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Consumer preferences for low-salt foods: a Danish case study based on a comprehensive supermarket intervention

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Abstract

Objective: The objective is to analyse Danish consumers' attitudes to buying food with reduced salt content.
Design: The study is based on a comprehensive store intervention that included 114 stores belonging to the same supermarket chain. Three different salt claims were tested for 8 weeks on six test products within the categories bread, cornflakes and frozen pizzas. Scanner data were supplemented with 134 brief interviews with consumers in nine selected stores.
Setting: Stores spread across Denmark.
Participants: Consumers who buy food in the stores.
Results: Statistical regression analyses of the scanner data indicated that none of the three claims significantly affected demand for any of the test products. The interviews confirmed that many consumers were more focused on other elements of the official dietary advice than reduced salt consumption, such as eating plenty of vegetables, choosing products with whole grains and reducing their intake of sugar and fat.
Conclusions: Overall, both the scanner data and the interviews pointed in the same direction, towards the conclusion that salt content is often a secondary factor when Danish consumers make dietary choices.

Keywords
Low-salt foods
Supermarket intervention
Consumer preferences
Food claims
Health promotion

Excessive salt intake has been linked with a number of diseases, including CVD, cancer and high blood pressure[1]. Raised blood pressure is estimated to cause around 12·8 % of all deaths worldwide[2], while CVD is the leading cause of deaths globally[3]. Nutritionists recommend reduced intake of salt[3,4], but in Denmark it is estimated that 90 % of the population still consume too much. Women on average consume roughly 8 g of salt daily, while the intake among men is around 11 g[5]. The official dietary goal formulated by the Nordic Council of Ministers is to reduce the salt intake to about 6 g/d for both women and men[6]. Saha *et al.*[7] calculate that this reduction would save, or delay, 1040 deaths in Denmark each year; they observe that a reduction in salt intake is estimated to have a larger impact on CVD and cancer mortality in Denmark than higher compliance with any other recommendations in the official dietary guidelines, such as increased intake of fruit and vegetables or reduced intake of red meat.

Over the last decade, various initiatives have been proposed at national level to reduce salt consumption. In 2009, the Nordic Keyhole label was launched in Denmark. The Keyhole is a commonly used Nordic label which sets criteria for, among other things, contents of fat, sugar, salt, fibres and whole grains based on shared regulation within the participating Nordic countries. It is voluntary for manufacturers to use the label on products that meet the requirements (https://altomkost.dk/english/#c41068). Advice to consume less salt was added to the official Danish dietary guidance in 2013[8]. In an international perspective, Trieu *et al.*[4] found that seventy-five countries have a national salt reduction strategy. Of these, thirty-one have adopted front-of-pack labelling schemes. However, only twelve countries have reported reductions in the salt intake.

While experts see the health-promoting potential of reducing salt intake, several consumer surveys have shown that such reduction is of secondary importance to many consumers. The Nordic Council of Ministers[9] examined consumer attitudes to food labelling in a quantitative study based on more than 1000 telephone interviews in the five Nordic countries. The analysis showed that Danish consumers generally consider shelf life as the most important piece of information, but that they also attach some

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importance to information concerning the content of nutrients such as salt. Mørk and Grunert[10] examined Danish consumer attitudes to salt in food using a quantitative survey with a choice experiment answered online by approximately 1000 respondents. The study included a supermarket intervention in a single store as well which involved around 200 consumers. The results of the choice experiment indicated that the claim 'Meets the Danish Veterinary and Food Administration's Salt Target' had a positive effect on the likelihood of a meal being chosen. By contrast, the claim 'Reduced salt content' had a negative effect on the purchasing probability. The supermarket intervention was based on two types of intervention: (1) signs on the shelf-edge relating to selected salt-reduced products with the text 'Meets the Danish Veterinary and Food Administration's Salt Target' and (2) information handed out to the consumers about the relationship between salt intake and health. The results indicated no overall effect of the interventions. However, for goods in the 'pleasure category' (e.g., biscuits, chips, cakes and cornflakes) a positive effect of using a combination of the two types of intervention was identified. Many studies have shown that consumers perceive taste and food safety as very important, but that properties such as price and healthiness also are important[11,12]. Since flavour in the food is enhanced by salt, there is a risk that the consumers will perceive the product as less tasty when they see that the salt content is low[13].

In general, previous studies, mainly based on stated preferences or observed shopping trips, have shown that Danish consumers' interest in reducing their salt intake is rather limited. The present study adds to this research field by focusing on the preferences for low-salt products revealed in a daily shopping context. The purpose of the study was to investigate, through analyses of scanner data and in-store interviews, whether claims about salt affect demand for different product types in a large-scale supermarket intervention.

