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Consumer Valuation of Health Attributes in Food

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We estimate a model that allows consumers' food demand to depend on both the health effects and the consumption experience generated by the consumption of nutrients contained in food. We use home scan data of food purchases from approximately 2,500 Danish consumers enriched with nutrient content information. More-educated consumers have healthier diets than those with less education, and we find that this is explained by differences in how these groups value the consumption experience associated with nutrients, not by differences in their health valuation of nutrients.

Key words: food consumption, hedonic model, taste

Introduction

Unhealthy diets can lead to a variety of health problems—including cancer, cardiovascular disease, diabetes, osteoporosis, and obesity (World Health Organization, 2015)—many of which have seen dramatic growth worldwide (OECD, 2011). There seems to be a tradeoff between the immediate consumption experience associated with consuming fatty, salty, and sweet foods and the associated long-term health consequences of consuming those foods. One pressing question is how this tradeoff affects consumers' valuations of and demand for different food products. A social bias has been observed in the Western world: diet-related health problems are more prevalent among less-educated and low-income population groups (Marmot, 2005; Brønnum-Hansen and Baadsgaard, 2008, 2012; Hoffmann, 2011; Majer et al., 2011; Mackenbach, 2012; Marmot et al., 2012). They also have less healthy diets with larger intake of unhealthy nutrients such as saturated fat and sugar (Darmon and Drewnowski, 2008; Beenackers et al., 2012; Hiscock et al., 2012; Pechey et al., 2013; Demarest et al., 2014; Gallo et al., 2012; Groth et al., 2014). One possible explanation for the disparity is that more-educated consumers may be better informed than less-educated consumers and therefore more aware of the health implications of their diets (e.g., Grunert and Wills, 2007; Grunert et al., 2010; Pampel, Krueger, and Denney, 2010; Johnston et al., 2015). If this is the case, information campaigns focusing on increasing health awareness and education among less-educated consumers may be effective.

However, food taste preferences are developed in early childhood and are an important determining factor of what individuals consume (Drewnowski, 1997; Birch, 1999; Wright, Nancarrow, and Kwok, 2001). Therefore, another possible explanation for the observed social bias in diets may be differences in how groups value the immediate consumption experience associated with, for example, saturated fat or sugar in different types of foods. If consumers care about health effects but still choose an unhealthy diet because they have strong preferences for the consumption experience of unhealthy nutrients, then information campaigns that focus on health awareness may

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not be effective. Instead, policies focusing on changing the habits and social norms that form these preferences may be more effective.

In this study, we differentiate consumers based on education, but it is important to stress that the groups we compare also differ in other important dimensions, such as income. We do not attempt to determine which social background characteristics drive observed differences in dietary health. Instead, we focus on whether consumers' valuation of health effects or valuation of the consumption experience can explain the difference. We utilize a unique panel dataset with observations from approximately 2,500 Danish consumers provided by GfK Panel Services Scandinavia. Table 1 compares the consumption of different nutrients for consumers with no education or vocational education (hereafter abbreviated to less-educated), consumers with a short, nonvocational education (hereafter abbreviated to medium-educated) as well as consumers with a medium or long tertiary education (hereafter abbreviated to more-educated). On average, all groups eat more sugar and saturated fat and less fiber than recommended by the Danish official dietary recommendations, but deviations from the recommended diet are largest among less-educated consumers and smallest among more-educated consumers, as observed in most other studies (e.g., Darmon and Drewnowski, 2008; Groth et al., 2013, 2014; Pechey et al., 2013).

Our panel data are unusual in that they cover *all* components of a household's diet, including all nutrients and seven aggregate food groups (i.e., meat; dairy; flour, bread, and cereals; fish; fruit and vegetables; fats; and biscuits, cakes, spreads, and ice cream) over a long period.[1] The granularity of these data allows us to disentangle consumers' valuation of health from consuming a given nutrient from their valuation of the consumption experience associated with the presence of the same nutrient in different types of foods. More specifically, we model health and consumption experience valuations of unsaturated and saturated fat, sugar, carbohydrates, fiber, and protein contained in the seven food groups. The key identifying assumptions we make are that the consumer's health valuation of a given nutrient depends on his or her total consumption of that nutrient, while the valuation of the consumption experience associated with consuming the same nutrient is food-specific.

Our methodological starting point is the hedonic price model, which originates from the characteristic model in which consumers derive utility or satisfaction from the characteristics that goods contain rather than from the good itself (Lancaster, 1966; Rosen, 1974; Lucas, 1975; Ladd and Martin, 1976; Ladd and Suvannunt, 1976). A key implication of this model is that the price paid by a consumer for a good must equal the sum of his marginal valuations of all the characteristics contained in the product. Based on this, hedonic pricing models are used to decompose revealed consumer preferences for specific foods into implied valuations of the characteristics contained in those foods. The literature covers the valuation of search goods (e.g., convenience: Ahmad and Anders, 2012; Vickner, 2015) and credence goods (e.g., organic: Huang and Lin, 2007; Schulz, Schroeder, and White, 2012; Schröck, 2014), as well as the valuation of other attributes such as nutrients (Stanley and Tschirhart, 1991; Shongwe et al., 2007; Thunström, 2007; Drescher et al., 2008; Drescher, Thiele, and Weiss, 2008; Thunström and Rausser, 2008; Ward, Lusk, and Dutton, 2008; Richards, Mancino, and Nganje, 2012; Carlucci et al., 2013). However, most of these studies only consider a few related food items simultaneously, while the estimated valuations of nutrients, such as saturated fat, contained in different foods differ substantially. This is not surprising, since nutrients, in addition to having health implications in many cases, also have important effects on taste and texture that are relevant to the immediate experience of consuming the food. If the effect of a given nutrient on this experience varies among goods, so will its total marginal utility value. However, to the best of our knowledge, no studies have attempted to decompose consumer valuations of different nutrients into a marginal valuation that originates from its health effects and a marginal valuation that originates from associated consumption experiences.

[1] For a description of the composition the aggregated food groups, see Appendix A.

We find that more-educated consumers value the health effects of nutrients the same as or lower than less-educated consumers, which implies that their healthier diets are explained by differences in valuations of the consumption experience. While stronger health preferences may partly explain why medium-educated consumers have healthier diets than less-educated consumers, we find that differences in valuations of the consumption experience are again important. These results may have important implications for the design and role of information campaigns and labeling schemes that are a key nutrition policy instrument in many countries. If the consumption experience is the determining factor for diet composition, information campaigns and labeling should focus on the consumption experience or taste instead of the health effects of consuming a given food or nutrient.

Characteristics Model of Food Demand

We model the consumption of a vector of different foods, $\boldsymbol{q} = (q_1, \dots q_i, \dots q_J)$. We assume that consumers derive utility from the immediate experience of consuming these foods, $\tilde{u}(q_1, \dots, q_i, \dots q_J)$, from different long-term health effects of consuming the same vector of foods, $\tilde{v}(q_1, \dots, q_i, \dots q_J)$, and from the utility of consuming other goods, Z. We assume additive separability between the consumption experience, each of the health effects, and consumption of other goods to facilitate estimation of the model:

$$U = \tilde{u}(q_1, \dots q_j, \dots q_J) + \sum_{i=1}^{I} \tilde{v}_i(q_1, \dots q_j, \dots q_J) + Z. \tag{1}$$

In the classical characteristics model, utility is derived directly from the consumption of characteristics such as the nutrients contained in foods, implying that a given nutrient in one food is a perfect substitute for the same nutrient in another food. This assumption seems reasonable when considering the health implications of nutrient consumption, since the health implications of consuming, for example, unsaturated fats in milk and in spareribs are equivalent. However, since we model consumer choice covering the entire food basket, this assumption may be problematic when considering the immediate experience associated with consuming nutrients in different foods. It seems obvious that the corresponding implications for the consumption experience can vary substantially between different foods (e.g., the taste of saturated fat may vary considerably between milk and spareribs, and the effect that fiber or carbohydrates have on texture may vary substantially between bread and vegetables). Therefore, we explicitly model the health and consumption experience effects of nutrient consumption on the consumer's utility, which allows us to apply a more reasonable assumption than perfect substitution.[2]

We consider a household consuming a vector of $\boldsymbol{J}$ (running index j) different foods. Following the traditional characteristics model approach (e.g., used by Ladd and Zober, 1977; Lenz, Mittelhammer, and Shi, 1994; Shi and Price, 1998; Ranney and McNamara, 2002), we assume that each food consists of a number of nutritional characteristics and a number of non-nutritional characteristics. The amount of nutrient i contained in 1 unit of food j is given by a technology matrix, $\boldsymbol{A}$:

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[2] Note that the perfect substitutability assumption may be reasonable when modeling consumption experience implications of nutrients in similar goods (such as different milk variants or different breakfast cereals), which is the approach applied in the majority of studies in the literature.

