


Increasing vegetable consumption out-of-home: VeggiEAT and Veg+ projects

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Abstract

Adequate vegetable consumption is fundamental to a healthy, balanced diet; however, global compliance with recommendations to increase consumption is poor. There is a growing interest in the sustainability of current dietary patterns in light of expected climate change and an expanding global population where part of the response is increasing vegetable intake. Two international projects, *VeggiEAT* and *Veg+*, explored the determinants of vegetable liking and consumption in different age groups and countries and the effect of a nudging strategy on vegetable consumption in an out-of-home setting. The projects found that the importance given by consumers to natural or healthy ingredients, social norms, female gender and positive attitudes towards nudging all influenced vegetable consumption. Some sensory factors, such as bitterness and sourness, had a negative loading, while others, such as sweetness, had a positive effect on liking for vegetables. 'Dish of the day', as a nudging strategy in a workplace canteen setting, increased vegetable dish selection for some of the sample (adolescent females) but not for males or older people. Globally, there is a strong need to promote the consumption of vegetables as a public health issue but also to improve their availability and uptake, especially within out-of-home foodservice.

Keywords: consumer behaviour, nudging, out of home, sensory aspects, vegetable acceptability

Introduction

Population health and the state of the planet rely on a food system that respects planetary boundaries and prioritises societal health. It is easy to make an ethical and moral case for more sustainable diets given that

food lies at the intersection of some of the world's greatest environmental and societal challenges (Hughes & Hughes 2016). The Food and Agriculture Organization (FAO 2016) identifies lifestyle, symbolised by eating out, as an important aspect that must be considered for improving sustainability for all. In general, consumption of plant-based foods, even from the most inefficient agricultural practices, is less environmentally damaging than the most efficient animal-based food production (Poore & Nemecek 2018;

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Bowles *et al.* 2019; Chai *et al.* 2019). Notwithstanding, vegetables are one of the most difficult categories of food to introduce into menu planning, especially out of home, since they are not as well liked as other ingredients (Morizet 2012). Hence, the aim of the VeggiEAT and Veg+ projects was to develop an evidence base for predictive modelling of vegetable intake that takes into account individual characteristics (acceptability, intake level, age group) as well as environmental cues such as choice architecture (nudging). This paper provides an overview of background knowledge and the objectives of two related projects examining the factors associated with increased vegetable consumption. The synthesis of results from both projects provides a comprehensive summary of current knowledge on promoting out-of-home vegetable consumption.

The projects, co-ordinated by Bournemouth University, arose because the foodservice industry provides 40% of food consumed outside the home in the UK, equating to £60 billion in revenue in 2019 (Defra 2019), and unlike the food manufacturing industry has been slow to respond to the emerging agenda of health and sustainability (Hughes & Hughes 2016). The availability of a larger variety of vegetables in foodservice has been shown to positively affect consumption, while little variety has been reported as an obstacle (Ensaft *et al.* 2015). Other factors such as age and liking of vegetables also mediate the effect of offering a choice (de Wild *et al.* 2015). Previous consumer studies have given some indication of attitude to and preference for vegetable intake but there has been limited attention given to contextual factors such as sensory variation which would aid industry response (Feeney *et al.* 2014). Most research on barriers and facilitators has been conducted at the level of general vegetable consumption and not at the commodity/meal level that would acknowledge the use of vegetables as ingredients (Cox & Poelman 2015). Food consumer behaviour is highly complex with many external and internal influences on perception, attitude and action. The product attributes, the individual characteristics of the consumer and the eating environment all play a key role in food-related decisions.

The VeggiEAT and Veg+ projects aimed to increase knowledge about attitudes to vegetables specifically across the lifespan. While the health benefits of high fruit and vegetable consumption are well known and considerable work has attempted to improve intakes of both, increasing evidence also recognises a distinction between fruit and vegetables, both in their

impacts on health and in their consumption patterns (Appleton *et al.* 2016). Although research demonstrates health benefits from a high consumption specifically of vegetables, intakes remain low, and barriers to increasing this are prevalent, making intervention difficult (Rodrigues *et al.* 2019).