The intervention and methodological approach are described in the 'Materials and methods' section of the paper. The results of the econometric analyses are given in the 'Results' section and then discussed in a broader context in the 'Discussion' section. Finally, conclusions are drawn.

Materials and methods

Materials

Test products and salt claims

The intervention involved six existing low-salt test products within the product categories: pre-packaged rye bread, pre-packaged white bread, pre-packaged spice buns, frozen pizzas and cornflakes. Bread was chosen as a test product, as it is consumed regularly in many homes and thus is a substantial source of salt. Rye bread represented a healthier type of bread that contains nutrients, whole grains and fibres. It is a basic product traditionally used daily for lunch in Denmark. White bread is also consumed daily in many households, while spice buns usually are eaten more occasionally. Pizzas were included to investigate consumer preferences for salt in prepared food with high salt content. The inclusion of cornflakes as a test product enabled us to compare our results with findings recently published by Mørk and Grunert[10]. Cornflakes are also a product often consumed by children. The six food categories figure in the twelve salt priority categories defined by WHO[3].

In the intervention, we tested three salt claims: claim (A) 'Meets the Danish Veterinary and Food Administration's Salt Target', claim (B) 'Meets the Danish Veterinary and Food Administration's Salt Target. Same good taste' and claim (C) 'Meets the Danish Veterinary and Food Administration's Salt Target (followed by the Keyhole logo)'. Claim A was chosen because Mørk and Grunert[10] had found that this claim had a greater effect than 'Reduced content of salt'. To take into account the possibility that consumers are reluctant to choose low-salt products because they fear that the taste will be impaired, we tested claim B, which stresses that the reduced salt content will not affect the taste of the product. Claim C tested the effect of combining the well-known Keyhole label with salt claim A. To avoid overloading the participating consumers with information, we did not combine the text on claim B with the Keyhole label. All test products were in the store's product range and none of them had printed specific salt claims on the packaging.

Table 1 gives an overview of the products and claims included in the intervention. Claim A was tested on all six test products, whereas claim B was tested on five test products. The rye bread was the only test product to be labelled with the Keyhole on its packaging, and it was therefore used to test claim C.

Intervention stores and scanner data

The intervention was carried out in collaboration with the discount chain Lidl (www.lidl.dk). At the time of the intervention, the chain had 114 stores in Denmark, spread across the country. Of these, seventy-six were selected as intervention stores and thirty-eight as control stores. Claim A was tested in half the intervention stores, while claim B and C were tested together in the other half. The three groups of stores were composed so that the stores in each group (1) were spread evenly around the country and (2) represented Lidl's variation with respect to store size. Thus, the aim was to make the three groups as identical as possible in terms of store size and geographical location in order to minimise the risk of bias due to fundamental differences between the groups. Employees of Lidl did the selection of stores as they had the most accurate knowledge about the stores.

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Table 1 Overview of the claims tested on different low-salt product types

Product	Claim A	Claim B	Claim C
White bread	X	X	
Spice buns	X	X	
Rye bread	X		X
Pizza Margherita	X	X	
Pizza Salami	X	X	
Cornflakes	X	X	

Claim A = 'Meets the Danish Veterinary and Food Administration's Salt Target', Claim B = 'Meets the Danish Veterinary and Food Administration's Salt Target. Same good taste' and Claim C = 'Meets the Danish Veterinary and Food Administration's Salt Target (followed by the Keyhole logo)'.

Signs with claims A–C were placed next to the test products in the intervention stores. The signs were designed by Lidl to match price labels and other information in the stores and had two different sizes. The smaller ones (1/18 of an A4 sheet) were placed on shelf fronts; the larger ones (1/3 of an A4 sheet) were placed above the test products. The text on the signs was printed in black on white paper, as shown in Fig. 1 (in Danish). The signs were set up and maintained by employees at the individual Lidl stores.

The intervention took place over 8 weeks (week 37 through week 44) in 2018. Before the intervention period, as a control, the demand for the test products in the absence of the salt claims was measured in all of the stores over 4 weeks (week 33 through week 36). At the start of the intervention, all intervention stores were contacted by telephone (by a Lidl employee) to ensure that the signs were in place. All stores were provided with essential information on the intervention and asked not to rearrange products while the intervention was ongoing.

Lidl provided scanned sales data for the control period and the intervention period for the product groups. The dataset included data on the six test products as well as on all other products within the product categories of pre-packaged bread, frozen pizzas and breakfast cereals. The data were aggregated at store level; they included product ID, total number of units sold each day and daily price. All sales figures provided for analysis were 'blinded', that is, multiplied by an unknown factor that was constant throughout the entire period. Further, information concerning campaigns including the test products, such as price reductions, advertising and the like, was provided. The discount chain ran sales campaigns including rye bread and cornflakes in weeks 36–37 and including both types of pizza in weeks 38–39.

