Nudging using the "dish of the day" strategy does not work for plant based meals in a Danish adolescent and elderly sample

ABSTRACT:

BACKGROUND: An adequate nutrition is an important factor for health and well-being in adolescents and in older age. Fruits and vegetables are part of a healthy diet as important source of nutrients, but their intakes are lower than the recommendations in the European countries.

OBJECTIVE: to compare the choice made by adolescents and elderly people between three similar dishes, one based on meat, one on fish and one on vegetables, in two different conditions: a neutral (control) situation and an intervention situation in which the vegetable-based meal was designated "dish of the day".

METHODS: A quasi-randomised field trial design was used with a sample of 94 Danish adolescents (aged 13-17 years) and 97 Danish elderly people (aged ≥65 years), who were randomly allocated to intervention or control groups. In the control situation participants were asked to choose between three similar meals, one meat, one fish and one the VeggiEat dish. In the intervention, the VeggiEat dish was labelled the "Dish of the day". All dishes were provided free of charge, displayed side by side in the same order, and served in same portions.

RESULTS: The dish choices showed no differences between the control and intervention groups in both age groups, and no differences were found among the other variables analysed.

CONCLUSIONS: This nudging strategy, "dish of the day", seems not to work for Danish adolescents and elderly population. Future nudging studies with these populations are needed in order to find the best strategy to move adolescents and elderly food habits towards a healthier pattern.

Keywords: Nudging. Adolescents. Elderly. Dish of the day. Vegetables consumption.

INTRODUCTION

An increase in unhealthy dietary habits, namely higher energy intake than needed and poor diet quality (as a low adherence to Mediterranean Diet)(Mesas et al., 2012) leads to a worldwide high prevalence of overweight or obesity and chronic diseases associated, such as heart

disease, stroke and diabetes (Barnett, 2017). An unhealthy diet is characterized by minimal intake of fruits and vegetables, excessive intake of processed foods, and of foods with higher content in saturated fat, salt and sugar(World Health Organization, 2003).

The recommended intake of fruits and vegetables varies between the countries. Generally, the countries follow World Health Organization recommendations (WHO, 2008), which is ≥400 g of fruits and vegetables per day. In Denmark, this recommendation is even higher (≥600 g per day) (Danish Food Administration, 1998). Despite all the available recommendations and guidelines towards healthier diet in Denmark (Nordic Nutrition Recommendations, 2014) and elsewhere in Europe, actual consumption of foods of plant origin remains a concern. Moreover, thanks to the investment in public information campaigns, most Europeans are aware of healthy eating recommendations, show positive attitudes towards healthy eating, yet they are still lagging behind in actual consumption (Perez-Cueto et al., 2012).

Data from European Food Safety Authority (European Food Safety Authority, 2008), shows that the mean vegetable intake in Europe is 220 g per day and the mean intake of both fruits and vegetables is 386g per day, which are still lower than the recommendations. The mean intake of fruits and vegetables in Europe ranges from 577g (Poland) to 196g (Iceland), being higher in the South than in the North (European Food Safety Authority, 2008). In Denmark, the mean intake of fruits and vegetables is 315g per day, reaching around 52% of the recommendations for this country (European Food Safety Authority, 2008).

The inadequate intake of fruits and vegetables is a matter of concern since around 5% of the overall burden of disease in European region could be attributed to low fruit and vegetable intake (Pomerleau, 2003). Adolescence is an important period where dietary habits consolidate, and they tend to track into adulthood (Mikkilä et al., 2005). For elderly, nutritional deficiencies are more common than at other periods in life (de Groot et al., 2004). Micronutrient deficiencies (vitamin B2, vitamin D, vitamin E, folic acid, potassium, magnesium and selenium) among elderly in Denmark and other Nordic countries have been reported (Mensink et al., 2013; Engelheart &Akner, 2015).