A systematic review of interventions aimed at increasing intake of vegetables as a distinct food group identified 77 studies, detailing 140 interventions, of which 133 (81%) were conducted in children (Appleton *et al.* 2016). They comprised interventions aiming to use or change hedonic factors, such as taste, liking and familiarity ($n = 72$), use or change environmental factors ($n = 39$), use or change cognitive factors ($n = 19$), or a combination of strategies ($n = 10$). Increased vegetable acceptance, selection and/or consumption were reported to some degree in 116 (83%) interventions, but the majority of effects were small and inconsistent in conclusion. From this systematic review, it appears that success is currently found from environmental, educational and multi-component interventions, but the authors concluded that publication bias was likely, and the long-term effects and cost-effectiveness were rarely considered. A focus on long-term benefits and sustained behaviour change is required.

The term 'vegetables' covers a heterogeneous group of foods, especially across cultures and geographical locales. For instance, legumes (dried beans and peas), which are not by botanical definition vegetables, are often included for calculating vegetable intake, although this definition is not consistent with the culinary parlance which classifies plant-based ingredients on the basis of taste (see Rodrigues *et al.* 2019 for further discussion). The FAO provides aggregated data at national level: it demonstrates that vegetable supply (excluding potatoes and pulses) in Europe has increased over the last 40 years (FAO 2020). However, in Northern Europe (*e.g.* Finland 84 kg/person/year) it is lower than in Southern Europe (Greece 150 kg/person/year). Often statistics for fruit and vegetable intake are combined, which distorts the true picture of vegetable consumption, especially for children. There is a tendency within this population to eat more fruit than vegetables, with this slowly reversing as individuals grow older (FSA 2014). It has been shown, for example, that 79% of primary schoolchildren (5-10 years old) eat less than 3.5 portions of vegetables a day rising to 96% among secondary school-aged children (11-15 years old) (Food Foundation 2020). Factors influencing vegetable intake are numerous and linked to each other in complex ways that are

not yet fully understood. Features of the physical, social and cultural environment as well as personal aspects, such as taste, preference and neophobia all play a part (Bevan *et al.* 2016). As a consequence, changing vegetable consumption patterns remains a challenge, particularly at population level.

The VeggiEAT project

(All reports and recipes available at <https://microsite.s.bournemouth.ac.uk/veggieat/>).

The main goal of the VeggiEAT project was to increase knowledge and understanding of the determinants of vegetable acceptability (liking), and consumption/intake; through investigation of the sensory characteristics and aspects of the eating environment and taking a lifespan approach (adolescents aged 10–19 years and older people aged ≥ 65 years). This was achieved by three overlapping research areas: product and sensory analysis, recipe development and consumer behaviour. The project was led by the Foodservice and Applied Nutrition Research Group and colleagues at Bournemouth University (UK) and involved a consortium of academics from the University of Copenhagen (DK) and the University of Florence (IT), and industry representatives from the Institute Paul Bocuse (FR) and Bonduelle (FR). The research was multidisciplinary, encompassing marketing, consumer studies, nutrition, public health, psychology, sociology, foodservice and culinary expertise.

Sensory characteristics

The sensory characteristics of different vegetables were evaluated across all participating countries (DK, FR, IT and UK) and were subsequently used to develop guidelines for recipe development. A positive relationship between stated liking and familiarity was found. Irrespective of the country, one group of highly liked vegetables (carrots, tomatoes, green salad) was identified, characterised by innately liked tastes (sweet, umami), delicate flavour and bright appealing colour. A second group of highly disliked vegetables consisted of cauliflower and broccoli, characterised by disliked sensations such as bitter taste and less preferred flavours. Internal preference maps from actual liking scores indicated that the generally disliked tastes (bitter, sour) were clearly correlated with a negative hedonic response. The hedonic valence of a generally well-accepted taste such as salty and texture descriptors depended on the type of vegetable. Internal preference maps from actual liking data indicate that flavour and

appearance descriptors of the distinct sensory properties of each type of vegetable positively affected liking, while the intensity of unusual flavours was related to sample disliking (our research is fully described in Dinnella *et al.* 2016; Clicerì *et al.* 2017 and Appleton *et al.* 2019). Both older people and adolescents also sorted vegetable (pea and sweetcorn) samples in relation to the sensory properties that were relevant for their hedonic judgement about each product. Appearance seemed to be less relevant for older people who tended to focus their attention more on texture and hedonic terms. The within-product approach used in this study highlighted that independent from familiarity and stated liking, the main drivers of actual liking and disliking were the same across countries and ages; sweetness, in opposition to bitterness and sourness.