Interviews

In all, 134 short interviews were conducted with consumers in nine intervention stores. These were conducted on weekdays and Saturdays at the beginning of the intervention between 11.00 and 18.00 h. To ensure geographic variation, four of the stores were located in Jutland and five on Zealand, at varying distances from the capital. There

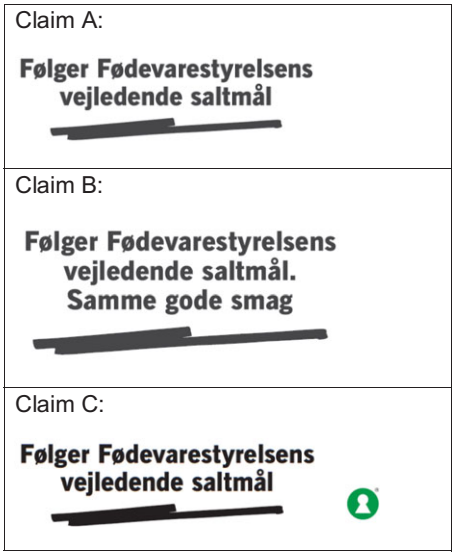

Fig. 1 Signs used to test claims A, B and C. Translation from Danish: Claim A = 'Meets the Danish Veterinary and Food Administration's Salt Target', Claim B = 'Meets the Danish Veterinary and Food Administration's Salt Target. Same good taste' and Claim C = 'Meets the Danish Veterinary and Food Administration's Salt Target (followed by the Keyhole logo)'. Signs were designed by Lidl

was no systematic selection of interviewee consumers, but an effort was made to ensure that the survey included different consumer segments, that is, a roughly equal representation of men and women, different age groups, etc. To allow the consumers to reproduce their thoughts and considerations in choosing products, the interviews were carried out in the relevant departments of the stores. The consumers were approached after they had chosen a product within the test categories (i.e., pre-packaged bread, frozen pizzas or breakfast cereals) and asked for their consent to participate in the survey. As an introduction, all interviewed consumers were informed that the survey concerned habits in relation to salt intake and was being carried out by the University of Copenhagen. To ensure a high rate of participation, the interviews were kept very short; they were designed to last a maximum of 5 min. No incentives to participate were offered.

Methods

The scanner data provided a quantitative measure of observed consumer behaviour in an everyday shopping situation. The interviews contributed information on consumer attitudes and intentions to reduce salt intake in the future. Details on the methods used to analyse these two datasets are provided below.

Scanner data analysis

Regression analysis of scanner data was used to assess whether there were statistical differences in sales of test products in intervention stores and control stores. The analysis was based on a model where the dependent

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variable y_{jit} described the number of units of the test product ($j = 1, \ldots, 6$) sold in store group i ($i = 1, 2$) at time t:

$$\begin{aligned} y_{jit} = {} & \alpha_j + \beta_{1j}\textit{intervention stores}_{jit} \\ & + \beta_{2j}\textit{effect of intervention}(\textit{intervention stores})_{jit} \\ & + \beta_{3j}\textit{effect of intervention}(\textit{control stores})_{jit} \\ & + \beta_{4j}\textit{Sunday}_{jit} + \beta_{5j}\textit{Monday}_{jit} + \beta_{6j}\textit{Tuesday}_{jit} \\ & + \beta_{7j}\textit{Wednesday}_{jit} + \beta_{8j}\textit{Thursday}_{jit} + \beta_{9j}\textit{Friday}_{jit} \\ & + \beta_{10j}\textit{campaigns}(\textit{intervention stores})_{jit} \\ & + \beta_{11j}\textit{campaigns}(\textit{control stores})_{jit} + \varepsilon_{jit} + \rho_j\varepsilon_{jit-1} \end{aligned}$$

where α_j, the β's and ρ_j are the parameters to be estimated. A separate model was estimated for each product and each claim. The variable *intervention stores* takes the value 1 for the entire period for the intervention stores and the value 0 for the control stores. β_{2j} and β_{3j} are included to control for the sales during the intervention. The variable *effect of intervention (intervention stores)* takes the value 1 for the intervention stores during the intervention and the value 0 during the control period. For the control stores, the variable *effect of intervention (intervention stores)* takes the value 0 both during the control period and during the intervention. The variable *effect of intervention (control stores)* takes the value 1 for the control stores during the intervention and the value 0 during the control period. For the intervention stores, the variable *effect of intervention (control stores)* takes the value 0 both during the control period and during the intervention. The parameters β_{4j} to β_{9j} capture the potential effect of the day of the week the shopping is done, that is, Saturday is reference day in the regression. In the regression, parameters β_{10j} and β_{11j} capture the effect of campaigns in the intervention stores and control stores, respectively. The campaigns were identical across the entire retail chain and took place in both the intervention and control stores. The variable *campaigns (intervention stores)* takes the value 1 during the campaign period for the intervention stores and 0 otherwise. Correspondingly, the variable *campaigns (control stores)* takes the value 1 during the campaign period for the control stores and 0 otherwise.

