexitarians are 'meat-reducers' and tend to hold positive attitude on the plant-based dish (Cliceri, 2018; Dagevos & Voordouw 2013; Reipurth et al., 2018).

Gender as one of the most important factors has a statistically significant impact on older participants' dish choice in this study. Compared with females, males were less likely to choose the plant-based dish, which was consistent with previous studies that gender was strongly associated with older people's vegetables and fruits consumption (Appleton, McGill, & Woodside, 2009; Baker & Wardle, 2001; Donkin et al., 1998). Baker et al. (2001) demonstrated that compared with old males, females consumed more vegetables and fruit per day and reported more knowledge about nutrition, especially regarding plant-based foods. Therefore, compared with males, females may have more possibilities to choose plant-based food and intake more plant-based food. Also, nudging females towards healthier food could be easier than nudging males' if we provide more health related claim (Kaur et al., 2017). Perhaps, treat different gender group with specialized strategies may increase the efficiency of promoting older people's healthy eating.

According to the results from food choice motives, sensory factor was an important predictor of plant-based dish choice among older people in this study. The more the older participants paid attention to a food's taste, smell and texture, the more they were likely to select the plant-based choice. Older people may suffer sensory loss from the ageing process including taste impairment,

weakened smell perception and chewing difficulties (Kohyama, Mioche, & Martin, 2002; Murphy, 1993), which lower their interest in meals. In this study, the newly designed plant-based dish may easily draw attention from the older people who value its sensory properties. It is well known that sensory properties influence older people's food preferences and this effect can be larger if connected with perceived health value (Laureati, Pagliarini, & Calcinoni, 2008; Mathey, Siebelink, de Graaf, & Van Staveren, 2001; Laureati, Pagliarini, Calcinoni, & Bidoglio, 2006; Richardson, Shepherd, & Elliman, 1993) (Goff & Klee, 2006).

In addition, dimensions of universalism and security in Human Values Scale were found significantly associated with older participants' plant-based choice. Schwartz et al. (1994) defined the motivational goal of universalism as 'understanding, appreciation, tolerance, and protection, for the welfare of all people and for nature'. In this study, participants who emphasized equal opportunities, understanding of others and caring about nature were more likely to choose the plant-based dish. Farragher, Wang, and Worsley (2016) demonstrated that the item of equality-universalism from the Personal Values Scale was positively associated with salad vegetable consumption, and supported the results of this present study. Therefore, increasing older people's awareness of equality and enhancing their concern about nature could be an effective way to facilitate the promotion of plant-based food. On the contrary, high scores of security were negatively related with older people's plant-based dish. The value security from the Human Values Scale means 'safety, harmony, and stability of society, of relationships, and of self,' for instance, national security, social order and clean are the exemplary types (Schwartz et al., 1994). In this study, when older participants placed more importance on safety, harmony and stability of society and of self, they had less probability to choose plant-based dish. Universalism and security were opposite conceptually in the value structure (Schwartz et al., 1994), in this study, these two dimensions indicated an opposite association with older people's plant-based dish choice.

Although food neophobia and Mediterranean diet adherence were not strongly associated with older people's plant-based dish choice in this study, they play an important role in eating behaviour among older people. Older people appeared more food neophobia when compared with other age groups (Stratton, Vella, Sheeshka, & Duncan, 2015) and familiarity is a key driver for older people to make food choices (Painter, Wansink, & Hieggelke, 2002). In this study, we assumed the general food neophobia may reduce the plant-based dish choice because of the novelty of veggi balls dish, but the results showed that food neophobia was not a critical factor influencing dish choice. The neophobia specifically for each menu dish was not tested in this study, which may be related with

older consumers' dish choice. Further studies are needed to confirm the relationship between specific dish food neophobia and the choice of plant-based food among the older people. In addition, comparing the nudging effect 'dish of the day' on novel and common plant-based food choice may help to improve the strategy of promoting older people's healthy eating. Mediterranean diet is regarded as a rich source of plant-based food in people's daily diet across EU countries and supposed to influence older people's dish choice. However, in this study, adherence to a Mediterranean diet didn't affect older people's dish choice. The potential reason could be that this study was a cross-sectional design without long term following-up and older consumer only have one chance to choose the dish, which may be influenced by dish options, surroundings, people, mood or other possible factors.

Moreover, the attitudes towards nudging were not associated to the choice of the plant-based dish. It is generally accepted that attitudes are necessary but not sufficient to achieve behavioural change (Ariely, 2008; Dolan et al., 2012; Thaler & Sunstein, 2008). Although Pieniak et al. (2010) found that attitudes towards organic vegetables were strongly associated with food intake, the consumption data was based on participants' self-report instead of actual behaviour change, leading the uncertainty of the results. In addition, the scale was not designed specifically for older people, and few studies investigate the relationship between attitude towards nudging and plant-based dish choice. Changing older people's attitude towards nudging may not help to promote older people's eating behaviour, because sometimes people's decision may be influenced in an irrational way responding to the surroundings (Ariely, 2008; Thaler & Sunstein, 2008).

This study is the first attempt to investigate a nudging effect on older people's dish choice through a 'dish of the day' strategy in four EU countries. Gender, country, and an importance of sensory, universalism and security factors were potential determinants of older people's plant-based dish choice. Future research is needed on nudging method and to confirm the relationship between the above determinants and older people's plant-based dish choice. However, there are some limitations with this study that should be considered. First of all, there was a long questionnaire and it required great patience from older participants to complete, which may weaken the quality of data and also increase the missing data. Second, this study is a quasi-experimental design without follow-up, therefore, it can't provide insights into any sustained effect on older people´s dish choice. Third, the animal-based dish as a classical dish had some advantages when compared with plant-based dish in these four European countries. Furthermore, considering time-saving and various national data collections, a shorter 21-item version of Human Values Scale was chosen for this

study (Schwartz, 2012), but the Cronbach's alpha of full scale, universalism and security suggested the items within this scale had a relatively moderate internal consistency (Cortina 1993). At last, the 'dish of the day' as a nudging method did not increase older participants' plant-based dish choice. Taking multiple factors into consideration and make the stimulus more appealing may enhance the effectiveness of the intervention (Schröder & Lyon, 2013).