Product development and field testing

One of the aims of the VeggiEAT project was to move from 'product' to 'recipe' with the goal of developing innovative dishes that are accepted by consumers. Development criteria taken into consideration included aspects of nutritional profile, cost and scalable food service. Eleven dishes were developed by culinary masters students at the Institute Paul Bocuse in France which, on piloting with an expert panel, were reduced to three (sweetcorn soup, pea tart and a vegetable burger mix). These dishes were evaluated in the four countries (DK, FR, IT and UK) by both adolescents and older people. The vegetable burger mix fully reflected global nutritional guidelines and since it was also the one most preferred by consumers, this was the dish taken through to the field-testing stage in a self-serve workplace canteen. In addition, the most appropriate nudge for vegetable dish selection was identified from a pilot study and the cue of 'Dish of the day' selected. This default option strategy relies on the premise that people tend to prefer the status quo and was successful in increasing choices for the vegetarian offer in a Living Lab context (Saulais *et al.* 2019).

A natural field experiment ($n = 380$ adolescents and $n = 345$ older people) was implemented in the four countries to study the conditions under which this type of nudge would contribute to increasing the probability of choosing a vegetable-rich dish. The experimental design comprised two conditions: neutral and nudge (Dish of the day). The VeggiEAT dish consisted of the vegetable burger mix, shaped into 'balls'; the alternative dishes were traditional meatballs (made

with beef) or fish balls (made with minced white fish). All the dishes were served with rice or pasta, salad and tomato sauce, as was most acceptable to consumers of each age and in each of the European countries. Concurrently, a questionnaire was administered that comprised sociodemographic characteristics; food-related lifestyle (adherence to Mediterranean Diet, Food Frequency Questionnaire, Food Neophobia); personal values (Human Values Scale, self-efficacy, social norms and self-estimated health); and attitudes towards nudging. Binary logistic regression analyses were used to assess associations between choice of dish (dependent variable: plant-based and animal-based dish) and all other variables.

We found that 'Dish of the day' as a nudging strategy increased vegetable dish selection for some of the sample (adolescent females) but not for males or older people (Saulais *et al.* 2019). Choice of a vegetable-based dish among adolescents was predicted by natural dimension (higher importance given to natural ingredients, avoidance of artificial ones and absence of additives), social norms, female gender and positive attitudes towards nudging interventions (Dos Santos *et al.* 2018; Dos Santos *et al.* 2020). Among older participants, women were also more likely to be nudged to choose the plant-based dish (Zhou *et al.* 2019).

Analysis of the questionnaire responses showed that consuming a higher quantity of vegetables was associated with older age, higher affluence score and greater liking for vegetables, and a lower importance of familiarity. Greater vegetable variety was associated with a higher liking and importance of health benefits, and a lower importance of familiarity. These findings demonstrate a role for liking and a lower concern for eating familiar foods for older people for vegetable consumption, and a particular role for concern for health benefits (Appleton *et al.* 2017).

The implementation of nudges in real-life operations is still challenging. On the one hand, nudging appeared to be unsuccessful among adolescents and elderly in promoting the plant-based alternatives when presented with very similar options (Dos Santos *et al.* 2020; Zhou *et al.* 2019), while on the other hand, it was effective when the choice was made among unfamiliar dishes (Saulais *et al.* 2019). From this research, it appears that strategies to increase vegetable consumption should focus on promoting the health benefits of vegetables and enhancing the positive sensory and natural aspects of vegetables (Appleton *et al.* 2019), while nudging appears to be context-specific and successful results in one setting

do not necessarily translate into other contexts. Clearly, further study is required to test these hypotheses and therefore a second project, *Veg+*, was conducted.

The Veg+ project

(All reports available at <https://www.vegplus.info>).

The *Veg+* project extended the work of the *VeggiEAT* project by considering aspects of vegetable consumption from farm to fork in a young adult population in Brazil. All factors that influence vegetable consumption in young adults were evaluated; from vegetable supply by farms through fostering markets for locally produced goods to consumption. There are five million 'family farms' in Brazil which employ three quarters of the farm labour force and are responsible for one third of agricultural income; however, 87.5% Brazilians aged 16 to 24 years do not meet the intake recommendation of two portions of vegetables per day (Centre for Disease Control & Prevention 2017). The development of 'direct from farm' purchase policies in Brazil began in 2003 as part of the Zero Hunger Programme. Until then, food supplies were based on economic criteria that made the participation of family farmers difficult. After the implementation of the Food Purchase Programme, public procurement strategies were developed for family farmers (Brazil 2003). This programme has led to a reduced ecological footprint and a more engaged civil society in schools but is yet to reach university canteens (World Food Programme 2020). The *Veg+* project involved collaboration between Bournemouth University and the Federal University of Santa Catarina, Brazil.