For intervention stores, the parameter β_{2j} expresses the difference in sales during the intervention relative to the control period. The parameter β_{3j} expresses the same difference for the control stores. If there is a statistically significant difference between β_{2j} and β_{3j}, we can conclude that the claims have had a statistically significant effect on sales of test products. This is tested with a Wald test $\beta_{2j} - \beta_{3j} = 0$. To allow for serial correlation, which is often found in times series consumption data, we added an autoregressive component (AR1) for the residuals, $\rho_j\varepsilon_{jit-1}$, and estimate ρ_j.

Analysis of interview data

Descriptive statistics from the interviews were used to support the interpretation of scanner data. The consumers were segmented according to their willingness to purchase the test products. The segment of *positively inclined consumers* had either purchased a test product or indicated that they would consider buying it in the near future. The segment of *negatively inclined consumers*, on the other hand, had not purchased a test product and said they would not consider doing so in the near future. Asking the consumers to indicate why they were positive or negative towards products with a low salt content provided information about the possibilities and challenges of reducing the salt intake.

In addition, we used a logistic regression analysis to identify groups of consumers which tend to think that low salt content is important. In the estimation, the binary dependent variable, y, is the consumer's answer to the question, 'Do you think a low salt content is important for some specific foods?'. Specifically, $y = 1$ if the consumer answered 'yes' while $y = 0$ if the consumer answered 'no' or 'don't know'.

$$y = \alpha + \beta_1\textit{education} + \beta_2\textit{gender} + \beta_3\textit{age group} + \beta_4\textit{store} + \varepsilon$$

In particular, we estimated the relation between answering 'yes' and the following explanatory variables: constant α, consumer level of *education*, including six categories (primary and lower secondary school, upper secondary school, vocational upper, secondary education; vocational education and training, higher education and Other/don't know), *gender* (female, male and intersex), *age group* (18–39 years, 40–59 years, 60 years or older) and *store* in which the interview was conducted (store1–store9). The estimation was performed in SAS 9.4.

Results

Scanner data analysis

Figure 2 shows how many units of the test product were sold on average per day during the control period and the intervention for claims A, B and C. The figures also show the sales in the control stores. The data are blinded, so it is impossible to determine exactly how many units of each product were sold daily. Although the sales figures are unknown, the figures suggest that rye bread was sold in higher volumes than the other five test products.

During the intervention, sales of rye bread, cornflakes and especially pizza tended to rise in both the control and intervention stores. Where the figure suggests that a substantially larger number of pizzas was sold during the intervention, it should be noted that there was a sales campaign promoting pizza during the intervention.

The results from the regression analyses of scanner data are shown in Table 2. For all the tested products, these suggest that the estimated difference between β_2 and β_3 is