5. Conclusions

In summary, this study provided directions for future research in the promotion of older peoples' diet towards a plant-based pattern by using a 'dish of the day' nudging strategy. Although no statistically significant differences were found for dish choice in four EU countries, five potential determinants were identified that relate to plant-based dish choice. Females and participants from the United Kingdom and Denmark (compared with France) were more likely to choose the plant-based dish. In addition, the higher the importance given by participants to sensory properties, the more likely they were to choose the target dish. Every increment in the importance given to universalism increased the odds of choosing the plant-based dish, while increments in the security value had the opposite effect. In addition, confirming the relationship of these potential determinants with plant-based food choice is needed as similar studies in this field for older people are very small in number. Future interventions could build on the current study by improving the application of the 'nudge' and taking into account the strategic knowledge of what to do or not to do in the field, such as enhancing the explanations of plant-based foods, or incorporating effective stimuli cues of nudging, a more comprehensive strategy could be developed to enhance older people's plant-based food choice and finally to improve their health condition and quality of life.

Ethical Standards Disclosure

Ethical approval was obtained through the appropriate channels in all the VeggiEAT Project countries. Relevant health and safety issues, together with a risk assessment protocol, were addressed prior to the commencement of the research. Written informed consent was obtained from all participants. Confidentiality and anonymity were assured at all times.

Conflicts of Interest

Xiao. Zhou, Dr. Dos Santos, Dr Mello Rodrigues, Dr Hartwell and Dr Perez-Cueto report grants from European Commission, VeggiEAT Project (EU grant # 612326). Dr. Saulais reports

grants from European Union, during the conduct of the study; and grants from Malongo (coffee company), outside the submitted work. Dr. Buch-Andersen, Dr. Bredie, Dr. Appleton, Dr. Hemingway, Dr Giboreau, Dr. Monteleone, Dr. Dinnella and Dr. Brugarolas have nothing to disclose.

Acknowledgments

This article was supported by VeggiEAT project (received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under the Grant Agreement No. FP7 - 612326 - VeggiEAT). Wender L.P. Bredie and Tine Buch-Andersen are supported by ELDORADO project 'Preventing malnourishment and promoting well-being in the elderly at home through personalized cost-effective food and meal supply' (grant 4105-00009B, Innovation Fund Denmark). First author Xiao Zhou is presently supported by Chinese Scholarship Council.

References

Appleton, K. M., Dinnella, C., Spinelli, S., Morizet, D., Saulais, L., Hemingway, A., … Hartwell, H. (2017). Consumption of a high quantity and a wide variety of vegetables are predicted by different food choice motives in older adults from France, Italy and the UK. *Nutrients*, *9*(9), 1–17. http://doi.org/10.3390/nu9090923.

Appleton, K. M., Hemingway, A., Saulais, L., Dinnella, C.,, Monteleone, E., Depezay, L.,… Hartwell, H. (2016). Increasing vegetable intakes: rationale and systematic review of published interventions. *European Journal of Nutrition*, *55*(3), 869-896. https://doi.org/10.1007/s00394-015-1130-8 .

Appleton, K. M., McGill, R., & Woodside, J. V. (2009). Fruit and vegetable consumption in older individuals in Northern Ireland: Levels and patterns. *British Journal of Nutrition*, *102*(7), 949–953.http://doi.org/10.1017/S0007114509332122.

Ariely, D. (2008). Predictably irrational: The hidden forces that shape our decisions. HarperCollins.

Bacon, L., & Krpan, D. (2018). (Not) Eating for the environment: The impact of restaurant menu design on vegetarian food choice. Appetite, 125, 190-200. http:// doi.org/ 10.1016/j.appet.2018.02.006.

Baker, A. H., Wardle, J. (2001). Sex differences in fruit and vegetable intake in older adults. Appetite, 40, 269–275. https://doi.org/10.1016/S0195-6663(03)00014-X.

Bandayrel, K., & Wong, S. (2011). Systematic literature review of randomized control trials assessing the effectiveness of nutrition interventions in community-dwelling older adults. *Journal of Nutrition Education and Behavior*, *43*(4), 251–262. http://doi.org/10.1016/j.jneb.2010.01.004.

Bes-Rastrollo, M., Basterra-Gortari, F. J., Snchez-Villegas, A., Marti, A., Martnez, J. A., & Martnez-González, M. A. (2010). A prospective study of eating away-from-home meals and weight gain in a Mediterranean population: The SUN (Seguimiento Universidad de Navarra) cohort. *Public Health Nutrition*, *13*(9), 1356–1363. http://doi.org/10.1017/S1368980009992783.

Boeing, H., Bechthold, A., Bub, A., Ellinger, S., Haller, D., Kroke, A., … Watzl, B. (2012). Critical review: vegetables

and fruit in the prevention of chronic diseases. *European Journal of Nutrition*, *51*, 637–663. https://s.click.taobao.com/GsPUdQw.

Boyland, E. J., & Halford, J. C. G. (2013). Television advertising and branding. Effects on eating behaviour and food preferences in children. *Appetite*, *62*, 236–241. http://doi.org/10.1016/j.appet.2012.01.032.

