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Increasing fruit and vegetable intake among male university students in an *ad libitum* buffet setting: A choice architectural nudge intervention

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ABSTRACT

Insufficient consumption of fruit and vegetables (F&V) is associated with an increased risk of non-communicable diseases in the population. Several studies show a potential effect of promoting healthy eating by reorganizing the physical environment. However the evidence of the effect is ambiguous due to the complexity of determinants for food choices and more research is therefore needed. This study assessed the of a choice architectural intervention aimed at reducing energy density of meals consumed by male university students, by proportionally increasing their vegetable consumption.

A single one-day lunch meal study was conducted in a FoodScape Laboratory where an Intelligent Buffet was used to register the exact weight of each meal component self-served by each participant. A convenience sample of 65 men was divided to a control group ($n = 32$) and an intervention group ($n = 33$). The choice architecture in the intervention group consisted of altering the serving sequence and serving the F&V components in eight separate bowls. The self-served quantity (g) of meal components was measured using state-of-the-art equipment. Additionally a two-part questionnaire was used to obtain individual background information.

The quantity (g) of self-served F&V was significantly higher in the intervention group (+63.3 g, $p = .005$). The total energy (kJ) was significantly lower in the intervention group (−1326.3 kJ, $p = .010$), while there was no significant difference in the total amount (g) of self-served food between the two groups (−50.4 g $p = .326$). This emphasizes that the relative proportion of F&V/non-F&V changes as a result of the intervention.

This study found convincing evidence for combining order of placement in a buffet and separating the fruits and vegetables, as a means to increase the quantity of self-served fruit and vegetables and decrease consumption of other meal components among male university students. Such simple choice architecture interventions could be used as a supplement to already existing strategies in the promotion of healthy eating.

1. Introduction

Low intake of fruit and vegetables (F&V) in the population has a negative impact on public health and it is estimated that the total worldwide mortality due to inadequate F&V consumption was approximately 2.6 million in 2000 (Lock, Pomerleau, Causer, Altmann, & Mckee, 2005). High consumption of F&V is found to have a protective effect on lifestyle related diseases such as cardiovascular disease, metabolic syndrome, high blood pressure (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014; Tetens et al., 2013; Van Duyn & Pivonka, 2000) as well as numerous cancers (World Cancer Research Fund., 2007).

A Danish national dietary intake study shows that Danish men on average consume 376 g of F&V a day, which is insufficient according to the national recommendations (Tetens et al., 2013). Adherence to healthy eating recommendations has a strong gender component, where women are more likely to comply than men (Wardle et al., 2004). Studies show that men do not eat vegetables in order to lose weight, in opposition to women. Instead, men exercise to stay slim and healthy (Baker & Wardle, 2003), which is problematic as vegetables have a greater effect per portion than

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fruit in preventing i.e. colorectal cancer (Oyebode et al., 2014). Moreover, 'masculinity' is an important determinant when looking into the social aspects of men's food choices. Red meat is considered as masculine food whereas vegetables are regarded as feminine (Newcombe & Mccarthy, 2012), which yet again emphasizes the importance of a special focus on young men and their dietary choices.

Traditional health promotion, particularly the promotion of healthy eating, has been focused on providing information as a way to change health behavior at population level. Despite these efforts, actual change has been of modest magnitude (Capacci et al., 2012; Olstad, Goonewardene, McCargar, & Raine, 2014; Peersman, Harden, Oliver, Mauthner, & Oakley, 1999; Pérez-Cueto et al., 2012). One of the potential explanations is that the effect of changing people's health behavior would be larger when using combined strategies rather than solitary strategies (FCFS, 2009). In Denmark, although the recommendation on F&V consumption is the best known of the national dietary recommendations, it is at the same time the hardest one to comply with (Hansen, Aachmann, Lätheenmäki, & Grunert, 2013). Knowing that the determinants of food choices are complex and people tend to make food choice independently of their objective knowledge about healthy eating, other factors such as emotions and habits should be taken into account (Allom & Mullan, 2012).