Thus, strategies to improve fruit and vegetables intake are crucial. In the last years, studies have been exploring complementary strategies including how to alter environments in order to change food behaviours (Hanks et al., 2012; Levy et al., 2014; van Kleef et al., 2012, Bucher et al., 2016). Behavioural laboratory findings suggest that placement of foods of plant origin at the beginning of a buffet sequence (Kongsbak et al., 2016; Friis et al., 2017) or the provision of pre-

weighed portions positively influence consumers towards the choice and consumption of vegetables (Friis et al., 2017). Moreover, epidemiological data suggests that small changes towards healthier dietary habits, even if they happen later in life, will have positive and desirable health effects (Jankovic et al., 2014; Crous-Bou et al., 2014; Trichopoulou et al., 2003). Therefore, nudging has been suggested as a complementary tool towards the achievement of public health nutrition goals (Perez-Cueto et al, 2015). Nudging is a tool that aims to change people's behaviour in a predictable way without forbidding any options and keeping neutral their economic incentives (Thaler & Sustein, 2008). Evidence indicates that eating is largely an automatic behavior governed by environmental cues, suggesting that it might be possible to nudge healthier dietary behaviors (Olstad et al., 2014).

There are many nudging approaches in foodservice (Kraak et al, 2017). One of them is called the "healthy default picks". These defaults are automatic choices that the foodservice operators may want to use in order to make the healthy options more frequently, and therefore contribute to consumers meeting their dietary targets or recommendations. Such interventions are acceptable for children, adolescents (Nørnberg et al., 2016) and parents, but no information is available regarding the senior consumer (Kraak et al., 2017). In addition, in a previous study (Nørnberg et al., 2016), adolescents reported that they would accept the default strategy, but this has not been tested in relation to a pre-set option, such as type of food that in restaurants and cafeterias is generally represented by "the dish of the day" (Hinton et al., 2013). An online survey using "the dish of the day" approach showed that the default option is the most chosen in some occasions, for example, when the participants feel hungry (Giensen et al., 2013).

The aim of this study is to compare the choice by adolescents and elderly people between three similar dishes, two meat-based and one vegetable-based in two comparable choice situations: an intervention situation, where the vegetable-based meal was designated "dish of the day" and a control situation where no special designation was used.

Methods

This study is part of VeggiEAT, an European project (Denmark, France, Italy and United Kingdom) that aims to develop a platform for predictive modelling of processed vegetable

intake taking into account individual characteristics (acceptability, intake level, age groups) as well as environmental cues (choice architecture and institutional setting) and thus increase vegetable consumption in adolescents and elderly citizens. (VeggiEAT, 2017). This aim will be achieved through the development of consumer-oriented products (sensory evaluations); the development of recipes for use by institutional food providers (restaurants, canteens, etc.) and the benchmarking of choice architecture facilitating the consumption of vegetables.

In order to increase the consumption of vegetables by adolescents and elderly people, a VeggiEAT dish was designed at Institut Paul Bocuse, France, incorporating peas and sweet corn. The development of this dish was based on the sensory determinants of stated liking and actual liking of those vegetables, aiming to produce a tasty dish for the target populations. In this study, the VeggiEAT dish will be tested using the 'dish of the day` as a nudging strategy as a tentative to promote its consumption by adolescents and elderly consumers.

Study Design

This study was a quasi-randomised field trial design with random allocation to the intervention or the control situations. It was conducted in a sample of Danish adolescents (aged 13-17 years-old) and Danish elderly people (aged 65 years-old or more).

For adolescents' recruitment, an email to all schools with students from 13 to 17 years old in Copenhagen area was sent, explaining about VeggiEAT Project and inviting them to participate in the study. Three schools agreed in participating in VeggiEAT study: Copenhagen International School (CIS), Ørestad Gymnasium and Trekronergade Freinetskole. For Copenhagen International School, the study took place at the school cafeteria. For the other two schools, food was prepared at the Gastronomy laboratory and served at sensory evaluation room, at University of Copenhagen.

The senior citizens were recruited from three different elderly centres in Denmark (Aktivitetscenter Nødager, located in Lejre Commune; Aktivitets- og Frivilligcenter in Solrød Commune and Seniorhuset Korsagergård in Vallensbæk Commune) and some elderly from the food panel of Copenhagen University also participated in the study.

The study took place at the elderly centres and at University of Copenhagen (for the members of the university food panel).

