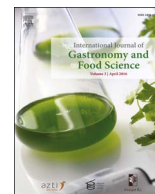




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Scientific paper

Danish adolescents like their vegetables fresh rather than frozen or canned<sup>☆</sup>

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## ABSTRACT

Food choices in adolescence usually track into adulthood and are determinants of health outcome later in life. Efforts to promote vegetables consumption (as marker of healthy eating) have been implemented with limited success. Vegetables furthermore are perishable, but shelf-lives can be extended thanks to canning and freezing. The objective of this paper is to identify the influence that familiarity with and liking of vegetables may play in shaping attitudes towards canned and frozen vegetables among Danish adolescents. Ninety school age adolescents participated (57% girls, 15.7 y SD 1.17y). In this sample, the majority of respondents were acquainted with vegetables (90%). The most liked vegetables were carrots, green salad, peas and corn. Lower liking levels were reported for squash, cauliflower and green beans. Most respondents showed a more positive attitude towards fresh vegetables rather than towards canned and frozen. Findings have implications for the provision of information through foodservice operations, and for the design of plant-based dishes and menus.

## Introduction

Achieving sustainable and healthy eating is a major societal concern, and it is a day-to-day issue for consumers. Healthy eating can be at the same time sustainable since it is characterised by a balanced diet rich in foods of plant origin (vegetables, fruits, pulses), limited in foods of animal origin and avoiding highly processed foods (Perez-Cueto, 2015). Such diets have been associated with reduced risk of myocardial infarction, stroke, total mortality, heart failure, disability, cognitive decline and cancer (Martinez-Gonzalez and Martin-Calvo, 2016). A public health nutrition goal is to achieve 400 g of fruits and vegetables per person daily intake at population level (WHO, 2008), while in Denmark the recommendation is higher (600 g or more/day) (Lynch et al., 2014).

The intake of foods of plant origin, particularly vegetables in Europe, the US, and across the world however, remain below World Health Organization recommendations (Bouchenak and Lamri-Senhadj, 2013). Although countries have been providing nutrition

recommendations for populations in order to promote healthy and sustainable diets, and despite consumers knowing well the recommendations, changes towards higher vegetable intake have been limited (Perez-Cueto et al., 2012). One potential reason for this fact might be related to the sensory properties of vegetables (Morizet et al., 2011), hence efforts to improve the taste of meals for e.g. school attending children are advocated (Cohen et al., 2015). Food intake in adolescence is a significant predictor of intake in adulthood and is influenced by gender, socioeconomic status and locality of residence (Lake et al., 2009; Mikkilä et al., 2007; Perez-Cueto et al., 2005).

Processing of foods apart from affecting the nutritional composition of vegetables, also provides effects that are desirable for taste and texture (Fabbri and Crosby, 2016; Lindley, 1998). Moreover, consumption of canned fruits and vegetables has been linked to improved dietary quality and desirable health outcomes, hence could contribute to achieving the unmet national intake goals (Freedman and Fulgoni, 2016). Since in previous work Danish adolescents were positive towards actions that would help them make healthier food-related

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choices (Nørnberg et al., 2016), and therefore it would also be sensible to further elucidate adolescent's preferences towards preserved vegetables (canned or frozen) and evaluate their potential role in increasing vegetable consumption at the foodservice level.

Hence, the objective of this study is to investigate Danish adolescents' familiarity and liking of vegetables and their attitudes towards the consumption of fresh, frozen and canned vegetables.

## Methods

### Data collection

An online survey was carried from January 6th to 20th, 2017 among Danish adolescents who were recruited using a snowball sampling procedure. Snowball sampling is used when respondents are added from the social network of existing participants since they should meet eligibility criteria, in this case adolescents in Denmark. In this case, a soccer team, a boarding school, and a classroom were contacted through key informants who further spread the link to their connections. The survey's aim was to identify current attitudes towards canned and frozen vegetables and the evaluation of vegetables by adolescents. Socio-demographic data (age, sex, locality of residence) were collected. Further an estimate of vegetables consumption was obtained with the question "How many portions of vegetables (excluding potatoes) do you consume on a typical day" with the following possible answers: none, 1–2, 3–4, 5 or more. Respondents were given the example of a big carrot or a big tomato as reference for portion. Attitudes towards canned, frozen and fresh vegetables were assessed by asking for degree of agreement or disagreement with the following statements: I prefer vegetables from the freezer rather than fresh vegetables; I think that vegetables canned are just as delicious as fresh vegetables; I think that fresh vegetables are healthier than frozen vegetables; I am uncomfortable eating canned vegetables; I think it is easier to cook with frozen or canned vegetables rather than with fresh vegetables; When it comes to vegetables, I am a creature of habit. I prefer vegetables that I'm used to eating; I prefer peas from the freezer rather than canned peas; I think that fresh vegetables are healthier than canned vegetables; I am uncomfortable eating frozen vegetables; I think that fresh vegetables are of higher quality than frozen vegetables; I prefer frozen sweet-corn than canned; I think that fresh vegetables are of higher quality than canned vegetables. The Likert type scale ranged from 1= fully disagree to 7 fully agree. Liking of vegetables (broccoli, carrots, cauliflower, green beans, green salad, peas, spinach, sweet-corn, tomatoes, squash) was evaluated using a hedonic scale ranging from 1= extremely dislike to 9= Like it very extremely. Familiarity with the aforementioned vegetables was evaluated on a scale where the following statements were given as choices: I don't know it, I know it but have not tasted it, I have tasted it but don't eat it, I eat it from time to time, I eat it regularly.