1.1. Choice architecture

A strategy, which has recently gained recognition in health promotion and public food service, is choice architecture (CA) that influences eating behavior through environmental structures (Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012). Previous studies have showed that it is possible to make people eat healthier by rearranging the physical environment (Olstad et al., 2014). Changes in perceived variety and display are associated with a higher intake of e.g. jellybeans (Kahn & Wansink, 2004), yoghurt and other foods (Rolls et al., 1980). Placing healthy food items in front of the buffet (serving sequence) or making healthier options more accessible have likewise shown to reduce energy intake (Downs, Loewenstein, & Wisdom, 2009; Freedman & Brochado, 2010; Wansink & Just, 2011).

These studies suggest that CA used in eating environments could be an effective way to change eating behavior in a desired way. At present, there is no conclusive evidence that CA can stand alone in improving public health (Hollands et al., 2013), but short-term experimental behavioral research shows its potential in supplementing existing strategies. Recent systematic reviews highlighted the need for more high quality research within the field to clarify which choice architectural changes are effective, in which combinations and in which situations (Nørnberg, Houlby, Skov, & Pérez-Cueto, 2015; Skov, Lourenco, Hansen, Mikkelsen, & Schofield, 2013). Previous research has mostly been carried out relying on manual techniques, such as retrospective dietary registration or cash sales, introducing potential biases, such as overestimation or unnatural eating situations. The present research makes a novel contribution by using the state of the art equipment/software in living lab facilities, designed to resemble a real life student canteen. This facilitates the measuring of dietary intake accurately, maintaining a natural eating environment, while allowing for rigorous control of external factors.

The aim of this study was to assess whether a choice architectural nudge intervention in a self-serving setting had an impact on young male students' F&V consumption. This study hypothesized (H_A) that the quantity of self-served F&V components would increase as result of placing F&V in separated bowls at the beginning of a buffet.

2. Material and methods

2.1. Sample

The study was carried out in March 2014 at the FoodScape Laboratory (Aalborg University, Copenhagen). A convenience sample of 65 young voluntary men was randomly assigned to eat at different times on the same day and divided into a control group ($n = 32$, 12.30PM) and an intervention group ($n = 33$, 11.30AM). Participants ($n = 65$) were recruited from the criteria; male university students aged between 18 and 29. Recruitment was carried out through social media and by handing out flyers at Aalborg University, Copenhagen. All participants gave their informed consent prior to participation and the necessary national standards of ethical conduct within social science were followed (Danish Social Science Research Council, 2002).

2.2. Questionnaire development

The questionnaire contained questions commonly used in consumer research studies (Saba, Cupellaro, & Vassallo, 2013). The questionnaire was separated into two parts; the first part was administered prior to the meal and contained information about age, level of appetite, educational achievement and self-reported height (cm) and weight (kg). The latter were used to calculate each participant's Body Mass Index (BMI) (WHO, 2000). The second part was administered after the meal and included a number of individual questions focused on the participants' self-assessed eating habits (range from very unhealthy to very healthy), level of fullness (Likert scale 1–9), liking of the food (Likert scale 1–9) and their knowledge of the Danish Dietary Recommendations regarding F&V (Yes/No).

2.3. Equipment

The study was conducted in a FoodScape Laboratory, which is an experimental research facility implemented recently to study various aspects of food behavior (Nørnberg, Houlby, Jørgensen, He, & Pérez-Cueto, 2014). By combining observational data systems (Noldus Observer XT®) with actual food serving weight (Intelligent Buffet) it is possible to collect data without burdening the participants. The FoodScape Laboratory can be changed to resemble a cafeteria, a restaurant or any similar food-serving situation. The Intelligent Buffet appears as a regular buffet serving installation with eight serving units. It contains a hidden integrated scale and a RFID reader in front of each serving unit, which allows matching individuals with their self-served meal components (in g). Each participant is provided with a wristband containing a RFID chip that function as a tracking device. The Intelligent Buffet registers when the participant stands in front of each serving unit, linking the food choices and quantities to the ID number of the personalized wristband.

The Noldus Observer XT was used as a video recording and visual data-coding tool. All equipment was calibrated prior to the data collection. Participants were informed about the measuring equipment (cameras and Intelligent Buffet) in the FoodScape Laboratory but were blinded to the overall purpose of the study.

2.4. Study design

A pilot experiment was carried out to get an indication of the needed amount of participants. A post hoc power calculation for the present study was performed using GPOWER (Faul, Erdfelder, Lang, & Buchner, 2007). Based on the total sample size of 65, (respectively $n = 32$ in the intervention group and $n = 33$ in the