Sample size Calculation

The Sample size was calculated based on the pilot test conducted in Institute Paul Bocuse (IPB) in November 2015 (Lwanga & Lemeshow, 1991). A minimum of 88 individuals (44 individuals for the control and 44 for the intervention), was needed, based on 80% power and a significance level of 95%.

For adolescents, individuals from Copenhagen International School formed the intervention group (n=45) and the ones from Ørestad Gymnasium and Trekronergade Freinetskole formed the control group (n=49).

For elderly, individuals from Vallensbæk Commune formed the intervention group (n=49) and those from Lejre, Solrød and food panel constituted the control group (n=48).

Data Collection

Four data collection occurred from February to May 2017, during lunchtime. The experiment was held at the elderly centres, at Copenhagen International School and at University of Copenhagen (for the two remaining schools and for the members of university food panel). Food was prepared by a cooking team in the elderly centres and served in their lunch area. For the data collection at Copenhagen University, food was prepared at University's Gastronomy Laboratory and served in the sensory evaluation room.

At the beginning of the exercise, each participant was assigned a randomly generated identification number, and asked to sign a consent form. Participants were also asked to complete two questionnaires, 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). Participants then chose between three similar meals, one of them the VeggiEat dish. In the intervention situation, the VeggiEat dish was termed the "dish of the day"; in the control situation it was not. In both situations the VeggiEat dish was displayed between the two alternative dishes.

The VeggiEAT dish consisted of vegetable "polpettes" (balls) incorporating peas and sweet corn, developed at Institut Paul Bocuse, France, in a previous stage of the Project (ref). The development of this dish was based on the sensory determinants of stated liking and actual liking of canned vegetables peas and sweet corn. 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.

Plates were weighed before and after the meal, so that food intake and waste could be measured. Data from the questionnaires were entered to computers using a standardised coding procedure and were analysed using SAS 9.4 using chi-square and Fisher tests to identify differences in dish choice, plate waste etc. between the intervention and control groups.

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.

Definition of the variables

Adherence to Mediterranean Diet

Mediterranean Diet Adherence was assessed using the 14-point Mediterranean Diet Adherence Screener (MEDAS) (Martínez-González et al., 2012) which comprises 12 questions on food consumption frequency and two about food intake habits considered characteristic of the Mediterranean diet. Each question was scored 0 or 1 and in this study, final Mediterranean adherence scores ranged from 0-14. This variable was dichotomized into two categories; final score equal or less than 7 = low adherence to Mediterranean Diet; final score ranging from 8 to 14 = high adherence to Mediterranean Diet.

Hunger scale

Hunger was self-rated by the participants prior to the meal, using the 10-point hunger scale (Ominchanski, 1992), which varies from 1 to 10 (1 being extremely hungry and 10 being extremely full). This variable was dichotomized into two categories; score ≤ 4 = a little hungry; score ≥ 5 = very hungry.

Liking of the Dish

This liking of the dish was evaluated using a 5-point Likert scale (1 being "don't like it at all" and 5 being "like it very much"). This variable was dichotomized into two categories: final score ≤ 3 indicates low liking and final score ≥ 5 = high liking.

Frequency of eating out

This variable was measured through the question: "How often do you eat out each week?" with five options: 1-never; 2-once a week or less; 3-two days a week; 4-3-4 days a week; and 5-every day. Responses were dichotomized into two options: rarely (1, 2 or 3) or frequently (4 or 5).

Food Neophobia

Food neophobia was evaluated using the Food Neophobia scale (Pliner & Hobden, 1992). This is a 10-point scale in which a high mean score, calculated by summing individual item scores measured on a 7-point Likert scale (ranging from strongly disagree to strongly agree), represents high food neophobia, while a low score represents low food neophobia. This variable was dichotomized into two categories: final score ≤ 35 = low food neophobia; final score > 35 = high food neophobia.

Attitudes towards Nudging

This was evaluated by asking about ten hypothetical scenarios so the respondents could relate to the concept of food choice behaviour change interventions (Dolan et al., 2012). The mean score of the scale was calculated by summing the individual item scores measured on a 5-point Likert scale (ranging from strongly disagree to strongly agree). For the analyses, the answers were dichotomized into two options: final score ≤ 25 = less positive attitudes towards nudging; final score > 25 = more positive attitudes towards nudging.