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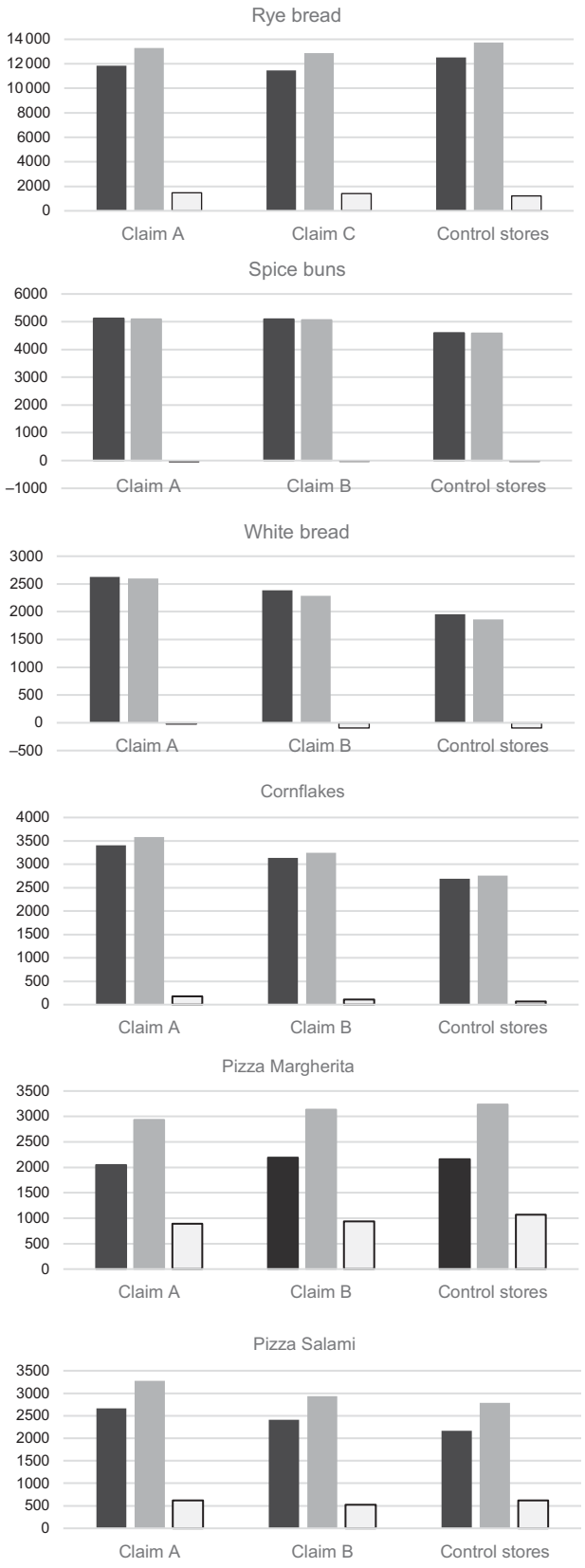

Fig. 2 Average number of packages of the six test products sold per day in intervention stores and control stores. Claim A = 'Meets the Danish Veterinary and Food Administration's Salt Target' (spice buns, white bread, cornflakes, rye bread, Pizza Margherita, Pizza Salami), Claim B = 'Meets the Danish Veterinary and Food Administration's Salt Target. Same good taste' (spice buns, white bread, cornflakes, Pizza Margherita, Pizza Salami) and Claim C = 'Meets the Danish Veterinary and Food Administration's Salt Target (followed by the Keyhole logo)' (rye bread). ■, control period; ■, intervention; □, diff. intervention and control period

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Table 2 Results of regression analysis for claims A, B and C

	Claim A												Claim B										Claim C	
	White bread		Spice buns		Rye bread		Pizza Margherita		Pizza Salami		Cornflakes		White bread		Spice buns		Pizza Margherita		Pizza Salami		Cornflakes		Rye bread	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Constant	2055*	85	6071*	146	15 879*	660	2455*	176	2364*	158	3538*	317	2098*	83	6156*	141	2478*	179	2521*	153	3283*	268	15 261*	639
Intervention stores	663*	90	532*	163	−742	752	−95	210	492*	192	269	424	419*	89	502*	151	33	210	230	184	515	351	−1094	735
Effect of intervention																								
Intervention stores (β_2)	−21	77	−102	140	1710*	632	507*	182	168	166	323	354	−96	77	−119	130	395*	183	166	159	−204	295	1607*	618
Control stores (β_3)	−98	77	−85	139	1347*	632	575*	182	225	166	−237	345	−102	77	−101	130	561*	182	225	159	−78	289	1408*	617
Sunday	−101	78	−1843*	120	−2906*	507	−575*	115	−514*	97	−538*	116	−173*	73	−2041*	127	−543*	125	−650*	98	−404*	112	−2182*	477
Monday	−314*	83	−2383*	133	−4701*	571	−709*	135	−662*	116	−884*	146	−426*	79	−2344*	136	−854*	145	−831*	116	−824*	140	−3849*	542
Tuesday	−341*	84	−2189*	136	−5544*	586	−527*	142	−332*	122	−900*	158	−337*	80	−2263*	137	−503*	151	−572*	122	−735*	151	−4717*	558
Wednesday	−46	84	−1540*	136	−4724*	586	−79	142	−76	122	−797*	157	−71	80	−1700*	137	−59	151	−247*	122	−608*	151	−3939*	558
Thursday	254*	83	−517*	133	−4980*	570	−76	135	371*	115	−549*	145	152	79	−601*	136	−44	145	124	116	−537*	139	−4618*	541
Friday	−129	78	−1564*	119	−4880*	504	−140	114	−1	96	−671*	115	−96	73	−1604*	126	−140	124	−199*	98	−615*	111	−4296*	474
Campaigns																								
Intervention stores					5808*	1006	3136*	274	3377*	243	681	380					4362*	281	3004*	237	657	349	6079*	975
Control stores					6148*	1006	3965*	274	3013*	243	817*	380					3954*	281	3015*	237	861*	349	6034*	975
Rho	0·14	0·08	0·24*	0·08	0·28*	0·07	0·41*	0·07	0·45*	0·07	0·73*	0·05	0·17*	0·07	0·16*	0·08	0·37*	0·07	0·43*	0·07	0·66*	0·06	0·31*	0·07
Wald test mean diff (and *P*-value)†	76·35	0·49	−16·30	0·93	362·51	0·69	−67·56	0·79	−57·56	0·81	559·55	0·27	6·17	0·95	−17·73	0·92	−166·14	0·52	−58·30	0·80	−126·24	0·76	198·87	0·82
Adj. R^2-value	0·66		0·76		0·63		0·82		0·82		0·34		0·50		0·76		0·84		0·82		0·26		0·64	