(2)
$$A \equiv goods \left\{ \begin{array}{c} 1 \\ \vdots \\ j \\ \vdots \\ J \end{array} \right. \overbrace{\begin{array}{ccccc} 1 & \dots & \mathrm{i} & \dots & \mathrm{I} \end{array}}^{nutrient\ characteristics} \begin{pmatrix} a_{11} & \dots & a_{1i} & \dots & a_{1I} \\ \vdots & \ddots & \vdots & \iddots & \vdots \\ a_{j1} & \dots & a_{ji} & \dots & a_{jI} \\ \vdots & \iddots & \vdots & \ddots & \vdots \\ a_{J1} & \dots & a_{Ji} & \dots & a_{JI} \end{pmatrix}$$

In the same way, the amount of non-nutrient characteristic m contained in 1 unit of food j is given by a similar technology matrix, $\boldsymbol{B}$. It follows that the total amounts of each of the I nutritional characteristics (given by vector $\boldsymbol{h} = (h_1, \dots h_i, \dots h_I)$) consumed by the household is:

(3)
$$\boldsymbol{h} = \boldsymbol{A}'\boldsymbol{q},$$

where $\boldsymbol{q} = (q_1, \dots q_j, \dots q_J)$ is the vector of quantities of consumed foods. The total amount of each of the M non-nutritional characteristics consumed in food j (given by vector $\boldsymbol{g}_j = (g_{j1}, \dots g_{jm}, \dots g_{jM})$) is:

(4)
$$\boldsymbol{g}_j = q_j \boldsymbol{b}_j,$$

where $\boldsymbol{b}_j$ is the relevant vector of per unit nutrient characteristics from the technology matrix $\boldsymbol{B}$. When a household purchases a vector of foods, it is assumed to derive utility from the experience of consuming the vector of foods. This utility is assumed to be produced in a two-step process: First, in the lower nest, characteristics contained in each food j are combined to produce the consumption experience subutility for this food:

(5)
$$x_j = k_j(\boldsymbol{h}_j, \boldsymbol{g}_j),$$

where $\boldsymbol{h}_j = \boldsymbol{a}_j q_j$ is the vector of quantities of nutrients consumed in good j ($\boldsymbol{a}_j$ is the relevant vector of per unit nutrient characteristics from the technology matrix $\boldsymbol{A}$, that is, the content of saturated fat, sugar, etc. in good j). In the same way, $\boldsymbol{g}_j$, defined in equation (4), is the vector of non-nutritional characteristics consumed in good j. We assume homogeneity of the production of the consumption experience so that $x_j = q_j k_j(\boldsymbol{a}_j, \boldsymbol{b}_j)$, which allows us to interpret $k_j(\boldsymbol{a}_j, \boldsymbol{b}_j)$ as a quality measure for good j.[3] Essentially, the quality of the consumption experience of a unit of good j depends on its content of characteristics. For example, a pound of beef may have a higher "taste" quality when it contains 20% fat than when it contains 10% or 30% fat. This valuation is not affected by the amount of beef consumed, which seems a natural and intuitive interpretation.

In the second step, utility is produced by combining the good-specific subutilities of the consumption experience derived from each good:

(6)
$$u(x_1, \dots, x_J).$$

This is a traditional model of consumption, in which (as we have formulated it) the quality of each good is a function of its characteristics. When a household purchases a vector of foods, it is, in addition to the utility derived from the consumption experience, assumed to derive health utility depending on the total amount of each nutritional characteristic, h_i, contained in the diet:

(7)
$$v_i(h_i).$$

[3] Note that this model is synonymous with a characteristics model of production of consumption experience from aggregate goods when homogeneity of subutility production is assumed (e.g., Lenz, Mittelhammer, and Shi, 1994). The difference between Lenz et al. and others and our study is that we allow nutritional characteristics to influence the consumption experience.

We assume that consumers' total utility is the sum of utility derived from the consumption experience, the different health characteristics, and the expenditure on a numeraire good that represents the consumption of nonfood goods. Expenditure on the numeraire is equal to income Y minus expenditure on the J different foods, $\sum_{j=1}^{J} C_j$, so that the consumer's utility (corresponding to equation 1 above) becomes[4]

$$(8) \qquad U = u(x_1,\ldots,x_J) + \sum_{i=1}^{I} v_i(h_i) + Y - \sum_{j=1}^{J} C_j.$$

Thus, we assume additive separability of utility from health, from the consumption experience, and from consumption of the numeraire good. Furthermore, we assume that each of the J goods can be bought in different qualities on the market, depending on the per unit characteristics they contain.

Given the prices of different qualities on the market, $p_j(\boldsymbol{a}_j,\boldsymbol{b}_j)$, the consumer chooses both the quantity and quality of each good to maximize normalized utility:

$$(9) \qquad \max_{q,\boldsymbol{A},\boldsymbol{B}} U = u(x_1,\ldots,x_J) + \sum_{i=1}^{I} v_i(h_i) + Y - \sum_{j=1}^{J} p_j(\boldsymbol{a_j},\boldsymbol{b_j})q_j,$$

where $x_j = k_j(\boldsymbol{h}_j,\boldsymbol{g}_j)$. For ease of exposition, we have limited the consumer's choice to only one quality for each good. However, it is easy to demonstrate that this is always implied by the optimal solution since different qualities of a given good are perfect substitutes.[5]

The resulting first-order condition for the optimal choice of quality and quantity of good j stemming from all the first-order conditions is

$$(10) \qquad p_j(\boldsymbol{a}_j,\boldsymbol{b}_j) = u'_j\left(\sum_{m=1}^{M}\frac{dk_j(\boldsymbol{h}_j,\boldsymbol{g}_j)}{dg_{jm}}b_{jm} + \sum_{i=1}^{I}\frac{dk_j(\boldsymbol{h}_j,\boldsymbol{g}_j)}{dh_{ji}}a_{ji}\right) + \sum_{i=1}^{I} v'_i(h_j)a_{ji}.$$

Thus, the marginal utility value of the consumption experience derived from good j, in general, depends on the consumption of other goods in a complicated way (marginal values of the consumption experience of foods depend on the consumption of other goods: $u'_j(x_1,\ldots x_J)$). However, the separability implied by our model of the quality of the consumption experience implies that this quality function only depends on the characteristics contained in the specific good.[6] Further, the marginal health utility value of nutrients is assumed to only depend on the aggregate consumption of this nutrient due to the assumed separability structure. These two assumptions are what allow us identification in the empirical model. Multiplying equation (10) by the quantities of each food consumed, q_j, gives us

$$(11) \qquad C_j = u'_j\left(\sum_{m=1}^{M}\frac{dk_j(\boldsymbol{h}_j,\boldsymbol{g}_j)}{dg_{jm}}g_{jm} + \sum_{i=1}^{I}\frac{dk_j(\boldsymbol{h}_j,\boldsymbol{g}_j)}{dh_{ji}}h_{ji}\right) + \sum_{i=1}^{I} v'_i(h_j)h_{ji},$$

where C_k is total expenditure on good j and h_{ji} is the total amount of nutrient i in good j. This is the first-order condition that we estimate empirically. We assume that the quality of the consumption

[4] We assume the price of the numeraire good is unity so that the quantity consumed (from which utility is derived) equals expenditure.