Background

The first stage of the project was to conduct a scoping review of existing literature examining the factors that affect vegetable consumption among college students globally (Rodrigues *et al.* 2019). Two empirical studies followed. Study 1 focussed on vegetable supply and evaluated local farmers' potential for vegetable production within a short food supply chain using semi-structured interviews (Table 1), while Study 2 assessed young adults' attitudes to and consumption of vegetables, using the *VeggiEAT* questionnaire (Dinnella *et al.* 2016; Appleton *et al.* 2019) together with a validated questionnaire developed by the Nutrition in Foodservice Research Centre, Federal University of Santa Catarina.

Vegetable supply and consumption

The literature analysis identified a purchasing potential for vegetables, particularly in a university setting (Martinelli *et al.* 2015). For example, the restaurant of the Federal University of Santa Catarina serves approximately 9000 meals per day. Thus, it would require more than 55 tons of vegetables per month, representing a yearly investment of 900 thousand dollars. However, due to the high volume of meals produced and the restaurant structure, all vegetables require some degree of pre-processing, such as washing, peeling and cutting. This can limit the access of family farmers since they have neither the manpower nor mechanised processes to do this, but could also represent an opportunity for them in relation to income. The results also showed the potential of the

restaurant for the promotion of sustainable and local production systems.

The key themes arising from the semi-structured interviews in Study 1 were grouped into benefits and difficulties for procurement from local farmers (Table 2) and suggested that local purchasing could improve the quality of canteen meals by increasing the diversity of fresh vegetables offered. Respondents also highlighted that a closer relationship between consumption and production would help preserve traditional food habits. Even so, with Brazil's political and economic status favouring lowest cost options, there is a sensitivity regarding public sector procurement which may hinder purchase from family farmers.

Inclusion criteria for Study 2 on vegetable consumption included students aged 18 years or older, and a sample size of $n = 525$ was achieved. The online questionnaire was available from November 2018 to April 2019 and consisted of questions on food-related life-style, for example: (1) availability and accessibility of vegetables; (2) cooking behaviour at home; (3) cooking behaviour away from home and personal attitude towards vegetables; (4) self-efficacy for using vegetables and seasonings; (5) self-efficacy on consumption of fresh vegetables; and (6) motives underlying the selection of food. Analysis of the survey was done by principal component analysis. This showed that vegetable consumption in young Brazilian adults was influenced by health, sensory and naturalness dimensions. The initial model contained eight predictor latent variables for the vegetable consumption outcome. Iterative evaluation and revision was undertaken until the measurement model met the criteria of acceptability. While health, naturalness and sensory showed similar strengths, the first two were positive and the last negative. The higher the participant

Table 1 Topics covered by the semi-structured interviews by category of interviewee for Study 1

Key informant category	Topics covered by the semi-structured interview
Policy makers (microlevel) Managers and staff of the university canteen	Characterisation of university food Menu planning regarding vegetables Seasonality
• Nutritionists	Selection of suppliers (purchase planning – prices)
• Procurement department	Purchase system for vegetables – procurement Receiving the products General requirements for vegetables (fresh/minimally processed)
Policy makers (macrolevel) Managers and staff of the department of agriculture:	Characterisation of agriculture in the city/region
• City level	Vegetable production planning
• State level	Selection of suppliers (purchase/sales planning)
• National level	Purchase system for vegetables – procurement Delivery of fresh/ minimally processed products Financial incentives and existing supporting initiatives
Family farmers and collectives Representatives of the farmers' organisation	Characterisation of family farmers participation in the collectives Vegetable production planning (family farmers)
• Family farmers (5)	Seasonality
• Representatives/leaders	Selection of suppliers (sale planning) Sale system Delivery of products Minimal food processing (peeling, washing, packaging), barriers and possibilities

Table 2 A summary preview of key themes from Study 1

Benefits of buying from local farmers to the university canteen	Difficulties of buying from local farmers for the university canteen
Improved menu quality	Need for minimally processed foods
Local food acquisition	Need for a large amount of food purchased
Offering food with less pesticides	Bureaucratic barriers in the buying process
Stimulus and income to the local farmers	Prices higher than the market price
Maintenance of the farmer in the field	Fragility of the programme in view of the current political and economic moment

weighting for vegetable 'Healthiness' and 'Naturalness', the higher consumption was likely to be, whereas 'Sensory' factors had a negative influence. This may be supported by a notion of extreme taste, unpleasantness of texture and smell which can be associated with some vegetables, as was also found in the *VeggiEAT* project. The other potential predictor variables, weight control, price, familiarity, convenience, use of condiments and cooking behaviour, did not have a significant impact on vegetable consumption in this population group.

