

# Salt content in canteen and fast food meals in Denmark

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## Abstract

**Background:** A high salt (=NaCl) intake is associated with high blood pressure, and knowledge of salt content in food and meals is important, if the salt intake has to be decreased in the general population.

**Objective:** To determine the salt content in worksite canteen meals and fast food.

**Design:** For the first part of this study, 180 canteen meals were collected from a total of 15 worksites with in-house catering facilities. Duplicate portions of a lunch meal were collected from 12 randomly selected employees at each canteen on two non-consecutive days. For the second part of the study, a total of 250 fast food samples were collected from 52 retail places representing both city (Aarhus) and provincial towns. The canteen meals and fast food samples were analyzed for chloride by potentiometric titration with silver nitrate solution, and the salt content was estimated.

**Results:** The salt content in lunch meals in worksite canteens were  $3.8 \pm 1.8$  g per meal and  $14.7 \pm 5.1$  g per 10 MJ for men ( $n = 109$ ), and  $2.8 \pm 1.2$  g per meal and  $14.4 \pm 6.2$  g per 10 MJ for women ( $n = 71$ ). Salt content in fast food ranged from  $11.8 \pm 2.5$  g per 10 MJ (burgers) to  $16.3 \pm 4.4$  g per 10 MJ (sausages) with a mean content of  $13.8 \pm 3.8$  g per 10 MJ.

**Conclusion:** Salt content in both fast food and in worksite canteen meals is high and should be decreased.

Keywords: catering; salt intake; meals; canteen meals; burgers; pizzas; sausages; salt

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An association between salt (=NaCl) intake and blood pressure has been reported in many epidemiological studies (1). Furthermore, some recent studies have shown that high salt intake is independently associated with increased risk of cardiovascular disease (2). Besides this, high salt intake may be a risk factor for other diseases like stomach cancer and have a negative effect on calcium and bone mineral metabolism.

The intake of salt in many countries is far above the recommended intake. In most European countries the salt intake ranges from 9 to 12 g per day in men and 7 to 9 g per day in women (3). The recommended intake differs from country to country, but most countries recommend 5–6 g per day at least as a long-term goal. In Denmark the recommended intake is 6 g per day for women and 7 g per day for men, with the long-term goal of 5–6 g per day (4).

The growing interest in the role of salt intake for disease prevention increases the need for strategies to reduce the salt intake in a population. It is necessary to know the important sources of salt in the diet. A recent Danish study showed that the intake of household salt is very low and most salt are derived from other sources (5).

The catering industry has a great responsibility to provide nutritious food to the consumers, but also in influencing perceived norms regarding eating behavior (i.e. change preference for salty food). Moderate reduction of dietary salt has been demonstrated to decrease preference for salty food (6).

Like in many other countries the intake of fast food meals has increased in Denmark since the 1970s (7). Salt intake has been found to be higher among women classified as having a fast food eating pattern compared with women with other eating patterns (8).

The aim of this study was to determine the salt content in fast food and worksite canteen meals.

## Methods

### *Worksite canteen meals*

The study sample consisted of 180 canteen meals as described earlier (9). The recruitment took place in two steps. A total of 23 worksites with in-house catering facilities representing both city (Aarhus) and smaller towns all situated in Jutland, were asked to participate in a survey describing the menus and serving system in the canteen. The worksites were selected randomly from a central national register. Worksite information was obtained on number of meals served, occupation (physically exacting to sedentary work), sex distribution, and canteen serving system to make sure that the final distribution would match the country as a whole. Two worksites refused to participate because of lack of time and one worksite was excluded to match the desired average distribution. A total of 20 worksites agreed to participate. Afterwards, the 20 worksites were asked to participate in the present study focusing on individual canteen food intake. Five of the 20 worksites refused to participate with the following reasons: lack of time (three worksites) or concerns of the employees' reaction to the study (two worksites). Eight of the worksites that agreed to participate mainly served buffet style and seven of the worksites served à la carte line. Data collection took place between February and November 2004.

The double portion technique with subsequent chemical analysis was used to quantify actual lunch intakes at the worksite canteens. Duplicate portions were collected from a total of 12 customers at each canteen on two different days (six samples per day). Employees were asked at random to participate in the study, and in average two persons at each canteen rejected to participate. Identical duplicate portions of the employees' selected food were collected by laboratory technicians. All items of the meal including bread, spread, fruit, dessert, etc. were sampled. However, beverages were not included in the analysis.