[5] When different qualities of the same good are perfect substitutes, it is optimal to consume the quality that, at the given market price, gives the consumer the largest amount of quality-adjusted units per monetary unit: $k_j(\boldsymbol{a}_j,\boldsymbol{b}_j) + \sum_{i=1}^{I} v'_i(h_i)a_{ji})/p_j(\boldsymbol{a}_j,\boldsymbol{b}_j)$. Note again that this is synonymous with the aggregate-good model, assuming homogeneity of subutility production (e.g., Lenz, Mittelhammer, and Shi, 1994). To see this, let different qualities be defined as aggregate goods that differ regarding their composition of the same set of underlying goods. Under homogeneity, the optimal aggregate good composition is independent of the consumed quantity of the aggregate good.

[6] One could imagine nonseparable relationships in which a particular quality of a certain food goes especially well with the specific qualities of other foods (e.g., sweet wine with sweet desserts). We have ruled out these types of complex substitutional relationships.

experience is linear in non-nutritional characteristics:

$$\text{(12)} \qquad \frac{dk_j(\boldsymbol{h}_j,\boldsymbol{g}_j)}{dg_{jm}} = \delta_{jm}.$$

These are proportions of meat or vegetable types with a clear preference ranking (e.g., a greater proportion of roast beef may imply greater quality). For the nutritional characteristics, we allow the quadratic form, which accounts for the fact that the quality of, for example, top-quality beef of a certain fat content will decrease both with lower and higher per unit contents so that

$$\text{(13)} \qquad \frac{dk_j(\boldsymbol{h}_j,\boldsymbol{g}_j)}{dh_{ji}} = \alpha_{ji} + \beta_{ji}[h_{ji}/q_j],$$

where the marginal value depends on the per unit content (concentration) of the nutrient. Note that this satisfies the assumed homogeneity of the consumption experience. Finally, we allow the same quadratic form for the health utility of nutrients:

$$\text{(14)} \qquad v_i'(h_i) = \gamma_i + \varphi_i[h_i].$$

We allow u_j' to vary over time to account for the fact that the vector of consumed food goods changes over time and because of the assumed separability quality- and health-utility parameters are constant over time. Technically, we do this by including time- and good-specific marginal utilities, u_{jt}', for each representative household that we model so that the regression equations that we estimate become

$$\text{(15)} \qquad [C_{jt}] = [u_{jt}']\left(\sum_{m=1}^{M}\delta_{jm}[g_{jmt}] + \sum_{i=1}^{I}\alpha_{ji}[h_{jit}] + \sum_{i=1}^{I}\beta_{ji}[h_{jit}^2/q_{jt}]\right) + \sum_{i=1}^{I}(\gamma_i[h_{jit}] + \varphi_i[h_{it}h_{jit}])$$

for each good j, where square brackets indicate the observed variables in our dataset with a t added to indicate time-varying variables. C_{jt} is observed total expenditure on good j at time t, u_{jt}' is represented via time and food specific dummies, g_{jmt} (the non-nutritional characteristics) is the observed quantities of different subtypes of food m for good j (i.e., beef, pork etc.), g_{jmt} captures unobserved characteristics contained in this particular food,[7] h_{jit} is the total amount of nutrient i in specific good j, and h_{it} is the total amount of nutrient i consumed at time t. Table 1 provides descriptive statistics for the consumption of goods and nutrients. We see that the second-order consumption experience and the health effects of nutrients (β_{ji} and φ_i, respectively) in equation (15) are identified through our assumptions about their dependence on the nutrients contained in the given food and the total amount of consumed nutrients, respectively. The separation of the first-order consumption experience and the health effects (α_{ji} and γ_i) is based on our assumption that the consumption experience varies over time and between foods, while health effects do not.

Data and Model Structure

We use monthly self-reported purchase data from a Danish consumer panel maintained by GfK Panel Services Scandinavia. The panel contains a monthly average of approximately 2,500 households that report quantity, price, and detailed product characteristics of all food purchases. In principle, the diary is filled in by the diary keeper immediately after each shopping trip and is sent to GfK weekly. As well as the purchase data, the individual who is mainly responsible for shopping in the household fills out an annual questionnaire concerning a number of background variables that characterize the household. We aggregate the purchase data to monthly observations, covering the entire period of

[7] However, characteristics such as store, package size, and brand are left out. This has implications for the value of products. However, as we consider the diet as a whole, it is not possible to include these factors in any meaningful sense.

Table 1. Consumption of Nutrients and Food, Number of Households, and Observations by Education Level

	Less Education	Medium Education	More Education	Test (p value Student's t-test) $\mu_{less} = \mu_{med}$	$\mu_{med} = \mu_{more}$	$\mu_{less} = \mu_{more}$
Number of households	2,355	651	862			
Number of observations	28,630	6,428	9,084			
Average length of panel membership (months)	15.5	12.7	13.9			
Value of food consumed (DKK/person/month)	865.48	913.49	969.04	0.0052	0.0000	0.0000
Amt. of food consumed (kg/person/month)	37.75	38.35	39.89	0.0000	0.0000	0.0000
Fish	2.22	2.22	2.25	0.9465	0.2128	0.1928
Meat	5.61	5.53	5.02	0.0866	0.0000	0.0000
Fruit and vegetables	7.93	9.20	10.60	0.0000	0.0000	0.0000
Dairy	8.73	8.86	9.50	0.0660	0.0000	0.0000
Biscuits, etc.[a]	3.89	3.64	3.67	0.0000	0.6306	0.0000
Fats	1.14	0.99	0.92	0.0000	0.0000	0.0000
Flour, etc.[b]	8.23	7.91	7.94	0.0000	0.6467	0.0000
Nutrients (g/person/month)						
Fiber	513	520	555	0.0366	0.0000	0.0000
Carbohydrates	7,335	7,132	7,470	0.0002	0.0000	0.1556
Sugar	1,047	920	903	0.0000	0.2522	0.0000
Total fat	5,192	4,856	4,399	0.0000	0.0000	0.0000
Unsaturated fat	1,569	1,496	1,462	0.0000	0.0001	0.0000
Saturated fat	1,218	1,157	1,124	0.0000	0.0001	0.0000
Protein	2,972	3,009	3,045	0.0830	0.8906	0.1726

Notes: [a] Includes biscuits, cakes, spreads, and ice cream.
[b] Includes flour, bread, and cereals.

2003 and 2004. For many foods, the level of detail in the purchase data is close to barcode level. The purchase data are merged with nutrition matrices from the Food Composition Databank provided by the Danish Institute for Food and Veterinary Research.[8] The nutrition database provides detailed information about the content of macronutrients (e.g., protein, fats, carbohydrates and fiber) in 1,032 different foods.[9] As all values are given per 100 g edible part in the nutrient matrices, it is possible to calculate the total amount of various macronutrients purchased by the households by matching the nutrition matrices with the purchase data. For each type of food, the match is performed at the most detailed level possible. For example, it is possible to separate the purchased quantity of milk into different types of milk (e.g., butter milk, whole milk, semi-skimmed milk, skimmed milk, and flavored milk) and to match each type with a nutrition matrix that describes the exact content of nutrients in the particular type of milk. This results in a panel dataset at the household level in which the nutritional composition of purchases is measured together with prices and expenditure. We estimate the model for seven aggregate food types in which the quantities of different subfood types are used as an approximation of non-nutrient characteristics. For meat, for example, the amount of

[8] For more on the nutrition database, see http://www.foodcomp.dk/v7/fvdb_search.asp.
[9] The database covered 1,032 different foods in 2005 and is continuously being improved.