Discussion

It is accepted that there is insufficient vegetable consumption globally from young to old and that there is a disease burden associated with this low intake. There is also a paucity of data on the inclusion of vegetables as part of a composite meal. While there have been studies of perceptions of freshness, psychosocial, environmental and life course factors influencing fruit consumption, there are very little comparable data on vegetables and this constitutes an under researched area (Bray & Hartwell 2017).

Vegetable consumption in adolescents is reported to be low, at least in part, due to unappealing sensory properties, such as bitter tastes. However, not all vegetables have unappealing sensory properties, and strategies to improve vegetable consumption may benefit from wider consideration. Repeated exposure has been advocated to increase vegetable liking and consumption, as has the use of rewards but effect sizes are small, although limited evidence suggests potential long-term benefits (Appleton *et al.* 2018). Both the *VeggiEAT* and *Veg+* projects improved understanding of factors associated with the regular consumption and liking of vegetables with more appealing and less appealing sensory properties. The scoping review, carried out as part of the *Veg+* project (Rodrigues *et al.* 2019), summarises worldwide data regarding vegetable consumption from almost 70 000 college students. The findings demonstrate that the majority of young adults do not consume vegetables as frequently as recommended by the Centre for Disease Control and Prevention (2017), nor in sufficient quantities to satisfy other relevant guidelines. No consumption patterns according to country or region were apparent although being female was the more frequent predictor associated with a higher intake. Other factors such as normal weight, living in the family home, importance given to healthy eating, higher socio-economic level and more openness to new experiences (*i.e.*

reduced neophobia, greater nutrition knowledge, being more active and drinking less alcohol) were all associated with a higher intake of vegetables. Availability appears to be a key proximal determinant of consumption, especially when the figure for fruit is also added. Among older people, a systematic review of behavioural interventions showed that effective dietary education, meal service provision and food-based dietary interventions (*e.g.* improving diet quality) increase older people's consumption of fruit and vegetables while also improving their physical health and nutrition status (Zhou *et al.* 2018).

Where sensory and naturalness elements are found to positively influence the consumption of vegetables among young adults, small-scale family farmers through their diversified production and ability to supply a variety of fresh produce may offer a solution for improved menu quality in some contexts. While this provides numerous advantages including reducing food transportation, reducing pesticide use and supporting the local farming economy, key barriers exist in the abilities of small-scale family farms to provide a continuous supply of produce. Further, food service operators require processed produce such as pre-washed and sorted commodities which is challenging for local farmers to deliver. Taken together, these findings present new insights not previously reported in the literature.

There is a continuing need for research that identifies specific ways for improving vegetable consumption and translating this into new product development and new markets. From an operational perspective, processed vegetables, including canned and frozen varieties, provide a convenient way to help promote intake as they have a longer shelf life than their fresh counterparts, are available out of season, can take advantage of surplus or over production, can have cost advantages and are easy to use in commercial meal preparation and dish development. This latter aspect enables them to be incorporated into production schedules where labour is limited or unskilled or equipment is not available. Notwithstanding, consumers tend to have a more positive attitude towards fresh vegetables rather than canned or frozen (Perez-Cueto *et al.* 2017).

Food choices in adolescence usually track into adulthood and are determinants of health outcome later in life. Adolescents who eat more protein from plant origin are less likely to be obese or overweight (Lin *et al.* 2015). Even so, efforts to promote vegetable consumption (as a marker for healthy eating) have been implemented with limited success (Perez-

Cueto *et al.* 2012). Nudging is attracting considerable interest due to its understanding and application of heuristic biases among consumers. While a study to test and compare three nudges in promoting vegetable consumption using priming (creating a leafy environment with green plants and an odour of herbs), default (pre-portioned salad in a bowl containing 200 g of vegetables) and perceived variety (a pre-mixed salad subsequently divided into each of its components) showed that the default design successfully increased the energy intake from vegetables among study participants (124 kcal vs. 90 kcal in control, $P < 0.01$) (Friis *et al.* 2017), a default nudge towards a vegetable-based 'Dish of the Day' was not successful in increasing its uptake in the *VeggiEAT* study in either male adolescents or older adults from four European countries (Dos Santos *et al.* 2018; Dos Santos *et al.* 2020).