### Data analysis

Descriptive statistics for continuous variables are expressed in mean (SD), proportions with a 95% confidence interval (CI). Cronbach's Alpha was used to evaluate the internal consistency and unidimensionality of liking and familiarity scales (McCrae et al., 2011; Tavakoli and Dennick, 2011). Normality of data was evaluated using the Kolmogorov-Smirnov test (Ghasemi and Zahediasl, 2012). Association between liking scores and familiarity was evaluated with Spearman correlation since both scores were not normally distributed (de Winter et al., 2016; Mukaka, 2012). Further, exploratory factor analysis (Principal components and Varimax rotation) was performed to identify latent constructs within the attitudinal questions towards fresh, canned and frozen vegetables. Each of the product-specific liking score as well as the attitudinal statements were used as dependent variables in linear regressions in order to control for gender, age and

daily consumption of fruits and vegetables, and to test whether these variable did or did not have any effect on each of the scores. A p-value less than .05 was considered statistically significant in all tests.

### Ethics

The Scientific Committee of the Capital Region of Denmark revised the study protocol, gave the consent to go ahead with the study, and cleared from further formal approval with Reference H-16034595. Further, the directives concerning subject's protection and Informed consent (1995/46/EC, 2001/20/EC and 2005/28/EC) have been applied as well as those concerning Human rights in Biomedicine (98/79/EC). Hence, participants gave consent to participate, were free to leave at any point and leave incomplete questionnaires, and data has been stored anonymously and respondents cannot be traced or contacted again.

## Results

In total 90 Danish adolescents fully completed the online questionnaire, (51 girls, 39 boys; mean age 15.7 y (SD 1.17), who on average consume 2.83 portions of fruits and vegetables daily.

Table 1 shows the familiarity levels and the hedonic evaluation of the listed vegetables. The main picture is that about 10% of the respondents either don't know the products or have not tasted them ever. This sample of Danish adolescents is well acquainted with the listed vegetables and like them (mean liking scores ranging from 5.5 to 7.8). Majority of respondents are regular consumers of carrots, green salad and tomatoes, while the less regularly eaten products are squash and cauliflower. Further, correlation analysis using Spearman rho's revealed significant correlations between familiarities scores reported for different vegetables, as well as between liking scores attributed to different vegetables (data not shown). Table 2 displays the Linear Regression models obtained for each liking score controlling for age, gender and vegetable intake. All liking scores are positively associated with the reported vegetable intake, but inversely associated to male gender (broccoli, cauliflower and squash). Table 3 shows Spearman rho's for significant correlations between liking and familiarity scores by vegetable item. As expected, positive and significant correlations were observed between familiarity and liking of each individual item, but also it is interesting to observe that further correlations exist with

**Table 1**  
Familiarity and liking scores.

	I don't know it (%)	I know it, but I have not tasted it (%)	I have tasted it, but I don't eat it (%)	I eat it from time to time (%)	I eat it regularly (%)	Mean liking score <sup>a</sup>	SD
Broccoli	0	0	16	56	29	6.6	2.0
Carrots	0	0	4	29	67	7.8	1.4
Cauliflower	0	6	33	50	11	5.5	2.1
Green beans	1	6	27	44	22	5.9	2.2
Green salad	0	0	3	33	63	7.4	1.6
Peas	0	0	12	47	41	7.1	1.9
Spinach	1	7	17	49	27	6.2	2.2
Sweetcorn	0	0	14	53	32	7.2	2.1
Tomatoes	0	1	17	21	61	6.9	2.5
Squash	1	9	36	44	10	5.5	2.2
Other beans and vegetables	1	10	26	48	16	5.6	2.3

<sup>a</sup> Liking score was measured in a hedonic scale which could take the following values 1=Extremely dislike, 2=Dislike very much, 3=Dislike moderately, 4=Dislike slightly, 5=Neither like nor dislike, 6=Like slightly, 7=Like moderately, 8=Like very much and 9=Like it extremely.

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