Table 2. Average Content of Nutrients in Each of the Food Categories (g/kg)

	Dairy	Meat	Fats	Fruits and Vegetables	Biscuits, etc.[a]	Fish	Flour, etc.[b]
Added sugar (g/kg)	**2.82**	2.95	0.00	0.00	**212.96**	0.00	**2.49**
	(2.9%)	(1.8%)	(0.0%)	(0.0%)	**(93.0%)**	(0.0%)	**(2.3%)**
Carbohydrates (g/kg)	**42.60**	17.11	5.00	**91.88**	**296.60**	**104.52**	**462.45**
	(5.9%)	(1.5%)	(0.1%)	**(12.5%)**	**(17.7%)**	**(3.6%)**	**(58.7%)**
Fiber (g/kg)	0.42	0.95	0.00	**19.34**	**3.98**	0.70	**32.24**
	(0.8%)	(1.1%)	(0.0%)	**(36.9%)**	**(3.3%)**	(0.3%)	**(57.5%)**
Protein (g/kg)	**54.96**	**207.08**	4.88	**11.76**	**17.96**	**144.62**	**61.09**
	(18.7%)	**(43.3%)**	(0.2%)	**(3.9%)**	**(2.6%)**	**(12.3%)**	**(19.0%)**
Saturated fat (g/kg)	**25.21**	**61.46**	**314.48**	1.24	**14.99**	**18.02**	**3.70**
	(21.7%)	**(32.5%)**	**(32.5%)**	(1.0%)	**(5.5%)**	**(3.9%)**	**(2.9%)**
Unsaturated fat (g/kg)	**11.63**	**92.51**	**388.77**	0.18	**14.90**	**75.90**	**9.95**
	(7.8%)	**(37.9%)**	**(31.2%)**	(0.1%)	**(4.3%)**	**(12.7%)**	**(6.1%)**

Notes: The contribution (in percentage) of the nutrient from this food group to total consumption of the nutrient in question. Figures in bold indicate variables included in the model.
[a] Includes biscuits, cakes, spreads, and ice cream.
[b] Includes flour, bread, and cereals.

beef consumed would constitute the amount of one non-nutrient characteristic consumed, while the amount of pork consumed would constitute the amount of another non-nutrient characteristic.

We use purchase data to reflect the consumption experience and health effects of food consumption. Despite the bias that may arise due to interpreting purchase data as consumption data, the purchase data have the advantage in that they contain prices and total outlay on food, which would not have been available had we used 24-hour recall data. Furthermore, Appelhans et al. (2017) find that food purchases yield an unbiased and reasonably accurate estimate of overall diet quality measured by 24-hour recall data. It is, however, less accurate for characterizing the dietary intake of specific nutrients. We also consider aggregating the data to monthly observations to decrease the mismatch between the time of purchase of an item and the time of consumption. In Table 1, we show key values for the dataset after normalizing for household size and omitted reporting weeks.[10]

From Table 1, we see the same differences in our Danish panel as have been found in a number of other studies. More-educated consumers spend more money on food and consume more fruit and vegetables, less meat, and fewer sugary products and fats compared to less-educated consumers. Looking at nutrients, the more educated consumers consume more fiber and less saturated fat and sugar compared to less-educated consumers. We then follow the approach from Lenz, Mittelhammer, and Shi (1994) and construct 32 aggregate food "qualities," each of which consists of a number of underlying subqualities.[11] These 32 aggregated food qualities constitute the quality of each of the seven main foods described in equation (4); hence, they are the elements in the $\boldsymbol{B}$ matrix. The $\boldsymbol{A}$ matrix is constructed based on the per unit content of nutrients in each type of food. Not all goods contain all types of nutrients. Table 2 shows the amount of each of the nutrients in g/kg in each of the j food categories (e.g., dairy products contain, on average, 54.96 g of protein in 1 kg and 2.60 g of added sugars). To facilitate model estimation, we exclude nutrients from the model of a specific food category if the contribution from this food to total nutrient consumption is insignificant (less than 2% of total consumption). For example, we only include protein, unsaturated fat, and saturated fat from meat in the model since carbohydrates, fiber and added sugars from meat all account for less than 2% of total consumption of the respective nutrient.

[10] Unreported weeks are assumed to have consumption equal to the mean of reported weeks in the current month.
[11] Appendix A lists the 32 food qualities and their relationships with the seven main food groups.

Table 3. Parameter Values, the Health Attribute

	All Households		Less Education		Medium Education		More Education	
	Coeff.	**Std. Err.**	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**
Health utility, γ_i								
Added sugars	5.76E−08	0.0049	−0.0060	−5.11E−08	−0.0240**	0.0099	6.39E−11	0.0134
Carbohydrates	−0.0018	0.0031	2.61E−03	2.98E−03	0.0387***	0.0086	−0.0235***	0.0056
Fiber	0.1119***	0.0359	0.1334***	0.0361	0.4095***	0.0504	0.1616**	0.0647
Protein	0.1211***	0.0086	0.0804***	0.0112	0.0200	0.0200	0.2740***	0.0115
Saturated fat	3.34E−09	0.0154	2.82E−09	2.41E−02	−2.74E−09	0.0472	6.12E−11	0.0226
Unsaturated fat	0.1862***	0.0120	0.2027***	0.0168	0.1461***	0.0359	0.0309*	0.0167
Health utility, quadratic, φ_i								
Added sugars	−7.7E−08***	−2.94E−08	−2.70E−09	−0.0500	−1.11E−07	7.30E−08	−6.05E−11	−9.19E−08
Carbohydrates	−5.04E−08***	−9.29E−09	−1.81E−07***	−1.08E−08	−5.99E−12	3.04E−08	−1.79E−07***	−2.84E−08
Fiber	−1.9E−05***	−1.20E−06	−2.43E−08	−1.38E−06	−6.64E−05***	4.18E−06	−2.69E−05***	−4.90E−06
Protein	−1.57E−06***	−6.17E−08	−1.48E−06***	−7.60E−08	−1.63E−06***	2.40E−07	−2.10E−06***	−1.43E−07
Saturated fat	−1.81E−06***	−9.42E−08	−2.17E−06***	−1.36E−07	−5.88E−07***	7.56E−08	−2.13E−06***	−2.29E−07
Unsaturated fat	−1.81E−06***	−9.42E−08	−2.17E−06***	−1.36E−07	−5.88E−07	7.56E−07	−2.13E−06***	−2.29E−07

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level. In the model for all households, we tested whether the quadratic terms for saturated and unsaturated fat were equal. That could not be rejected, so we set the parameters to be equal in the estimation for different educational groups for ease of estimation (the variables are heavily correlated, causing problems with convergence).

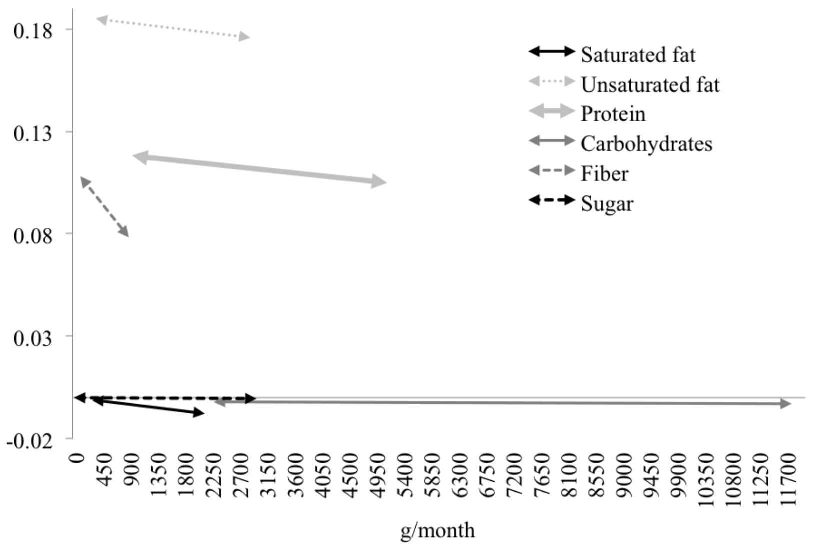

Figure 1. Marginal Health Valuation of Nutrients

Estimation and Results

We estimate the model specified in equation (15) using monthly food purchases per person for the seven main food groups as a system of seven nonlinear regression equations using the NLSUR command in Stata 10. We chose the SUR estimation technique to reflect the dependence of parameters across equations and the dependency of the random errors between equations. The model is estimated independently for three different educational groups, where households are allocated according to the educational status of the individual who is mainly responsible for shopping: less-educated (no education or a vocational education), medium-educated (short nonvocational education), and more-educated (medium or long tertiary education). We also estimate a pooled model for all consumers to validate our model results. Summary statistics for these models are presented in Appendix B.