The two research programmes (*VeggiEAT* and *Veg+*) provide an interesting snapshot of vegetable consumption across the lifespan where it is evident that there are common factors of sensory, health and naturalness dimensions.

Conclusion

Globally, there is a strong need to promote the consumption of vegetables as a public health issue but also to improve sustainability and food service operations. Sustainable considerations include not only planetary but personal health and the livelihood of small-scale family farmers globally. Both *VeggiEAT* and *Veg+* found that sensory characteristics such as bitterness and sourness have a negative influence on acceptance and consumption of vegetables, while sweetness encourages consumption. Additionally, personal views on health and the perception of naturalness act on likely vegetable consumption. The synergistic approach of both *VeggiEAT* and *Veg+* projects to explore factors affecting vegetable consumption across the whole food chain will aid the transition from theoretical understanding to practical application. The geographical areas chosen for fieldwork provide insight from a spread of countries and cultures. As such, they present a comprehensive test bed for consumer study and evaluation of factors associated with increased vegetable intake from farm to fork.

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References

- Appleton KM, Dinnella C, Spinelli S *et al.* (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: 923.
- Appleton KM, Dinnella C, Spinelli S *et al.* (2019) Liking and consumption of vegetables with more appealing and less appealing sensory properties: Associations with attitudes, food neophobia and food choice motivations in European adolescents. *Food Quality and Preference* 75: 179–86.
- Appleton KM, Hemingway A, Rajska J *et al.* (2018) Repeated exposure and conditioning strategies for increasing vegetable liking and intake: Systematic review and meta-analyses of the published literature. *American Journal of Clinical Nutrition* 108: 842–56.
- Appleton KM, Hemingway A, Saulais L *et al.* (2016) Increasing vegetable intakes: rationale and systematic review of published interventions. *European Journal of Nutrition* 55: 869–96.
- Bevan A, Hemingway A, Appleton K *et al.* (2016) Familiarity and liking of vegetables: Is it important for vegetable consumption? *British Journal of School Nursing* 11: 125–30.
- Bowles N, Alexander S & Hadjikakou M (2019) The livestock sector and planetary boundaries: A 'limits to growth' perspective with dietary implications. *Ecology Economics* 160: 128–36.
- Bray J & Hartwell H (2017) *The key to eating five fruit and veg a day might just be to make them more tasty*. Available at: <https://theconversation.com/the-key-to-eating-five-fruit-and-veg-a-day-might-just-be-to-make-them-more-tasty-75681> (accessed 19 August 2020).
- Brazil (2003) "Law n. 10,696, 02 July 2003". Provides for the renegotiation and extension of debts arising from rural credit operations, and provides other measures. Brasília, Brazilian Federal Official Gazette, 2003.
- Centre for Disease Control and Prevention (2017) *Only 1 in 10 Adults Get Enough Fruits or Vegetables*. Available at: <https://www.cdc.gov/media/releases/2017/p1116-fruit-vegetable-consumption.html> (accessed 8 October 2019).
- Chai BC, van der Voort JR, Grofelnik K *et al.* (2019) Which diet has the least environmental impact on our planet? A systematic review of vegan, vegetarian and omnivorous diets. *Sustainability* 11: 4110.
- Clicer D, Dinnella C, Depezay L *et al.* (2017) Exploring salient dimensions in a free sorting task: A cross-country study within the elderly population. *Food Quality and Preference* 60: 19–30.
- Cox D & Poelman A (2015) Towards greater vegetable consumption: Change the product or change the person? Case studies of two vegetable commodities. *Food Research International* 69: 348–56.