Briley, M. E. (1989). The determinants of food choices of the older people. *Journal of Nutrition for the Elderly*, *9*, 39–45. https://doi.org/10.1300/J052v09n01_05.

Broers, V. J. V., De Breucker, C., Van den Broucke, S., & Luminet, O. (2017). A systematic review and meta-analysis of the effectiveness of nudging to increase fruit and vegetable choice. *European Journal of Public Health*, *27*(5), 912–920. http://doi.org/10.1093/eurpub/ckx085.

Bucher, T., Collins, C., Rollo, M. E., McCaffrey, T. A., De Vlieger, N., Van der Bend, D., … Perez-Cueto, F. J. A. (2016). Nudging consumers towards healthier choices: a systematic review of positional influences on food choice. *British Journal of Nutrition*, *115*(12), 2252–2263. http://doi.org/10.1017/S0007114516001653.

Bursac, Z., Gauss, C. H., Williams, D. K., & Hosmer, D. W. (2008). Purposeful selection of variables in logistic regression. *Source code for biology and medicine*, *3*(1), 17.

Buscher, L. A., Martin, K. A., Crocker, S., Li, S., Neumark-Sztainer, D., Thornquist, M., & Cheskin, L. (2001). Point-of-purchase messages framed in terms of cost, convenience, taste, and energy improve healthful snack selection in a college foodservice setting. Journal of the American Dietetic Association, 101(8), 909–913. http://doi.org/10.1016/S0002-8223(01)00223-1.

Campbell-Arvai, V., Arvai, J., & Kalof, L. (2014). Motivating sustainable food choices: The role of nudges, value orientation, and information provision. *Environment and Behavior*, *46*, 453-475. https://doi.org/10.1177/0013916512469099.

Chernoff, R. (2001). Nutrition and health promotion in older peoples. *The journals of gerontology*. *Series A, Biological sciences and medical sciences*, *56*(2), 47-53.

Cliceri, D., Spinelli, S., Dinnella, C., Prescott, J., & Monteleone, E. (2018). The influence of psychological traits, beliefs and taste responsiveness on implicit attitudes toward plant-and animal-based dishes among vegetarians, flexitarians and omnivores. Food Quality and Preference, 68, 276-291. https://doi.org/10.1016/j.foodqual.2018.03.020.

Committee of experts on nutrition, food and consumer health. Nutrition in care homes and home care report and recommendations: from recommendations to actions. (2008). http://dske.dk/Politik/Internationalt/rapport_fra_sub_commitee_under_europaraadet_dec_08.doc.pdf Accessed 21 August 2017.

Cortina, J. M. (1993). What is coefficient Alpha? An examination of theory and applications. *Journal of Applied Psychology*, *78*, 98-104.

Dagevos, H., & Voordouw, J. (2013). Sustainability and meat consumption: is reduction realistic?. Sustainability: Science, Practice and Policy, 9(2), 60-69. https://doi.org/10.1080/15487733.2013.11908115.

Dolan, P., Hallsworth, M., Halpern, D., King, D., Metcalfe, R., & Vlaev, I. (2012). Influencing behaviour: The mindspace way. *Journal of Economic Psychology*, *33*(1), 264–277. http://doi.org/10.1016/j.joep.2011.10.009.

Donini, L. M., Savina, C., & Cannella, C. (2003). Eating habits and appetite control in the older people: The Anorexia of Aging. *International Psychogeriatrics*, *15*(1), 73–87. https://doi.org/10.1017/S1041610203008779.

Donkin, A. J. M., Johnson, A. E., Lilley, J. M., Morgan, K., Neale, R. J., Page, R. M., & Silburn, R. L. (1998). Gender and living alone as determinants of fruit and vegetable consumption among the elderly living at home in urban Nottingham. *Appetite*, *30*(1), 39–51. http://doi.org/10.1006/appe.1997.0110.

Dubbert, P. M., Johnson, W. G., Schlundt, D. G., & Montague, N. W. (1984). The influence of caloric information on cafeteria food choices. *Journal of Applied Behavior Analysis*, *17*(1), 85-92. http://dx.doi.org/10.1901/jaba.1984.17-85.

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M. I., Corella, D., Arós, F., … PREDIMED Study Investigators. (2013). Primary Prevention of Cardiovascular Disease with a Mediterranean Diet. *New England Journal of Medicine*, *368*(14), 1279. http://doi.org/10.1056/NEJMoa1200303.

European Commission. Directorate-General for Economic and Financial Affairs. The 2012 Ageing Report: Economic and budgetary projections for the EU27 Member States (2010-2060). (2012). http://ec.europa.eu/economy_finance/publications/european_economy/2012/pdf/ee-2012-2_en.pdf Accessed 21 August 2017.

Feldman, C., Mahadevan, M., Su, H., Brusca, J., & Ruzsilla, J. (2011). Menu engineering: A strategy for seniors to select healthier meals. *Perspectives in Public Health*, *131*(6), 267–274. http://doi.org/10.1177/1757913911419897.

Friis, R., Skov, L. R., Olsen, A., Appleton, K. M., Saulais, L., Dinnella, C., … 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. http://doi.org/10.1371/journal.pone.0176028.

Giesen, J. C. A. H., Geyskens, K., Goukens, C., & Havermans, R. C. (2013). Changing the default. How to promote healthier food choices. *Appetite*, *71*, 475. https://doi.org/10.1016/j.appet.2013.06.026.

Goff, S. A., Klee, H. J. (2006). Plant volatile compounds: sensory cues for health and nutritional value? Science, 311(5762), 815-819. http://doi.org/10.1126/science.1112614.