After the employees finished eating their lunch, they were asked to return the plates to the technicians in order to record/subtract plate waste. Salt added at the table was not included. The duplicate portions were individually mixed and homogenized in a Grindomix type GM200 (Retch).

### *Fast food*

Fast food was defined as food that can be eaten without the use of knife and fork. Before the data collection was carried out, a survey was performed to study the consumption of various kinds of fast food in Denmark, and the result of this survey was used to plan the data

collection to be representative for the consumption of fast food in Denmark.

Fast food samples were collected from 52 retail places representing both city (Aarhus) and provincial towns, including pizzerias, major burger chain restaurants, outlets selling fast food, hot-dog stands, kiosks, and petrol stations. A total of 250 samples were collected in the period February 2004 to June 2005. The samples were subdivided into seven groups of fast food and further divided into 45 different subgroups. The seven main groups were: burgers, sandwiches, pitas, durum rolls, sausages, grilled meals, and pizzas.

Three items of each of the 250 fast foods were collected, weighed separately, then mixed and homogenized in a Grindomixer (Retsch) and kept in plastic bags at  $-18^{\circ}\text{C}$  until analysis. Moreover, one sample of each fast food was separated and all components were weighted.

### *Analyses*

Chloride content was determined and salt content was estimated by multiplying with 1.648. The chloride ion concentration was determined by potentiometric titration with silver nitrate solution, and salt content was estimated from the chloride content.

Analyses of the content of protein, fat, and ash were performed according to procedures given by the Nordic Committee on Food Analysis (10–12). Dry matter content was determined by drying in a vacuum oven at  $70^{\circ}\text{C}$  to constant weight. Carbohydrate and energy content were calculated from contents of dry matter, protein, fat, and ash (13).

### *Calculations*

Canteen meals were categorized into four groups: (1) hot meals, (2) sandwiches (mainly open sandwiches), (3) salad, or (4) a combination of hot meals/sandwiches and salad/fruit/snack vegetables.

As some fast food is eaten as combo menus with a combination of e.g. sausages and bread, ketchup, mustard, burger in combination with chips, etc., the salt content of typical menus was calculated. Condiments were not analyzed. The calculations were made by using food composition table values (14) for the salt content and the analyzed value for the main part of the meal. The weight of the condiments used in the calculation was determined as described above. It was not possible to give standard deviations for the salt contents in meals as these are calculated values.

### *Statistics*

Results are given in mean  $\pm$  SD. Comparisons of salt content in meals between men and women, and between

**Table 1.** Salt intake in meals eaten in worksite canteens (mean  $\pm$  SD)

	Men (n = 109)	Women (n = 71)	All (n = 180)	p-value*
Salt intake (g per meal)	3.8 $\pm$ 1.8	2.8 $\pm$ 1.2	3.4 $\pm$ 1.6	<0.001
Salt intake (g per 100 g)	1.0 $\pm$ 0.3	0.9 $\pm$ 0.4	1.0 $\pm$ 0.4	0.044
Salt intake (g per 10 MJ)	14.7 $\pm$ 5.1	14.4 $\pm$ 6.2	14.6 $\pm$ 5.5	0.498

\*Difference between genders.

**Table 2.** Salt intake from various meal options eaten in worksite canteens (mean  $\pm$  SD)

	Hot meals (n = 42)	Sandwiches (n = 32)	Salad (n = 20)	Combination (n = 86)
Salt intake (g per meal)	4.3 $\pm$ 1.9	3.1 $\pm$ 1.2	1.9 $\pm$ 0.9*	3.4 $\pm$ 1.5
Salt intake (g per 100 g)	1.1 $\pm$ 0.4	1.2 $\pm$ 0.3	0.6 $\pm$ 0.3*	0.9 $\pm$ 0.3
Salt intake (g per 10 MJ)	16.1 $\pm$ 6.4	13.0 $\pm$ 3.8	10.8 $\pm$ 4.8*	15.3 $\pm$ 5.4

\*p < 0.05 compared with the other meal options.

different kinds of meals were done using students *t*-test. Data processing was done with SPSS version 14.0 (Chicago, IL, USA).

## Results

The salt content in lunch meals in worksite canteens is shown in Table 1. The intake is higher in men compared with women when given as gram per meal, but there was no gender difference per energy unit.

Of the 180 meals, 109 (61%) had a salt content at or below 1.0 g per 100 g. Eleven (6%) of the meals had a salt content at or below 7 g per 10 MJ. Five (3%) of the meals had a salt content equal to or more than the recommended daily salt intake of 7 g.