Statistical Analyses

Data were analysed in SAS 9.4 using chi-square and Fisher tests, as appropriate, to identify differences between the intervention and control groups in terms of these variables.

Results

Sample characterization is found in Table 1 and 2, which shows that the test groups were homogeneous for the purposes of the experiment. For adolescents, the intervention group had a higher proportion of vegetarians compared to the control group.

In general, no differences were found in terms of dish choice or the majority of the questionnaire variables (Table 3 and 4). For adolescents, the control group had higher proportion of participants that reported high liking of the dish compared to the intervention group.

Discussion

In this study, we sought to influence the choice of the dish by adolescents and elderly people in an intervention situation, where the vegetable-based dish was designated "Dish of the day", versus a control situation, where participants' attention was not drawn to it. We found no

difference in dish choice between control and intervention situation in both age groups. In addition, we found no differences in the other variables studied for elderly people (MEDAS; hunger level prior the meal; liking of the dish; frequency of eating out; food neophobia and attitudes towards nudging). For adolescents, those in the control group had a high liking of the dish.

To date there have been no studies evaluating the effectiveness of nudging strategies in changing dietary choices in elderly people. For adults, a meta-analysis has shown that nudge interventions on average cause a 15.3 % increase in healthier consumption decisions, measured either by frequency of healthy choices or by overall intake (Arno & Thomas, 2016).

This is the first study to evaluate nudging by default (using the "dish of the day" strategy) in a real-life setting, so this precludes direct comparison with previous studies. In an online survey, the default option was the most chosen in specific situations, for example, when the participants felt hungry (Giensen et al., 2013). Other studies has taken different approaches, for instance it has been shown that increasing portion size can increase the total energy consumption of the meal, or decrease energy intake if the first course dish (portion size also increased) is a low-calorie item such as a salad (Hinton et al., 2013; Rolls et al., 2004; Rolls et al., 2002).

Most of the adolescents and elderly people in our sample showed high food neophobia, which could be one of the reasons why the intervention did not produce the expected result. The "vegetarian balls" would have been a novel dish compared with the meat and fish alternatives that they already knew. Familiarity seemed to have an important role for the choice of the alternative dishes. Some studies found that neophobia is higher in childhood (Adessi et al., 2005; Cooke, Wardle, & Gibson, 2003), tends to decrease until early adulthood (Koivisto-Hursti & Sjoden, 1996; Rigal et al., 2006) while other have found that it increases with age (Dovey et al., 2008; Henriques et al., 2009; Meiselman et al., 2010). In addition, most of the individuals in our sample rarely ate out, which may have made them less prone to try new dishes, contributing to high food neophobia, since there is a link between food neophobia and number of novel foods sampled (Koivisto & Sjöden, 1996; Koivisto & Sjöden, 1997; Raudenbush et al.,1998).

On the other hand, participants in this study (except adolescents in the intervention group) tended to show a positive attitude towards nudging, i.e. they were broadly in favour of using a targeted campaign to promote healthy eating. However, using such initiatives does not necessarily mean that people will change their food habits. The adolescents in the intervention group showed a less positive attitude towards nudging, indicating that probably they are not very prone to be nudged

or that nudging strategies in this group are less likely to work, which may have contributed to the failure of the strategy in this group.

Food choice and the amount eaten have a strong effect on the decisions of people sharing the same social context (ref social norms). Both adolescents and elderly people during this food experience sat together (around four people per table). Thus the choice and/or the amount of food consumed by one person could have influenced the others, especially for the adolescents, once during this period of the life they need to feel approved and liked by their friends (ref social norms). They also answered the questionnaires while they were sharing the table with friends, which can also have influenced their answers.