Gregg, E. W., Engelgau, M. M., & Narayan, V. (2002). Complications of diabetes in older people people. *BMJ*, *325*(7370), 916–917.

Hansen, P. G., Skov, L. R., & Skov, K. L. (2016). Making Healthy Choices Easier: Regulation versus Nudging. *Annual Review of Public Health*, *37*(1), 237–251. http://doi.org/10.1146/annurev-publhealth-032315-021537.

Hausman, D. M., Welch, B. (2010). Debate: To nudge or not to nudge. *Journal of Political Philosophy*, *18*(1), 123-136. https://doi.org/10.1111/j.1467-9760.2009.00351.x .

Hinkle D. E., Wiersma, W., Jurs, S. G. (2003). Applied statistics for behavioral sciences . (5th ed.). Boston: Houghton Mifflin.

House of Lords Science and Technology Select Committee. (2011). Report on Behaviour Change. House of Lords.

Jankovic, N., Geelen, A., Streppel, M. T., de Groot, L. C. P. G. M., Orfanos, P., van den Hooven, E. H., … Feskens, E. J. (2014). Adherence to a healthy diet according to the World Health Organization guidelines and all-cause mortality in elderly adults from Europe and the United States. *American Journal of Epidemiology*, *180*(10), 978–988. http://doi.org/10.1093/aje/kwu229.

Joyce, G. F., Keeler, E. B., Shang, B., & Goldman, D. P. (2005). The lifetime burden of chronic disease among the older people. *Health Affairs (Millwood)*, *24*(2), W5R18-29. https://www.healthaffairs.org/doi/10.1377/hlthaff.W5.R18.

Kaur, A., Scarborough, P., & Rayner, M. (2017). A systematic review, and meta-analyses, of the impact of health-related claims on dietary choices. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 93.

Kearney, J., Hulshof, K., & Gibney, M. (2001). Eating patterns – temporal distribution, converging and diverging foods, meals eaten inside and outside of the home – implications for developing FBDG. *Public Health Nutrition*, *4*(2b), 693–698. http://doi.org/10.1079/PHN2001156.

Kohyama, K., Mioche, L., & Martin, J. F. (2002). Chewing patterns of various texture foods studied by electromyography in young and elderly populations. *Journal of Texture Studies*, *33*(4), 269–283. http://doi.org/10.1111/j.1745-4603.2002.tb01349.x.

Lachat, C., Naska, A., Trichopoulou, A., Engeset, D., Fairgrieve, A., Marques, H. Á., & Kolsteren, P. (2011). Essential actions for caterers to promote healthy eating out among European consumers: Results from a participatory stakeholder analysis in the HECTOR project. *Public Health Nutrition*, *14*(2), 193–202. http://doi.org/10.1017/S1368980010002387.

Laureati M, Pagliarini E, Calcinoni O. (2008). Does the enhancement of chemosensory stimuli improve the enjoyment of food in institutionalized older people? *Journal of Sensory Studies*, *23*(2), 234–250. http://doi.org/10.1111/j.1745-459X.2008.00152.x.

Laureati, M., Pagliarini, E., Calcinoni, O., & Bidoglio, M. (2006). Sensory acceptability of traditional food preparations by elderly people. *Food Quality and Preference*, *17*(1–2), 43–52. http://doi.org/10.1016/j.foodqual.2005.08.002.

Leenaert, T. (2012). Chapter 16 Meat moderation as a challenge for government and civil society: the Thursday Veggie Day campaign in Ghent, Belgium. In Sustainable food planning: evolving theory and practice. (pp. 189-196). Wageningen Academic Publishers. https://doi.org/10.3920/978-90-8686-187-3_16.

Martínez-González, M. A., García-Arellano, A., Toledo, E., Salas-Salvadó, J., Buil-Cosiales, P., Corella, D., … Estruch, R. (2012). A 14-item mediterranean diet assessment tool and obesity indexes among high-risk subjects: The PREDIMED trial. PLOS ONE, 7(8). http://doi.org/10.1371/journal.pone.0043134.

Mathey, M.-F. A. M., Siebelink, E., Graaf, C. de, & Staveren, W. A. Van. (2001). Flavor enhancement of food improves dietary intake and nutritional status of elderly nursing home residents. *The Journal of Gerontology*, *56*(4), 200–205.

McDaniel, J. H., Hunt, A., Hackes, B., & Pope, J. F. (2001). Impact of dining room environment on nutritional intake of Alzheimer's residents: A case study. *American Journal of Alzheimer's Disease & Other Dementiasr*, *16*(5), 297–302. http://doi.org/10.1177/153331750101600508.

Mongin, P., Cozic, M. (2018). Rethinking nudge: not one but three concepts. *Behavioural Public Policy*, *2*(1), 107-124. https://doi.org/10.1017/bpp.2016.16.

Murphy, C. (1993). Nutrition and chemosensory perception in the elderly. *Critical Reviews in Food Science and Nutrition*, *33*(1), 3–15. http://doi.org/10.1080/10408399309527607.

Nørnberg, T. R., Houlby, L., Skov, L. R., & Peréz-Cueto, F. J. A. (2016). Choice architecture interventions for increased vegetable intake and behaviour change in a school setting: a systematic review. *Perspectives in Public Health*, *136*(3), 132–142. http://doi.org/10.1177/1757913915596017.

Nørnberg, T. R., Skov, L. R., Houlby, L., & Pérez‐Cueto, F. J. A. (2016). Attitudes and acceptability of behaviour change techniques to promote healthy food choices among Danish adolescents. Family and Consumer Sciences Research Journal, 44(3), 264-279.