*Indicates that the estimate is significant at least at 0·05 level. Claim A = 'Meets the Danish Veterinary and Food Administration's Salt Target', Claim B = 'Meets the Danish Veterinary and Food Administration's Salt Target. Same good taste' and Claim C = 'Meets the Danish Veterinary and Food Administration's Salt Target (followed by the Keyhole logo)'.
†Wald test: $\beta_2 - \beta_3 = 0$.

small as compared with the standard error of the β_2 coefficient. The Wald tests also show that treatment effect is strongly insignificant. The most significant effect is found for cornflakes with claim A, with a *P*-value of 0·27. Thus, the regression analyses indicate that the different types of claim did not affect sales in a statistically significant way for any of the products. The regression results also indicate that there was a large difference in sales of test products on different weekdays. Most of the estimated dummy variables for weekdays are statistically significant on a 5 % significance level. Saturday is used as reference day. As the results show, most units of the test products were sold on Saturdays. The variables that capture the effects of sales campaigns are all significant at a 0·05 significance level, except for cornflakes where the effects are significant at a 0·1 significance level. In addition, the result shows that ρ in the autoregressive component $\rho_j \varepsilon_{jit-1}$ is significant in all regression models at a 0·01 significance level, except for white bread where ρ is significant at a 0·1 significance level.

To test the robustness of the results, we also allowed the intervention effects to vary over time, with a unique treatment effect for each week during the 8 week intervention period. This was done by interacting the variables '*effects of intervention (intervention stores)*' and '*effects of intervention (control stores)*' with eight dummy variables, $d_{kt}, k = 1, \ldots, 8$, that each took the value 1 during intervention week k and 0 otherwise. Wald tests were then carried out for $\beta_{2jk} - \beta_{3jk} = 0$, for each separate week $k = 1, \ldots, 8$ for all products and claims. The Wald tests were all strongly insignificant, and no clear pattern emerged among the estimated intervention effects. The Wald test that was closest to being significant (*P*-value = 0·24) was for cornflakes with claim A for week three of the intervention. The intervention effects that are presented in Table 2 thus seem robust. A power analysis for the regression models in Table 2 shows that power for a large effects size is 0·99 (effects size value 0·59), 0·95 for a medium effects size (0·39) and 0·17 for a small effects size (0·14).

Interview data analysis

In total, sixty-three interviews were conducted in relation to purchases of bread, sixty-one in relation to breakfast cereals and eleven in relation to pizza. This unequal distribution across the three categories reflects the number of purchases made. Very few consumers bought frozen pizzas; more bought bread or breakfast cereal.

In total, thirty-nine consumers belonged to the segment of *positively inclined consumers* (i.e., they had either bought a test product or would consider doing so in the near future). Figure 3 shows numbers of consumers agreeing with ten different statements, including 'other reasons' and 'don't know', when asked why they had chosen or would consider choosing a test product.

In total, 109 consumers were categorised as *negatively inclined consumers* (i.e., they had not purchased a test product and said they would not consider doing so in the near future). These consumers were asked: 'Why did you not choose/would not consider choosing the product next to the sign?' They could answer by choosing one or more of nine statements in addition to 'other reasons' and 'don't know'. Approximately two-thirds stated that they bought the item they usually buy instead of the test product. A substantial share indicated that the test product was not the type of product they needed, or that they had 'other reasons' not to buy it. Elaborating on these 'other reasons',