The pooled model uses a quadratic representation of the nutrient consumption experience variables for all nutrients. In the estimations for educational groups, we dropped the quadratic specification in favor of a linear representation whenever the quadratic component was not significant in the pooled model. Excluding insignificant quadratic parameters facilitates our estimation of models for the three education groups, where the number of observations is reduced compared to the full model. Table 3 shows parameter values for the health attributes of nutrients, both for the model estimated on all households and for each of the educational groups. Many of the parameters are highly significant. All quadratic parameters have the expected negative sign (or are insignificant), indicating decreasing (nonincreasing) marginal health utility of nutrients with a net positive health valuation and increasing (nondecreasing) marginal disutility of nutrients with a net negative health valuation. Combining the parameters, all nutrients also have the expected marginal valuation signs (positive net valuation of fiber, protein, and unsaturated fat and negative net valuation of sugar, saturated fat, and carbohydrates) within the value span covered by our data (see Figure 1).

Table 4 shows the parameter values for the consumption experience of saturated fat, added sugar, and fiber (the nutrients of main interest) for each of the educational groups; Appendix Tables C1 and C2 show the (numerous) parameters for the three other nutrients as well as non-nutritional attributes. Generally, the consumption experience of fiber is negatively valued, but mostly among less-educated consumers. Added sugar is positively valued in dairy products and, in general, negatively valued in other products. However, more-educated consumers consistently have the lowest taste valuations for

Table 4. Parameter Values, Consumption Experience, α_{ij} and β_{ij} for Educational Groups

	Less Education		Medium Education		More Education	
Nutrient *i*, Good *j*	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**
Added sugar, α_{ij}						
Dairy	0.5989***	0.0252	0.1540**	0.0683	0.0165	0.0456
Flour, etc.[a]	−0.0305***	0.0095	0.1105***	0.0208	−0.0907***	0.0216
Biscuits, etc.[b]	−0.0918***	0.0079	−0.0533***	0.0120	−0.1260***	0.0197
Added sugar, squared, β_{ij}						
Dairy	Omitted					
Flour, etc.[a]	−1.73E−01*	0.1054	−0.7696***	0.3045	−1.31E−09	0.2804
Biscuits, etc.[b]	0.0668***	0.0039	0.0895***	0.0067	0.0863***	0.0121
Fiber, α_{ij}						
Fruit/veg	−0.1814***	0.0322	−0.5429***	0.0675	−0.0496	0.0621
Flour, etc.[a]	−0.0862**	0.0387	−0.2672***	0.0576	−0.0257	0.0680
Biscuits, etc.[b]	−0.6211***	0.0794	−0.4693***	0.1105	−0.2441	0.1951
Fiber, squared, β_{ij}						
Fruit/veg	Omitted					
Flour, etc.[a]	−0.9126***	0.0964	−1.0673***	0.2551	−0.8433***	0.0000
Biscuits, etc.[b]	Omitted					
Saturated fat, α_{ij}						
Fish	−0.1801***	0.0258	−0.2883***	0.0586	−0.0919***	0.0334
Dairy	0.1797***	0.0453	−0.4807***	0.0562	0.0081	0.0778
Fats	−0.0968***	0.0276	−0.1613**	0.0747	−0.0536	0.0373
Flour, etc.[a]	−0.0967***	0.0262	−0.2222***	0.0523	−0.1322***	0.0269
Meat	0.2224***	0.0559	0.1053	0.1330	−0.0661	0.1084
Biscuits, etc.[b]	0.1202***	0.0271	0.0502	0.0479	0.1339***	0.0404
Saturated fat, squared, β_{ij}						
Fish	Omitted					
Dairy	1.0200***	0.0866	3.2306***	0.2802	0.6701***	0.1276
Fats	−0.0904***	0.0187	−0.0518	0.0741	−0.1200***	0.0397
Flour, etc.[a]	Omitted					
Meat	0.1410*	0.0754	0.6580***	0.1366	0.5784***	0.1896
Biscuits, etc.[b]	0.2158***	0.0404	−0.2011**	0.0999	−0.0335	0.1481

Notes: Single, double, and triple asterisks (*, **, ***) indicate [statistical] significance at the 10%, 5%, and 1% level.
[a] Includes flour, bread, and cereals.
[b] Includes biscuits, cakes, spreads, and ice cream.

sugar. Among less-educated consumers, saturated fat is positively valued in meat, sugar products, and dairy products and negatively valued in fats and flour, bread, and cereals.

Discussion of Results

Health Preferences

Inserting the estimated parameters from the aggregated model (all consumers) into equation (13), we calculate the marginal health valuations of each nutrient as a function of monthly per capita nutrient consumption. These are illustrated for six nutrients in Figure 1, where each arrow indicates health values between the 5th percentile and the 95th percentile of monthly per capita nutrient consumption observed in our data period.[12] Our estimation indicates positive health valuations for unsaturated fat, protein, and fiber and negative health valuations for sugar, saturated fat, and carbohydrates. These valuations are aligned with the official Danish dietary recommendations from 2003–2004,[13], which indicate that sugar and saturated fat are unhealthy while fiber, protein, carbohydrates, and unsaturated fat are healthy. Since most Danish consumers are aware of these recommendations, it is not unreasonable to validate our model results against them. The only real inconsistency is that consumers have a negative valuation of carbohydrates in our estimation, despite the positive evaluation in the official dietary recommendations. This inconsistency may be because the official carbohydrate recommendation was questioned in the popular press and in various popular diets (e.g., the Atkins and South Beach diets) during our data period. In addition, the focus of authorities during this period was on communicating warnings about the negative health consequences of consuming saturated fat and, to some extent, sugar and providing positive recommendations about fiber in the diet.

Figure 2 presents marginal health valuations for the three educational groups, calculated from equation (13) using parameter estimates from each of the three subgroup models. In each subfigure, the arrows indicate health values between the 5th percentile and the 95th percentile of observation for the indicated education subgroup. We only present and discuss the most important nutrients; added sugar, fiber, and saturated fat.

Figure 2a illustrates health valuations of added sugar. The marginal health valuations are almost constant for all three groups across the consumption variation indicated by our data. It is also clear that medium-educated consumers have a substantially more negative evaluation of sugar than less- and more-educated consumers (these two groups' health valuations do not statistically differ from 0).

Figure 2b presents the marginal health valuations for fiber. All three groups have significant positive valuations, while these decrease notably with aggregate fiber consumption for the medium-educated group (which has the highest valuation). Thus, it seems that, within this group, consumers not only realize that fiber is healthy but also that the marginal benefits decrease with consumption. Medium-educated consumers again deviate from the other groups by having a substantially more positive health valuation across the entire 90% span of values in our data.

Figure 2 represents the marginal health valuations for saturated fat. All three groups have significant negative marginal health valuations that increase substantially (numerically) with aggregated saturated fat consumption. Therefore, it seems that consumers in all three groups not only realize that saturated fat is unhealthy but also that it is more important to reduce consumption if you eat a lot of saturated fat in the first place. However, for saturated fat, we find that medium-educated consumers are the least concerned about health compared to less- and more-educated consumers across the entire 90% span of values in our data.

In conclusion, the *first* noticeable valuation pattern is that consumers generally seem to understand and appreciate the documented health effects of nutrients, but only in relation to fiber and saturated fat do they appear to appreciate that these health effects are closely related to the amount of nutrient consumed. The *second* noticeable valuation pattern is that the less- and more-educated consumers have similar marginal health valuations; the medium-educated group stands out

[12] Fiber consumption is 117–914 g/person/month, protein 956–5,132 g/person/month, carbohydrates 2,290–11,785 g/person/month, saturated fat 292–2,136 g/person/month, unsaturated fat 381–2,887 g/person/month and sugar 0–317 g/person/month.