Nurk, E., Refsum, H., Drevon, C. A., Tell, G. S., Nygaard, H. A., Engedal, K., & Smith, A. D. (2010). Cognitive performance among the elderly in relation to the intake of plant foods. The Hordaland Health Study. The British Journal of Nutrition, 104(8), 1190–201. http://doi.org/10.1017/S0007114510001807.

O'Dwyer, N. a, McCarthy, S. N., Burke, S. J., & Gibney, M. J. (2005). The temporal pattern of the contribution of fat to energy and of food groups to fat at various eating locations: implications for developing food-based dietary guidelines. *Public Health Nutrition*, *8*(3), 249–257. http://doi.org/10.1079/PHN2004701.

Olstad, D. L., Vermeer, J., McCargar, L. J., Prowse, R. J. L., & Raine, K. D. (2015). Using traffic light labels to improve food selection in recreation and sport facility eating environments. *Appetite*, *91*, 329–335. http://doi.org/10.1016/j.appet.2015.04.057.

Omichinski, L. (1999). You count, calories don't. HUGS International.

Orfanos, P., Naska, A., Trichopoulou, A., Grioni, S., Boer, J. M. A., Van Bakel, M. M. E., … Slimani, N. (2009). Eating out of home: Energy, macro-and micronutrient intakes in 10 european countries. The european prospective investigation into cancer and nutrition. *European Journal of Clinical Nutrition*, *63*, S239–S262. http://doi.org/10.1038/ejcn.2009.84.

Painter, J. E., Wansink, B., & Hieggelke, J. B. (2002). How visibility and convenience influence candy consumption. *Appetite*, *38*(3), 237–238. http://doi.org/10.1006/appe.2002.0485.

Payette, H., & Shatenstein, B. (2005). Determinants of healthy eating in community-dwelling elderly people. Canadian *Journal of Public Health*, 96, S27-31. : http://dx.doi.org/10.17269/cjph.96.1502.

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology*, *49*(12), 1373–9. http://doi.org/10.1016/S0895-4356(96)00236-3.

Phillips, F. (2005). Vegetarian nutrition. *Nutrition Bulletin*, *30*(2), 132–167. http://doi.org/10.1111/j.1467-3010.2005.00467.x.

Pieniak, Z., Aertsens, J., & Verbeke, W. (2010). Subjective and objective knowledge as determinants of organic vegetables consumption. Food quality and preference, 21(6), 581-588. https://doi.org/10.1016/j.foodqual.2010.03.004.

Pliner, P., Hobden, K., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, *19*(2), 105–120. http://doi.org/10.1016/0195-6663(92)90014-W.

Reipurth, M., Hørby, L., Gregersen, C. G., Bonke, A., & Cueto, F. J. P. (2018). Barriers and facilitators towards adopting a more plant-based diet in a sample of Danish consumers. Food Quality and Preference. https://doi.org/10.1016/j.foodqual.2018.10.012

Richardson, N. J., Shepherd, R., & Elliman, N. A. (1993). Current attitudes and future influence on meat consumption in the U.K. Appetite, 21(1), 41-51. http://doi.org/10.1006/appe.1993.1035.

Saka, B., Kaya, O., Ozturk, G. B., Erten, N., & Karan, M. A. (2010). Malnutrition in the elderly and its relationship with other geriatric syndromes. *Clinical Nutrition*, *29*(6), 745–748. http://doi.org/10.1016/j.clnu.2010.04.006.

Schröder, M., & Lyon, P. (2013). Embedding healthy eating: Nudging or toolbox? *Nutrition and Food Science*, *43*(4), 330–338. http://doi.org/10.1108/NFS-03-2012-0028.

Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues*, *50*(4), 19–45. http://doi.org/10.1111/j.1540-4560.1994.tb01196.x.

Schwartz, S. H. (2003). A proposal for measuring value orientations across nations. In: Qeustionnaire development report of the European social survey. Jerusalem, (pp 259–319). ESS.

Schwartz, S. H. (2012). An overview of the Schwartz theory of basic values. *Online readings in Psychology and Culture*, *2*(1), 11. https://doi.org/10.9707/2307-0919.1116.

Schwartz, S. H., Breyer, B., & Danner, D. (2015). Human Values Scale (ESS). *ZIS - The Collection Items and Scales for the Social Sciences*. https://doi.org/10.6102/zis234.

Shatenstein, B., Gauvin, L., Keller, H., Richard, L., Gaudreau, P., Giroux, F., … Payette, H. (2013). Baseline determinants of global diet quality in older men and women from the NuAge cohort. *Journal of Nutrition, Health and Aging*, *17*(5), 419–425. http://doi.org/10.1007/s12603-012-0436-y.

Skov, L. R., Lourenço, S., Hansen, G. L., Mikkelsen, B. E., & Schofield, C. (2013). Choice architecture as a means to change eating behaviour in self-service settings: A systematic review. *Obesity Reviews*, *14*(3), 187–196. http://doi.org/10.1111/j.1467-789X.2012.01054.x.

Slavin, J. L., Lloyd, B. (2012). Health benefits of fruits and vegetables. *Advances in Nutrition*, *3*(4), 506–516. https://doi.org/10.3945/an.112.002154.

Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: the food choice questionnaire. *Appetite*, *25*(3), 267–284. http://doi.org/10.1006/appe.1995.0061.

Stevens, D. A., & Lawless, H. T. (1981). Age-related changes in flavor perception. *Appetite*, *2*(2), 127–136. http://doi.org/10.1016/S0195-6663(81)80006-2.

Stratton, L. M., Vella, M. N., Sheeshka, J., & Duncan, A. M. (2015). Food neophobia is related to factors associated with functional food consumption in older adults. *Food Quality and Preference*, *41*, 133–140. http://doi.org/10.1016/j.foodqual.2014.11.008.