In relation to the adherence to Mediterranean diet, it was expected a low adherence to this dietary pattern, once Denmark is located outside the Mediterranean area. As Mediterranean diet is a dietary pattern rich in plant-based foods (cereals, fruits, vegetables, legumes, nuts, seeds and olives), and low in meat-based dishes, it is expected that a population with a low adherence to this diet would choose more meat-based dishes instead the vegetarian ones. Denmark is the 12th country that most consumed meat, reaching 95.2 kilos of meat per capita/year (Food and Agriculture Organization, 2013). In 2002, Denmark occupied the first position in this rank, with 145.9 kilos of meat per capita/year (Food and Agriculture Organization, 2013).

Older people are the population segment most closely linked to the traditions in general. Older Danes grew up either during the Second World War or immediately after. In those days, the meaning of plant-based foods was associated with poverty and restriction, while animal-based foods were perceived more as associated to wealth and financial well-being. In relation to food habits, one of the most traditional foods in Denmark are open sandwiches, that consists of a single slice of rye bread, spread with butter and with different fillings, highlighting herring, smoked fish or meat as the most popular ones (Hjalager & Corigliano, 2000). The consumption of vegetable is not part of eating habits for the majority of Danish elderly citizens, once recent survey found that only 16% of them eat salads or raw vegetables every day (Kjøller, Davidsen & Juel, 2010).

As limitations for this study, although the sample size was adequate for our study according to sample size calculations, maybe a larger sample would allow us to find different associations. Despite the data have been collected in different places (at the school cafeteria, at the elderly centers and at Copenhagen University), the Project team made an effort to keep everything as homogenous as possible. Finally, as the questionnaires were self-administered, the participants could have under or overestimated their answers (for example, frequencies and quantities).

In conclusion, it was observed that this nudging strategy, "dish of the day" (nudging by default), seems not to work for both Danish adolescents and elderly population, under the study conditions. Future nudging studies with this population are needed in order to find the best strategy to move elderly food habits towards a healthier pattern.

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Table 1: Characteristics of adolescents' participants by group

	Total (n=97)	Control (n=48)	Intervention (n=49)
Sex (% female)	48.8	61.0	46.0
Age (years)			
Mean (SD)	14.8 (0.85)	14.8 (0.83)	14.9 (0.87)
Range	13-17	14-17	13-17
People who declared to be Vegetarian (%)	9.6	2.0	7.0

Table 2: Characteristics of elderly participants by group

	Total (n=97)	Control (n=48)	Intervention (n=49)
Sex (% female)	67.0	65.0	69.0
Age (years)			
Mean (SD)	73.9 (6.4)	73.2(6.8)	74.7 (6.0)
Range	65-89	65-87	65-89
People who declared to be Vegetarian (%)	1.3	2.1	0
Self-rated health			
Very good	37	15	22
Good	42	23	19
Fair	17	11	6
Bad	1	0	1

Table 3: Proportional comparison with (%) of variables in adolescents between intervention and control groups.

	Intervention (n=45)	Control (n=49)	P value
Choice of the dish			
Meatballs	30 (67.0)	33 (67.4)	
Veggieballs	11 (24.0)	10 (20.4)	0.81
Fishballs	4 (9.0)	6 (12.2)	
Gender			
Male	17 (38.0)	26 (53.0)	0.30
Female	28 (62.0)	23 (57.0)	
Adherence to MD			
Low adherence	29 (64.0)	33 (67.0)	0.76
High adherence	16 (36.0)	16 (36.0)	
Hunger			
Little hungry	37 (76.0)	38 (78.0)	0.81
Very hungry	11 (24.0)	11 (22.0)	
Liking of the dish			
Low liking	27 (60.0)	19 (39.0)	
High liking	18 (40.0)	30 (61.0)	**0.03**
Frequency of eating out*			
Rarely	44 (98.0)	42 (86.0)	
Frequently	1 (2.0)	7 (14.0)	0.06
Food Neophobia			
Low food neophobia	7 (16.0)	5 (10.0)	0.43
High food neophobia	38 (84.0)	44 (90.0)	
Attitudes toward Nudging			
Less positive atittude	24 (53.0)	17 (35.0)	0.08
More positive attitude	21 (47.0)	31 (65.0)	

* Fisher Test because 50% of the cells have expected counts less than 5.

Table 4: Proportional comparison with (%) of variables in elderly between intervention and control groups.

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

* Fisher Test because 50% of the cells have expected counts less than 5.