- De Wild V, de Graaf C, Boshuizen H *et al.* (2015) Influence of choice on vegetable intake in children: an in-home study. *Appetite* 91: 1–6.
- Defra (Department for Food Environment and Rural Affairs) (2019) *Food statistics pocket book*. Available at: <https://www.gov.uk/government/publications/food-statistics-pocketbook/food-statistics-in-your-pocket-summary#uk-consumer-expenditure-on-food-drink-and-catering> (accessed 08 October 2019).
- Dinnella C, Morizet D, Masi C *et al.* (2016) Sensory determinants of stated liking for vegetable names and actual liking for canned vegetables: A cross-country study among European adolescents. *Appetite* 107: 339–47.
- Dos Santos Q, Nogueira BM, Rodrigues VM *et al.* (2018) Nudging using the ‘dish of the day’ strategy does not work for plant-based meals in a Danish sample of adolescent and older people. *International Journal of Consumer Studies* 42: 327–34.
- Dos Santos Q, Perez-Cueto FJA, Rodrigues VM *et al.* (2020) Impact of a nudging intervention and factors associated with vegetable dish choice among European adolescents. *European Journal of Nutrition* 59: 231–47.
- Ensaff H, Homer M, Sahota P *et al.* (2015) Food choice architecture; an intervention in a secondary school and its impact on student’s plant based food choices. *Nutrients* 7: 4426–37.
- FAO (2016) *Influencing food environments for healthy diets*. Available at: <http://www.fao.org/3/a-i6484e.pdf> (accessed 08 October 2019).
- FAO (2020) *FAOSTAT*. <http://www.fao.org/faostat/en/#data/FBS> (accessed 21 July 2020)
- Feeney E, O’Brien S, Scannell A *et al.* (2014) Genetic and environmental influences on liking and reported intakes of vegetables in Irish children. *Food Quality and Preference* 32: 253–63.
- Food Foundation (2020) <https://foodfoundation.org.uk> (accessed 19 June 2020).
- Friis R, Skov LR, Olsen A *et al.* (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: e0176028.
- FSA (2014) *Food and you*, <https://www.food.gov.uk/sites/default/files/media/document/food-and-you-2014-uk-bulletin-2.pdf> (accessed 8 October 2019).
- Hughes N & Hughes E (2016) *Catering for Sustainability*. Available at: http://www.foodethicscouncil.org/uploads/publications/Catering%20for%20Sustainability_Full_Report%281%29.pdf (accessed 21 July 2020).
- Lin Y, Mouratidou T, Vereecken C *et al.* (2015) Dietary animal and plant protein intakes and their associations with obesity and cardio-metabolic indicators in European adolescents: the HELENA cross-sectional study. *Nutrition Journal* 14: 10.
- Martinelli SS, Soares P & Fabri RK (2015) Potentialities of the institutional purchase in the promotion of local and sustainable agro-food systems: the case of a university restaurant. *Segurança Alimentar e Nutricional, Campinas* 22: 558–73.
- Morizet D (2012) Le comportement alimentaire des enfants de 8 à 11 ans: facteurs cognitifs, sensoriels et situationnels, PhD thesis, France, Université Claude Bernard, Lyon 1.
- Perez-Cueto FJA, Aschemann-Witzel J, Shankar B *et al.* (2012) Assessment of evaluations made to healthy eating policies in Europe: A review within the EATWELL Project. *Public Health Nutrition* 15: 1489–96.
- Perez-Cueto FJA, Dos Santos Q, Nielsen B *et al.* (2017) Danish adolescents like their vegetables fresh rather than frozen or canned. *International Journal of Gastronomy and Food Science* 9: 29–33.
- Poore J & Nemecek T (2018) Reducing food’s environmental impacts through producers and consumers. *Science* 360: 987–92.
- Rodrigues V, Bray J, Fernandes AC *et al.* (2019) Vegetable Consumption and Factors Associated with Increased Intake among College Students: A Scoping Review of the Last 10 Years. *Nutrients* 11: 17.
- Saulais L, Massey C, Appleton KM *et al.* (2019) When are ‘Dish of the Day’ nudges most effective to increase vegetable selection? *Food Policy* 85: 15–27.
- World Food Programme (2020) *Brazil CoE – Good Practices no. 2 – Financing School Feeding*. Available at: https://docs.wfp.org/api/documents/WFP-0000115689/download/?_ga=2.72416215.575245231.1595345798-578922172.1595345798 (accessed 21 July 2020).
- Zhou X, Perez-Cueto FJA, Dos Santos Q *et al.* (2019) Promotion of novel plant-based dishes among older consumers using the ‘dish of the day’ as a nudging strategy in 4 EU countries. *Food Quality and Preference* 75: 260–72.
- Zhou X, Perez-Cueto A, dos Santos Q *et al.* (2018) A Systematic Review of Behavioural Interventions Promoting Healthy Eating among Older People. *Nutrients* 10: 1–18.