[13] These recommended a maximum of 30% of total energy intake from fat and 10% from saturated fat (more refined recommendations suggest minimum requirements from unsaturated fat consumption, namely 10%–15% from monounsaturated fat and 5%–10% from polyunsaturated fat), 10%–15% of energy intake from protein, and 55%–60% from carbohydrates. Minimum fiber intake should be 3 g/MJ (about 2.4% of total energy intake), while intake of fruit and vegetables should be at least 600 g/day and intake of fish 200–300 g/week (Becker et al., 2004). The recommendations were updated in 2013

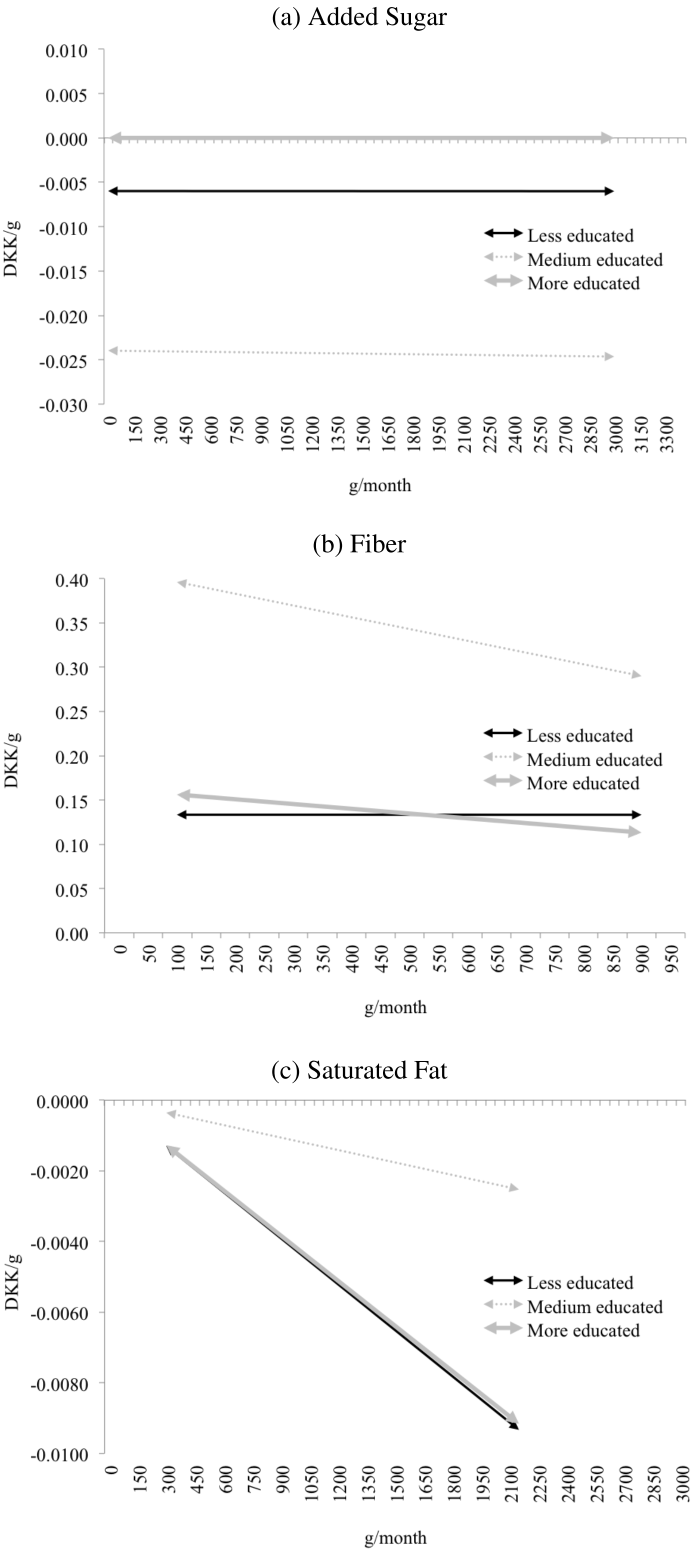

Figure 2. Marginal Health Valuations

for having stronger health preferences for two of three nutrients examined. This contrasts with the differences in healthiness of the three groups' diet composition (Table 1), where the more-educated group stood out for having the healthiest diet in all three nutrition dimensions.

Preferences for Consumption Experience

We now turn to consumers' preferences for consumption experiences. Figure 3 compares the consumption experience valuation of the three core nutrients we consider in our model contained in the seven aggregated foods calculated at the average nutrient content level from Table 2.

All educational groups like (or are neutral about) the consumption experience of sugar in dairy but dislike (or are neutral about) sugar in sugar products, which is the origin of most of the added sugar in the diet. More-educated consumers dislike sugar most. All groups dislike (or are neutral about) the consumption experience of fiber, but more-educated consumers dislike it least. The valuations of the consumption experience of saturated fat are more mixed. However, for the three food groups that contribute the majority of the saturated fat in the diet (fats, meat and dairy), less-educated consumers have mostly positive valuations of the consumption experience, while more-educated consumers have negative or neutral valuations.

To complete the picture, Figure 4 shows the valuation of non-nutritional characteristics of food (i.e., the 32 aggregated quality variants).[14] These reflect the consumption experience that is not associated with the nutritional content of the products. For example, more beef may increase the consumption experience within the meat category independent of the nutrient content. Less-educated consumers have a valuation of 48.6 Danish crowns (DKK)/kg to have beef within the meat category, while medium- and more-educated consumers have valuations of 50.7 DKK/kg and 56.9 DKK/kg, respectively, indicating that preference for beef increases with education.

Conclusion

Most hedonic studies only model a few related food items simultaneously. Furthermore, when comparing estimated valuations of nutrients (e.g., saturated fat or added sugar) contained in different foods from these studies, they are found to differ substantially. This is not surprising since these nutrients, in addition to having health implications, may also have important effects on the consumption experience of consuming the food (i.e., taste, texture). If the effect of a given nutrient on this experience varies among goods, so will its total marginal utility values. In this paper, we develop a hedonic characteristics model that makes it possible to disentangle the health values of a given nutrient from the consumption experience under the key identifying assumptions that the health value of a given nutrient in a consumer's diet depends on his or her total consumption of this nutrient, while the consumption experience only depends on the consumption of the nutrient contained in the given type of food.

We compare the three groups of consumers differentiated by education. Our results suggest that consumers generally understand and appreciate the documented health effects of nutrients, but only in relation to saturated fat and, to some extent, fiber do they appreciate that these effects are closely related to the amount of the nutrient consumed. Our results also indicate that more-educated consumers have healthier diets than the less-educated, but this is not because of a greater preference for health. Rather, more-educated consumers have preferences for the consumption experiences of healthy food. In contrast, differences in health preferences may partly explain why medium-educated consumers have healthier diets than the less-educated. It should be stressed that, while our results show that these differences are correlated with education, they do not show any causal relationship between valuations and education.

[14] Parameter values for the remaining nutrients as well as non-nutritional consumption experience parameters are shown in Appendix C.