Stroebele-Benschop, N., Depa, J., de Castro, J.M. (2016). Environmental strategies to promote food intake in older peoples: A Narrative Review. *Journal of Nutrition in Gerontology and Geriatrics*, *35*(2), 95-112. https://doi.org/10.1080/21551197.2016.1173614.

Sun, G. W., Shook, T. L., & Kay, G. L. (1996). Inappropriate use of bivariable analysis to screen risk factors for use in multivariable analysis. *Journal of clinical epidemiology*, *49*(8), 907-916.

Takahashi, K., Kamada, C., Yoshimura, H., Okumura, R., Iimuro, S., Ohashi, Y., … Ito, H. (2012). Effects of total and green vegetable intakes on glycated hemoglobin A1c and triglycerides in elderly patients with type 2 diabetes mellitus: The Japanese Elderly Intervention Trial. Geriatrics and Gerontology International, 12(1), 50–58. http://doi.org/10.1111/j.1447-0594.2011.00812.x.

Thaler, R., & Sunstein, C. (2008). Nudge: Improving decisions about health, wealth and happiness. New Haven: Yale University Press.

Thorndike, A. N., Riis, J., Sonnenberg, L. M., & Levy, D. E. (2014). Traffic-light labels and choice architecture: Promoting healthy food choices. *American Journal of Preventive Medicine*, *46*(2), 143–149. http://doi.org/10.1016/j.amepre.2013.10.002.

Trichopoulou, A., Bamia, C., Norat, T., Overvad, K., Schmidt, E. B., Tjønneland, A., … Trichopoulos, D. (2007). Modified Mediterranean diet and survival after myocardial infarction: The EPIC-Elderly study. *European Journal of Epidemiology*, *22*(12), 871–881. http://doi.org/10.1007/s10654-007-9190-6.

Trichopoulou, A., Costacou, T., Bamia, C., & Trichopoulos, D. (2003). Adherence to a Mediterranean diet and survival

in a Greek population. *New England Journal of Medicine*, *348*(26), 2599–2608. http://doi.org/10.1056/NEJMoa025039.

Trichopoulou, A., Kyrozis, A., Rossi, M., Katsoulis, M., Trichopoulos, D., La Vecchia, C., & Lagiou, P. (2015). Mediterranean diet and cognitive decline over time in an elderly Mediterranean population. *European Journal of Nutrition*, *54*(8), 1311–1321. http://doi.org/10.1007/s00394-014-0811-z.

Trichopoulou, A., Orfanos, P., Norat, T., Bueno-de-Mesquita, B., Ocké, M. C., Peeters, P. H. M., … Trichopoulos, D. (2005). Modified Mediterranean diet and survival: EPIC-elderly prospective cohort study. *BMJ (Clinical Research Ed.)*, *330*(7498), 991. http://doi.org/10.1136/bmj.38415.644155.8F.

Volkert, D. (2002). Malnutrition in the elderly — prevalence, causes and corrective strategies. *Clinical Nutrition*, *21*(1), 110–112. http://doi.org/10.1016/S0261-5614(02)80014-0.

Wansink, B., & Sobal, J. (2007). Mindless eating : The 200 daily food decisions we overlook. Environment and Behavior, 39(1), 106–123. http://doi.org/10.1177/0013916506295573.

Woodside, J. V., Young, I. S., & McKinley, M. C. (2013). Fruits and vegetables: measuring intake and encouraging increased consumption. *Proceedings of the Nutrition Society*, *72*(2), 236–245. http://doi.org/10.1017/S0029665112003059.

World Health Organisation. Global health and ageing. (2017). https://www.nia.nih.gov/sites/default/files/2017-06/global_health_aging.pdf Accessed 31 August 2017.

World Health Organisation. World report on ageing and health. (2011). http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811_eng.pdf Accessed 20 August 2017.

Worsley, A., Wang, W. C., & Farragher, T. (2016). The associations of vegetable consumption with food mavenism, personal values, food knowledge and demographic factors. *Appetite*, *97*, 29–36. http://doi.org/10.1016/j.appet.2015.11.005.

Zhou, X., Perez-Cueto, F., Santos, Q., Monteleone, E., Giboreau, A., Appleton, K., … Hartwell, H. (2018). A Systematic Review of Behavioural Interventions Promoting Healthy Eating among Older People. *Nutrients*, *10*(2), 128. http://doi.org/10.3390/nu10020128.

APPENDIX A. Questionnaire 1

ID Number: _____

We are very pleased to welcome you to our study!

Before choosing your meal, please answer these few questions:

You are: ( ) Male ( ) Female

Do you consider yourself to be a vegetarian/vegan? ( ) No ( ) Yes _____

Could you tell us, how hungry do you feel now? (Please, circulate a number)

Please, do not hesitate in contacting us if you have any question.

APPENDIX B. Questionnaire 2

ID Number:

This questionnaire is designed to know a little about your personal characteristics. Please take a few minutes to answer the following questions. Do not hesitate in contacting us if you have any questions.