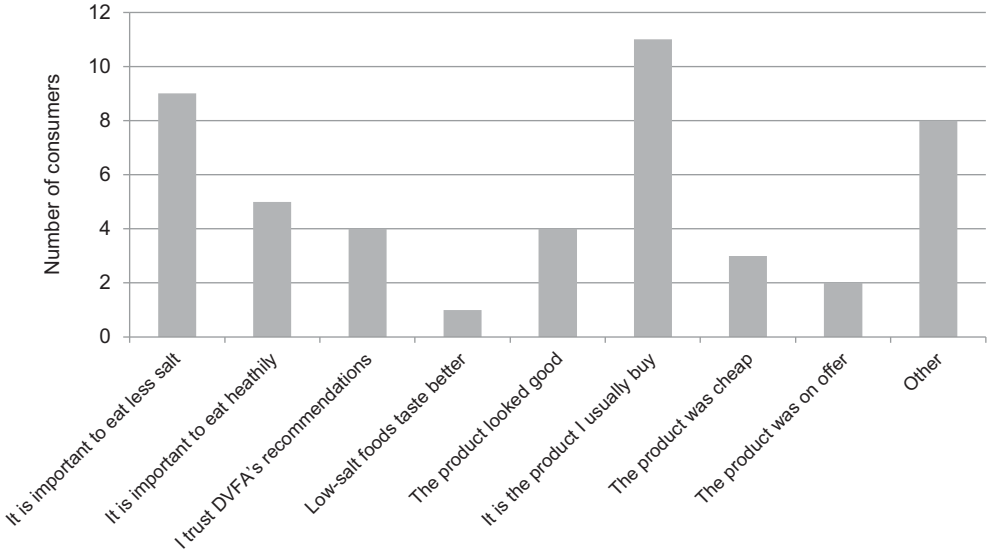

Fig. 3 Answers to the question 'Why did you choose/would you consider choosing the product next to the sign?'. Based on answers from thirty-nine consumers. Some consumers provided several answers. It was possible to answer 'don't know', but no consumers did so. DVFA is an abbreviation for Danish Veterinary and Food Administration

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Table 3 Description of sample and OR estimates based on logistic regression

	Description of sample	Point estimate	
	%	OR	95 % CI
Dependent variable			
Do you think a low salt content is important for some specific foods?			
Yes†	40		
Explanatory variables			
Education (reference: vocational education and training)			
Upper secondary school	10	1·87	0·38, 9·17
Vocational upper secondary education	7	5·20	0·78, 34·53
Primary and lower secondary school	5	0·45	0·05, 3·78
Higher education	40	1·40	0·45, 4·34
Other/don't know	3	0·29	0·02, 4·37
Gender (reference: male/intersex)			
Female	54	3·20*	1·20, 8·55
Age group (reference: 60 years or older)			
18–39 years	45	0·34	0·08, 1·43
40–59 years	36	0·33	0·08, 1·33
Interview store (reference: store9)			
Store1	12	15·00*	1·95, 115·39
Store2	10	25·20*	2·76, 230·45
Store3	13	9·02*	1·26, 64·57
Store4	13	5·98	0·80, 44·59
Store5	7	0·76	0·07, 8·51
Store6	9	1·61	0·19, 13·50
Store7	13	1·20	0·14, 10·25
Store8	15	0·49	0·06, 3·90

*Indicates that the estimate is significant at least at 0·05 level. Based on responses from 134 consumers.
†60 % answered 'No' or 'Don't know'.

some consumers referred to the consideration of their children. In relation to purchases of breakfast cereals, especially, the consumers pointed to children's habits and preferences as factors in their choice. In addition, some consumers emphasised that other product attributes were more important than the salt content, for example, organic production or a high content of whole grains.

The results from the logistic regression as shown in Table 3 suggest that only store and gender affected the likelihood of belonging to the group of consumers which tended to think that low salt content is important. In particular, consumers in store1, store2 and store3 were more likely than consumers in store9 to belong to the group which consider that a low salt content is important. Moreover, women were more likely than men to belong to the group.

Discussion

The scanner data indicated that consumers in the relevant stores were neither more nor less likely to choose products with lower salt content than regular products. This result was supported by the interviews, which indicated that reduced salt intake was of secondary interest to many of the interviewed consumers. Overall, there seems to be a mismatch between our consumers' willingness to reduce their salt intake and expert advice. Thus, while experts see health potentials in reducing salt intake, the importance of their message has not reached most consumers yet. However, it must be emphasised that the results did not suggest that consumers opted out of the salt-reduced products either.

Although the results suggest that some consumers are willing to reduce their salt consumption, the reasons given by these individuals often had little to do with low salt content – for example, they said the product was cheap, was in a small package or had a high wholegrain content. Several consumers also mentioned the importance of eating plenty of vegetables, or that they preferred food products to be organically produced. In short, it emerged that the consumers were often more focused on product attributes other than salt content. This supported the questionnaire responses reported in Mørk and Grunert[10], which indicated that consumers most often look for the organic label, followed by the Keyhole label and the wholegrain label. In addition, our interviews revealed that consumers often buy the goods they usually buy, or what their children prefer. Purchases of breakfast cereals were particularly likely to be dictated by children's preferences. A propensity to make habit-driven purchases was also identified in previous studies conducted by Grunert *et al.*[12] and Aachmann *et al.*[14]. The relatively low priority given to reduced salt content, as compared with other product attributes, underlined that low salt content itself rarely increases demand for a product.