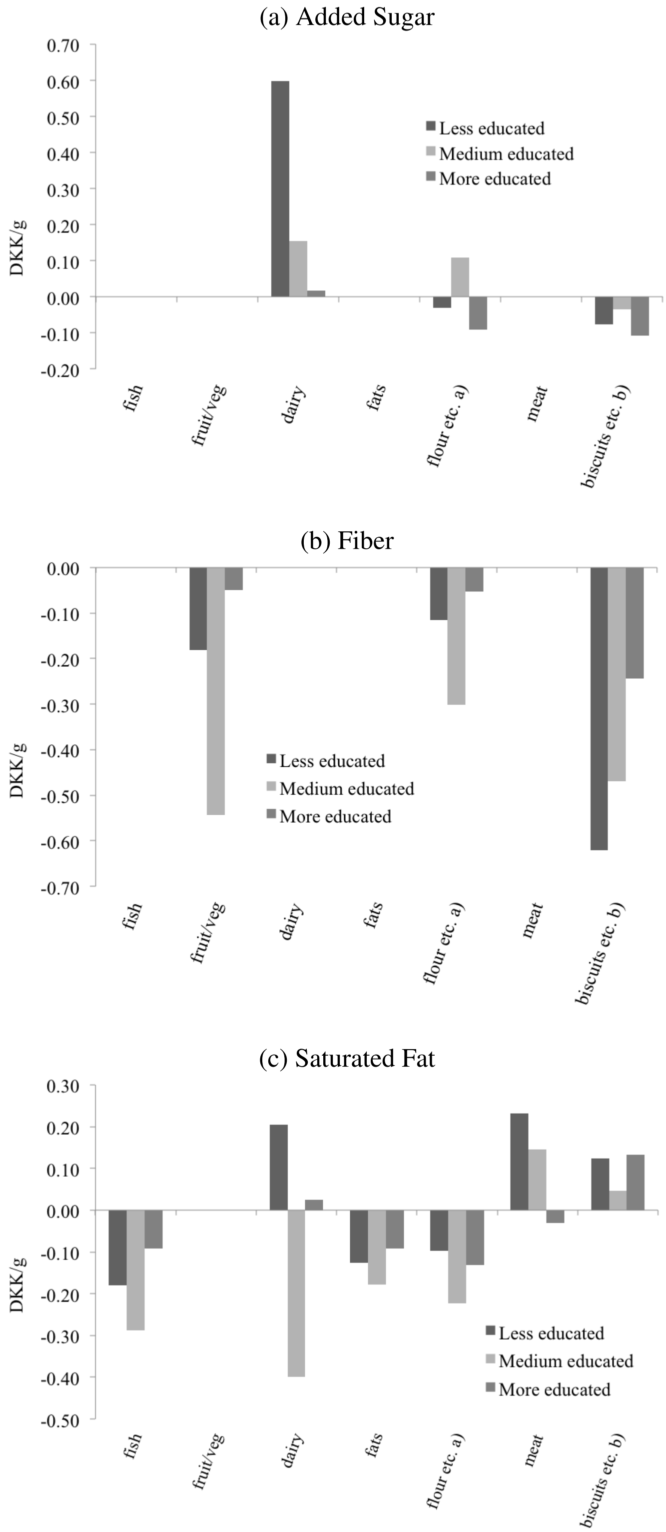

Figure 3. Marginal Consumption Experience Valuations

Notes: [a] Includes flour, bread, and cereals.
[b] Includes biscuits, cakes, spreads, and ice cream.

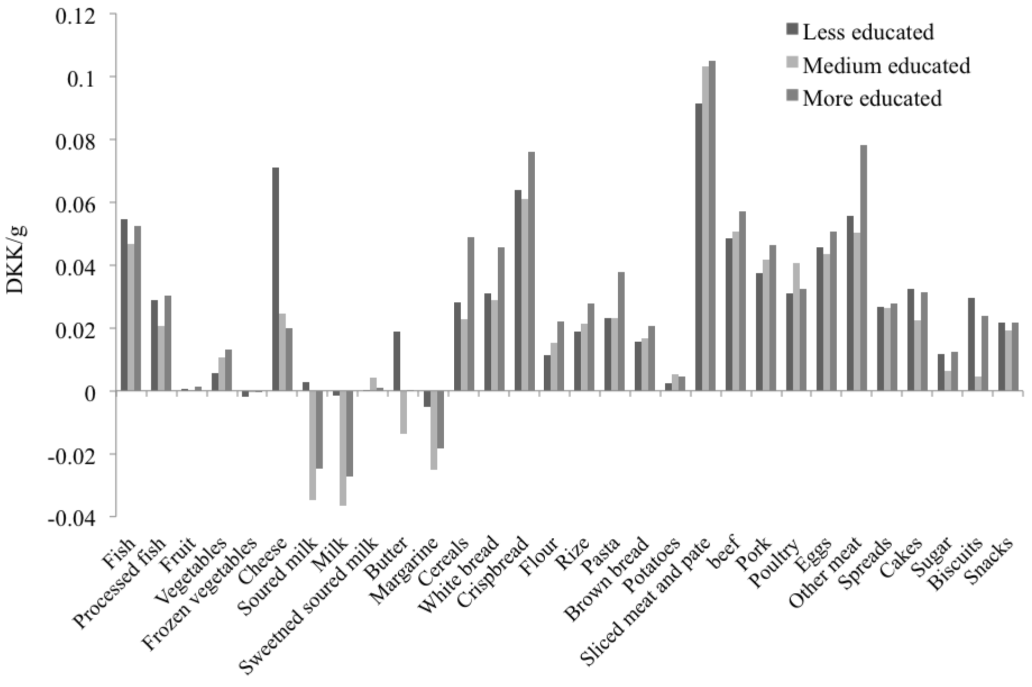

Figure 4. Valuation of the Consumption Experience of Non-Nutritional Characteristics

Nevertheless, our results may have important policy implications. A better understanding of why consumers have substantial differences in food preferences, especially between medium-educated and other consumers, could help improve the design of policies meant to inform and motivate consumers to eat healthier foods. However, what is perhaps more important is the result that more-educated consumers eat a healthier diet because they prefer the consumption experience of healthy foods. A better understanding of how these preferences are formed may guide and inspire policies focusing on forming healthier preferences. As food preferences are often formed in early childhood, this may, for example, be through school meal programs or policies aimed at motivating parents to help their children appreciate the consumption experience of healthy foods.

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Appendix A: Aggregating Foods into Goods

Original Grouping in Data	Quality Variants of Foods	Main Food Group
Processed fish	Processed fish	Fish
Fish	Fish	
Processed meat for bread	Processed meat	Meat
Liver pâté		
Brawn and pâté		
Rissole		
Bacon		
Sausages		
Beef and other meat	Beef	
	Other meat	
Pork	Pork	
Poultry	Poultry	
Eggs	Eggs	
Butter	Butter	Fats
Oil	Oil	
Margarine	Margarine	
Pizza	Dishes	
Dishes with rice and pasta		
Chocolate (for bread)	Spreads	Biscuits, cakes, spreads, and ice cream
Marmalade		
Biscuits	Biscuits	
Ice cream	Ice cream	
Sugar	Sugar	
Cake	Cakes	
Cookies		
Fruit	Fruit	Fruit and vegetables
Vegetables	Vegetables	
Frozen vegetables	Frozen vegetables	
Potatoes	Potatoes	Flour, bread, and cereals
Cereals	Cereals	
White bread	White bread	
Brown bread	Brown bread	
Flour	Flour	
Crisp bread	Crisp bread	
Rice	Rice	
Pasta	Pasta	
Speciality cheese	Cheese	Dairy
Ordinary cheese		
Milk	Milk	
Yogurt	Yogurt	

Appendix B: Results from Feasible Generalized Nonlinear Least Squares Regression

Equation	No. Coeff.	RMSE	Uncentered R^2
Pooled model ($N = 44,142$)			
Total expenditure on fish	40	20.50361	0.9732
Total expenditure on fats	38	56.10426	0.9012
Total expenditure on dairy	46	76.00578	0.8398
Total expenditure on fruit/veg	32	98.46872	−5.0540
Total expenditure on flour, etc.[a]	54	34.05683	0.9239
Total expenditure on meats	40	152.93734	0.8312
Total expenditure on biscuits, etc.[b]	50	87.01856	0.4906
No/vocational (less) education ($N = 28,630$)			
Total expenditure on fish	40	20.08006	0.9742
Total expenditure on fats	38	43.54888	0.9237
Total expenditure on dairy	46	66.49451	0.8631
Total expenditure on fruit/veg	32	90.75708	−3.9765
Total expenditure on flour, etc.[a]	54	33.04928	0.9248
Total expenditure on meats	40	143.56245	0.8455
Total expenditure on biscuits, etc.[b]	50	95.81182	0.3810
Short non-vocational education (medium) education ($N = 6,428$)			
Total expenditure on fish	39	18.41777	0.9786
Total expenditure on fats	36	62.74028	0.8924
Total expenditure on dairy	44	85.06465	0.8019
Total expenditure on fruit/veg	32	120.31776	−8.5258
Total expenditure on flour, etc.[a]	52	31.79167	0.9314
Total expenditure on meats	40	164.91830	0.8166
Total expenditure on biscuits, etc.[b]	48	54.34521	0.7915
Medium or long tertiary (more) education ($N = 9,084$)			
Total expenditure on fish	40	19.83544	0.9749
Total expenditure on fats	38	74.42616	0.8906
Total expenditure on dairy	46	86.60007	0.8422
Total expenditure on fruit/veg	32	89.45695	−4.3682
Total expenditure on flour, etc.[a]	54	36.55251	0.9253
Total expenditure on meats	40	145.34089	0.8573
Total expenditure on biscuits, etc.[b]	50	136.25992	−0.1994

Notes: [a] Includes flour, bread, and cereals.
[b] Includes biscuits, cakes, spreads, and ice cream.