1. Which main dish did you choose?

( ) Meat balls ( ) Veggie balls ( ) Fish cakes

2. How much did you like the dish?

3. How often do you usually eat out each week?

( ) Never

( ) Once a week or less

( ) 2 days a week

( ) 3-4 days a week

( ) Everyday

4. Choose according your food habits:

In my house olive oil is used for cooking	( ) Yes	( ) No
I consume more than 2 tablespoons of olive oil per day (for cooking + addition in salads)	( ) Yes	( ) No
I eat 2 or more cups of vegetables per day (including raw vegetables)	( ) Yes	( ) No
I eat 3 or more fruits per day (including fresh juices)	( ) Yes	( ) No
I eat 1 or more pieces of red meat (including sausages) per day	( ) Yes	( ) No
I eat 2 or more teaspoons of butter per day	( ) Yes	( ) No
I drink less than 1 glass of soft drinks per day	( ) Yes	( ) No
I eat more than 3 cups of pulses per week	( ) Yes	( ) No
I eat fish 3 or more times per week	( ) Yes	( ) No
I eat sweets, confectionery and candies less than 3 times a week	( ) Yes	( ) No
I eat dried fruits one or more times per week	( ) Yes	( ) No
I prefer eating chicken than beef or sausages	( ) Yes	( ) No
I eat pasta, rice and other cereals 2 or more times per week	( ) Yes	( ) No

5. Could you indicate what occasions you usually consume this type of food in?

	Any day	Weekend or Special occasions	Alone	With family or friends	At home	Outside home
Milk and dairy products	( )	( )	( )	( )	( )	( )
Meat (beef, pork, lamb, chicken)	( )	( )	( )	( )	( )	( )
Processed meat (sausages, bacon)	( )	( )	( )	( )	( )	( )
Fish and seafood	( )	( )	( )	( )	( )	( )
Vegetables	( )	( )	( )	( )	( )	( )
Fruits and fresh juices	( )	( )	( )	( )	( )	( )
Bread or cereals	( )	( )	( )	( )	( )	( )
Potatoes, rice and pasta	( )	( )	( )	( )	( )	( )
Sweets, snacks, confectionary	( )	( )	( )	( )	( )	( )
Soft drinks	( )	( )	( )	( )	( )	( )
Peanuts and other nuts	( )	( )	( )	( )	( )	( )

6. Please, could you indicate the level of importance you assign to each of these food characteristics?

It is important to me that the food I eat on a typical day:	**Not at all important 1**	**A little important 2**	**Moderately important 3**	**Very important 4**
1. Tastes good	( )	( )	( )	( )
2. Is nutritious	( )	( )	( )	( )
3. Takes no time to prepare	( )	( )	( )	( )
4. Contains natural ingredients	( )	( )	( )	( )
5. Smells nice	( )	( )	( )	( )
6. Is low in calories	( )	( )	( )	( )
7. Is familiar	( )	( )	( )	( )
8. Is easy to prepare	( )	( )	( )	( )
9. Contains no additives	( )	( )	( )	( )
10. Is not expensive	( )	( )	( )	( )
11. Helps me control my weight	( )	( )	( )	( )
12. Helps me relax	( )	( )	( )	( )
13. Is high in fibre and roughage	( )	( )	( )	( )
14. Contains no artificial ingredients	( )	( )	( )	( )
15. Makes me feel good	( )	( )	( )	( )
16. Can be cooked very simply	( )	( )	( )	( )
17. Is like the food I ate when I was a child	( )	( )	( )	( )
18. Keeps me healthy	( )	( )	( )	( )
19. Cheers me up	( )	( )	( )	( )
20. Helps me to cope with life	( )	( )	( )	( )
21. Is low in fat	( )	( )	( )	( )
22. Contains a lot of vitamins and minerals	( )	( )	( )	( )
23. Is cheap	( )	( )	( )	( )

24. Has a pleasant texture	( )	( )	( )	( )

7. Here we briefly describe some people. Please read each description and think about how much each person is or is not like you. Tick the boxes that show how much the person in the description is like you.

	How much is this person like you?					
	Very much like me	Like me	Some-what like me	A little like me	Not like me	Not like me at all
	1	**2**	**3**	**4**	**5**	**6**
1. Thinking up new ideas and being creative is important to him/her. He/she likes to do things in her own original way	( )	( )	( )	( )	( )	( )
2. It is important to him/her to be rich. He/she wants to have a lot of money and expensive things	( )	( )	( )	( )	( )	( )
3. He/she thinks it is important that every person in the world be treated equally. He/she believes everyone should have equal opportunities in life	( )	( )	( )	( )	( )	( )
4. It's very important to him/her to show his/her abilities. He/she wants people to admire what he/she does	( )	( )	( )	( )	( )	( )
5. It is important to him/her to live in secure surroundings. He/she avoids anything that might endanger his/her safety	( )	( )	( )	( )	( )	( )
6. He/she likes surprises and is always looking for new things to do. He/she thinks it's important to do lots of different things in life	( )	( )	( )	( )	( )	( )
7. He/she believes that people should do what they're told. He/she thinks people should follow rules at all times, even when no-one is watching	( )	( )	( )	( )	( )	( )
8. It is important to him/her to listen to people who are different from him/her. Even when he/she disagrees with them, he/she still wants to understand them	( )	( )	( )	( )	( )	( )
9. It is important to him/her to be humble and modest. He/she tries not to draw attention to herself	( )	( )	( )	( )	( )	( )
10. Having a good time is important to him/her. He/she likes to "spoil" him/herself	( )	( )	( )	( )	( )	( )
11. It is important to him/her to make his/her own decisions about what he/she does. He/she likes to be free and not depend on others	( )	( )	( )	( )	( )	( )
12. It's very important to him/her to help the people around him/her. He/she wants to care for their well-being	( )	( )	( )	( )	( )	( )
13. Being very successful is important to him/her. He/she hopes people will recognize his/her achievements	( )	( )	( )	( )	( )	( )
14. It is important to him/her that the government insure his/her safety against all threats. He/she wants the state to be strong so it can defend its citizens	( )	( )	( )	( )	( )	( )
15. He/she looks for adventures and likes to take risks. He/she	( )	( )	( )	( )	( )	( )

wants to have an exciting life						
16. It is important to him/her always to behave properly. He/she wants to avoid doing anything people would say is wrong	( )	( )	( )	( )	( )	( )
17. 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	( )	( )	( )	( )	( )	( )
18. It is important to him/her to be loyal to his/her friends. He/she wants to devote herself to people close to him/her	( )	( )	( )	( )	( )	( )
19. He/she strongly believes that people should care for nature. Looking after the environment is important to him/her	( )	( )	( )	( )	( )	( )
20. Tradition is important to him/her. He/she tries to follow the customs handed down by his/her religion or his/her family	( )	( )	( )	( )	( )	( )
21. He/she seeks every chance he/she can to have fun. It is important to him/her to do things that give him/her pleasure	( )	( )	( )	( )	( )	( )