As is always the case with major store interventions, a number of factors may have affected our results. Since the intervention took place over a long period of time, there is an inherent risk of lack of maintenance of the

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intervention and there will inevitably be external factors – for example, a product being temporarily out of stock, or other store campaigns that influence the demand for the test products in some stores. However, given the large number of stores, and granted also the unambiguous indication in the results that the labelling lacked effect, we do not suspect that external factors affected our data. However, we note that the intervention only included one supermarket chain, and that as a result of this the consumers involved in our study are not representative of the Danish population as a whole.

To drive the low-salt message home, it may be necessary to exert greater pressure on consumer preference through, for example, information campaigns focusing on the health consequences of consuming too much salt. This is complicated by the fact that consumer analysis clearly shows that consumers are heterogeneous and are prompted to change their behaviour through different types of information. While certain consumer groups request product information and use it when choosing products, other groups have limited-to-zero interest in information and labels and base their choices on factors signalled otherwise than through these[15]. Recent Nordic research shows that the latter group can be sizeable, and that the most important factor in not attending to new information is lack of interest rather than lack of understanding[16,17]. To put it another way, there is an inclination gap, not a knowledge gap. This suggests that it may not be easy to alter consumer preferences through information, and that certain consumer groups may be very difficult to reach. In an international study of consumers in Germany, Austria, Brazil, Hungary, India, China, South Africa and the USA, Newson *et al.*[18] found that salt reduction was seen as healthy and important, but that over a third of participants were not interested in salt reduction and the majority were unaware of the salt intake recommendations. In addition, Newson *et al.*[18] concluded that people were unaware of the main dietary sources of salt.

In this context, it is worth noting that only a relatively small proportion of the total food salt is added by consumers when food is prepared at home. Often, more extensive efforts are therefore needed to reach the recommended targets for salt reduction. One approach would obviously be for the food industry to reduce salt content in their products through reformulation. Voluntary initiatives of this kind have been seen in the UK and Finland[3,4]. South Africa was the first country to implement legislation on salt levels in a range of processed foods[19]. Perhaps lessons can be learned from calorie reduction here. Jensen and Sommer[20] examined the effects of reformulation in eight products in a Danish supermarket chain leading to reductions in calorie content of 2–17 %. The changes were made without informing consumers. Their results showed that there was a general decrease in the number of 'sold' calories, while revenues were affected to a lesser extent. It can be questioned whether these results can be translated to the salt case. Webster *et al.*[21] concluded that successful strategies to reduce salt intake have been multifaceted and tend to include food reformulation, consumer awareness initiatives and labelling.

A reduction in salt intake may depend upon a gradual process of adaptation, where the consumer slowly develops a preference for a lower salt content. Willems *et al.*[22] tested long-term liking of regular and reduced salt soups and found no significant difference in liking of the soups when consumed at home. In contrast, the reduced salt soups were less liked than the regular soup when consumed in a central location test. If preferences for a lower salt content develop slowly, reformulation will have the greatest effect if it occurs across a larger part of the total diet and not just individual products. One of the challenges of extensive product reformulation is that producers lack incentives to take it on. While there may be some value in terms of a producer's corporate social responsibility, negative expectations about the taste of low-salt products among consumers may make it risky for the producer to highlight such reformulation in the context of marketing. Thus, negative expectations may be a barrier to producer-driven developments in low-salt products unless a more coordinated effort can be initiated among the producers. Another obstacle to gradual, corporate social responsibility-based change in salt levels is that legislation dictates how extensive the reduction in salt must be before producers can highlight the reduction for marketing purposes[23]. Another way in which consumers can reduce their salt intake is by cutting their consumption of products in specific food product groups associated with high salt content. However, this strategy may make it necessary to compromise on other desirables, as it may well be that some relatively salty products contain high quantities of dietary fibre – rye bread could be an example here.

Given the lack of consumer interest in buying low-salt products, together with the relatively limited effect of reducing salt consumption at home, our analysis suggests that there is a need for further action if salt intake is to be effectively reduced.

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carrying out of study, analysis of data and writing of article. T.C. has contributed to design of study and writing of article. *Ethics of human subject participation:* Parts of the study are based on very brief verbal interviews with customers in the stores. The customers were completely anonymous and data cannot be linked to specific individuals. All questions concerned general information which were not of a sensitive nature. As a consequence, no ethical approval of the interview guide has been made. As customers were anonymous, consent was inferred by willingness to participate.

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