Appendix C: Parameter Values for Non-Core Nutrients and Non-Nutritional Characteristics

Table C1. Parameter Values, Consumption Experience of Nutrients, α_{ij} and β_{ij}, for Educational Groups

	No/Vocational (Less) Education		Short Non-Vocational Education (Medium) Education		Medium or Long Tertiary (More) Education	
Nutrient i, Good j	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**
Unsaturated fat, α_{ij}						
Fish	−0.0439**	0.0177	−0.1019**	0.0418	0.0060	0.0224
Dairy	−1.0695***	0.0973	0.0876		−0.2505	0.1789
Fats	−0.1754***	0.0170	−0.1015**	0.0400	0.0001	0.0186
Flour, etc.[a]	−0.2457***	0.0264	0.0162	0.0508	−0.2797***	0.0387
Meat	−0.5269***	0.0395	−0.4861***	0.0911	−0.1982***	0.0723
Biscuits, etc.[b]	−0.3190***	0.0243	−0.2243***	0.0406	−0.2014***	0.0441
Unsaturated fat^2, β_{ij}						
Fish	−0.7023***	0.0658	−0.2910**	0.1479	−0.3635***	0.1079
Dairy	–	–	–	–	–	–
Fats	−0.0027**	0.0011	−0.0326*	0.0182	−0.0178***	0.0055
Flour, etc.[a]	–	–	–	–	–	–
Meat	0.0106	0.0312	−0.1731***	0.0614	−0.1764**	0.0861
Biscuits, etc.[b]	−2.0106***	−0.2007	−1.9908***	−0.1987	−1.7008***	−0.1697
Carbohydrates, α_{ij}						
Fish	−0.0377***	0.0047	−0.0722***	0.0125	−0.0396***	0.0083
Fruit/veg	0.1708***	0.0038	0.1893***	0.0192	0.1205***	0.0070
Dairy	0.4628***	0.0205	1.2029***	0.0559	0.9583***	0.0349
Flour, etc.[a]	0.0232***	0.0038	−0.0591***	0.0128	0.0499***	0.0090
Biscuits, etc.[b]	0.0821***	0.0066	0.0767***	0.0118	0.1208***	0.0177
Carbohydrates, β_{ij}						
Fish	−0.2637***	0.0218	−0.3742***	0.0536	−0.2037***	0.0387
Fruit/veg	−0.7426***	0.0168	−1.0362***	0.0989	−0.2614***	0.0195
Dairy	−8.5125	−10.234	−12.299	−10.234	−8.9643	−10.234
Flour, etc.[a]	−0.0146***	0.0018	0.0156*	0.0087	−0.0131**	0.0062
Biscuits, etc.[b]	−0.1018***	0.0043	−0.1286***	0.0078	−0.1315***	0.0137
Protein, α_{ij}						
Fish	−0.0151	0.0232	0.3235***	0.0542	−0.1004***	0.0376
Fruit/veg	0.1734***	0.0132	0.3040***	0.0408	−0.1142***	0.0253
Dairy	0.1033***	0.0191	0.4691***	0.0450	0.0365	0.0275
Flour, etc.[a]	−0.2733***	0.0178	0.0763	0.0643	−0.5872***	0.0526
Meat	−0.0463***	0.0117	0.0342*	0.0220	−0.2491***	0.0148
Biscuits, etc.[b]	0.0828***	0.0205	0.0349	0.0309	−0.1506***	0.0472
Protein, β_{ij}						
Fish	−0.3540***	0.0670	−1.3643***	0.1574	−0.6347***	0.1172
Fruit/veg	–	–	–	–	–	–
Dairy	−1.5708***	0.0469	−3.0779***	0.1716	−1.4711***	0.0851
Flour, etc.[a]	–	–	–	–	–	–
Meat	−0.0019	0.0023	0.0005	0.0078	−0.0063	0.0060
Biscuits, etc.[b]	−0.0151	0.0232	0.3235***	0.0542	−0.1004***	0.0376

Notes: [a] Includes flour, bread, and cereals.
[b] Includes biscuits, cakes, spreads, and ice cream.

Table C2. Non-Nutritional Consumption Experience Parameters, δ_{jm}

	Less Education		Medium Education		More Education	
	Coeff.	**P>z**	**Coeff.**	**P>z**	**Coeff.**	**P>z**
Beef	0.0486	0.0000	0.0507	0.0000	0.0569	0.0000
Biscuits	0.0296	0.0000	0.0045	0.2240	0.0239	0.0020
Brown bread	0.0155	0.0000	0.0166	0.0000	0.0206	0.0000
Butter	0.0188	0.0000	−0.0137	0.4710	0.0001	0.9960
Cakes	0.0325	0.0000	0.0223	0.0000	0.0312	0.0000
Canned fish	0.0290	0.0000	0.0205	0.0000	0.0304	0.0000
Cereals	0.0280	0.0000	0.0226	0.0000	0.0490	0.0000
Cheese	0.0711	0.0000	0.0245	0.0030	0.0200	0.0010
Crispbread	0.0640	0.0000	0.0611	0.0000	0.0759	0.0000
Eggs	0.0456	0.0000	0.0435	0.0000	0.0506	0.0000
Fish	0.0545	0.0000	0.0468	0.0000	0.0524	0.0000
Flour	0.0114	0.0000	0.0154	0.0000	0.0220	0.0000
Frozen vegetables	−0.0019	0.0000	−0.0005	0.6400	−0.0005	0.5420
Fruit	0.0007	0.0000	0.0000	0.8160	0.0012	0.0000
Margarine	−0.0050	0.0390	−0.0251	0.0230	−0.0184	0.0020
Milk	−0.0015	0.2090	−0.0365	0.0000	−0.0272	0.0000
Other meat	0.0555	0.0000	0.0503	0.0000	0.0780	0.0000
Pasta	0.0233	0.0000	0.0232	0.0000	0.0377	0.0000
Pork	0.0374	0.0000	0.0418	0.0000	0.0463	0.0000
Potatoes	0.0025	0.0000	0.0052	0.0000	0.0045	0.0000
Poultry	0.0309	0.0000	0.0406	0.0000	0.0326	0.0000
Rice	0.0187	0.0000	0.0212	0.0000	0.0277	0.0000
Sliced meat and pâté	0.0913	0.0000	0.1031	0.0000	0.1050	0.0000
Snacks	0.0218	0.0000	0.0191	0.0000	0.0218	0.0000
Sour milk	0.0027	0.0430	−0.0349	0.0000	−0.0247	0.0000
Spreads	0.0267	0.0000	0.0263	0.0000	0.0276	0.0000
Sugar	0.0116	0.0060	0.0062	0.3110	0.0126	0.2560
Sweetened sour milk	0.0004	0.0800	0.0043	0.0000	0.0009	0.0270
Vegetables	0.0056	0.0000	0.0105	0.0000	0.0131	0.0000
White bread	0.0309	0.0000	0.0287	0.0000	0.0457	0.0000