8. How much do you agree or disagree with the following statements about trying new or different foods?

	Disagree strongly						**Agree strongly**
	1	**2**	**3**	**4**	**5**	**6**	**7**
I am constantly sampling new and different foods	( )	( )	( )	( )	( )	( )	( )
I don't trust new foods	( )	( )	( )	( )	( )	( )	( )
If I don't know what is in a food, I won't try it	( )	( )	( )	( )	( )	( )	( )
I like foods from different countries	( )	( )	( )	( )	( )	( )	( )
Ethnic food looks too weird to eat	( )	( )	( )	( )	( )	( )	( )
At dinner parties, I will try a new food	( )	( )	( )	( )	( )	( )	( )
I am afraid to eat things I have never had before	( )	( )	( )	( )	( )	( )	( )
I am very particular about the foods I will eat	( )	( )	( )	( )	( )	( )	( )
I will eat almost anything	( )	( )	( )	( )	( )	( )	( )
I like to try new ethnic restaurants	( )	( )	( )	( )	( )	( )	( )

9. How much do you agree or disagree with the following statements about your buffet habits?

	Disagree strongly				**Agree strongly**
	1	**2**	**3**	**4**	**5**
View the entire selection before selecting what to take on their plate	( )	( )	( )	( )	( )
Follow the line and decide what to take as the dishes are presented	( )	( )	( )	( )	( )

Take vegetables or salad and then the other dishes	( )	( )	( )	( )	( )
Take meat and then the other dishes	( )	( )	( )	( )	( )
Take pasta, rice, and potatoes first and then the other dishes	( )	( )	( )	( )	( )

10. How much do you agree or disagree with the following statements about your habits?

	Disagree strongly				**Agree strongly**
	1	**2**	**3**	**4**	**5**
Think I am healthier compared to others with my age	( )	( )	( )	( )	( )
Eat healthier than others their age	( )	( )	( )	( )	( )
Would like to lose weight	( )	( )	( )	( )	( )
Eat more vegetables than most people at my age	( )	( )	( )	( )	( )
My friends eat vegetables every day	( )	( )	( )	( )	( )
My parents used to eat vegetables every day	( )	( )	( )	( )	( )
My parents used to encourage me to eat vegetables every day	( )	( )	( )	( )	( )

11. How much do you agree or disagree with the following statements about you?

	Not at all true 1	**Hardly true 2**	**Moderately true 3**	**Exactly true 4**
I can always manage to solve difficult problems if I try hard enough	( )	( )	( )	( )
If someone opposes me, I can find the means and ways to get what I want	( )	( )	( )	( )
It is easy for me to stick to my aims and accomplish my goals.	( )	( )	( )	( )
I am confident that I could deal efficiently with unexpected events	( )	( )	( )	( )
Thanks to my resourcefulness, I know how to handle unforeseen situations	( )	( )	( )	( )
I can solve most problems if I invest the necessary effort	( )	( )	( )	( )
I can remain calm when facing difficulties because I can rely on my coping abilities	( )	( )	( )	( )
When I am confronted with a problem, I can usually find several solutions	( )	( )	( )	( )
If I am in trouble, I can usually think of a solution	( )	( )	( )	( )

I can usually handle whatever comes my way	( )	( )	( )	( )

12. How much do you agree or disagree with the following statements:

	Disagree strongly 1	**2**	**3**	**4**	**Agree strongly 5**
I think it would be acceptable if foodservice providers used celebrities to inform me about health related to eating vegetables	( )	( )	( )	( )	( )
I think it would be acceptable if foodservice providers held a competition where the winner would be the one with the largest vegetable intake in 1 week	( )	( )	( )	( )	( )
I think it would be acceptable if foodservice providers made scare campaigns to get me to eat more vegetables, e.g., by showing examples of diseases caused by low vegetable intake	( )	( )	( )	( )	( )
I think it would be acceptable if foodservice providers informed me about how many vegetables I eat compared to other customers.	( )	( )	( )	( )	( )
I think it would be acceptable if foodservice providers automatically gave me a green salad with my lunch in order to get me to eat more vegetables if I easily could choose not to take it	( )	( )	( )	( )	( )
I think it would be acceptable if foodservice providers had posters with simple and easy tips on how I could eat more vegetables to get me to eat healthier	( )	( )	( )	( )	( )
I think it would be acceptable if the staff in foodservice providers asked me if I wanted more vegetables when buying my lunch	( )	( )	( )	( )	( )
I think it would be acceptable to change the names of the dishes in restaurants so the dishes containing many vegetables would sound more appealing and make me want to choose them	( )	( )	( )	( )	( )
I think it is acceptable if foodservice providers encouraged me to sign up for a "6 a day" or "I love vegetables" club to make me feel encouraged to eat more vegetables	( )	( )	( )	( )	( )
I think it would be acceptable if foodservice providers had posters showing happy seniors eating vegetables and a lonely and sad senior eating unhealthy food to make me feel like eating more vegetables	( )	( )	( )	( )	( )