The salt content in various canteen meals is given in Table 2, per 100 g, per portion, and per 10 MJ. The salt content in salad was significantly lower than the salt content in other meal types when expressed in all three ways, but no significant differences were found between salt content in the other meal types with mean salt content ranging from 13.0 to 16.1 g per 10 MJ.

The salt content in various groups of fast food is given in Table 3. Table 4 shows the salt content in selected subgroups of fast food. In only 17 (7%) of the fast foods was the salt content below 7 g per 10 MJ. Mean content per 10 MJ ranged from 12.2 to 16.1. Salt content in some commonly eaten complete fast food meals were estimated to range from 4.4 to 9.1 g per meal or 7.7 to 21 g per 10 MJ (Table 5).

## Discussion

This study shows that the salt content in both worksite canteen meals and fast food is high compared to the recommended daily intake. When expressed as g salt per

10 MJ, the mean salt content in canteen meals was generally even higher than the salt content in fast food.

The present study shows that a single canteen meal may provide more than half of the daily recommended amount of salt and that some meals even contain more than the daily recommended amount. Although only few studies have assessed salt content in canteen meals, a high content of salt seems to be a general finding. A study from France (15) found a mean content of 3.4 g salt in lunch meals from various catering establishments. Likewise, a recent Belgian study found a salt content of 3.1 g in lunch meals consumed at Ghent University (16). Both these results were similar to ours. Salt added at the table was not included in any of the studies.

If the mean amount of salt in the lunch meal is extrapolated to a daily intake, it would be 14.6 g per day for a person consuming 10 MJ. This is a very high value compared to the recommended long-term goal of

**Table 3.** Salt content in various kinds of fast food (mean  $\pm$  SD)

	Salt content (g per 100 g)	Salt content per 10 MJ (g per 10 MJ)
Burgers (n = 36)	1.15 $\pm$ 0.27	11.8 $\pm$ 2.5
Pitas (n = 20)	0.86 $\pm$ 0.24	12.2 $\pm$ 3.4
Pizzas (n = 33)	1.71 $\pm$ 0.53	15.0 $\pm$ 4.8
Sausages (n = 28)	2.02 $\pm$ 0.58	16.3 $\pm$ 4.4
Sandwiches (n = 72)	1.31 $\pm$ 0.27	13.5 $\pm$ 2.8
Durum rolls (n = 4)	1.29 $\pm$ 0.27	13.6 $\pm$ 3.7
Grilled meals (n = 57)	1.20 $\pm$ 0.49	10.9 $\pm$ 5.5
All (n = 189)	1.36 $\pm$ 0.51	13.1 $\pm$ 4.4

**Table 4.** Salt content in selected types of fast food (mean  $\pm$ SD)

	Food amount (g per portion)	Energy content per portion (kJ per portion)	Salt content per portion (g per portion)	Salt content per 10 MJ (g per 10 MJ)
Burger with meat, small ( $n=6$ )	173 $\pm$ 67	1,558 $\pm$ 406	1.8 $\pm$ 0.4	11.8 $\pm$ 1.0
Burger with meat, big ( $n=6$ )	342 $\pm$ 64	3,363 $\pm$ 752	3.4 $\pm$ 1.2	10.0 $\pm$ 3.0
Burger with meat/bacon/cheese ( $n=4$ )	382 $\pm$ 40	3,768 $\pm$ 473	4.9 $\pm$ 1.1	12.9 $\pm$ 1.8
Sandwich with chicken/bacon ( $n=4$ )	304 $\pm$ 37	2,680 $\pm$ 524	4.4 $\pm$ 1.5	16.0 $\pm$ 2.8
Sandwich with egg/shrimps ( $n=4$ )	280 $\pm$ 20	2,213 $\pm$ 82	3.1 $\pm$ 0.7	14.0 $\pm$ 2.5
Sandwich with kebab ( $n=4$ )	300 $\pm$ 28	2,750 $\pm$ 287	3.5 $\pm$ 0.2	12.8 $\pm$ 1.4
Pitas with kebab ( $n=4$ )	274 $\pm$ 51	1,963 $\pm$ 217	2.4 $\pm$ 0.5	12.0 $\pm$ 1.5
Pitas with chicken ( $n=4$ )	383 $\pm$ 163	2,805 $\pm$ 1,532	3.8 $\pm$ 2.4	13.8 $\pm$ 3.6
Pitas with salad ( $n=4$ )	262 $\pm$ 38	1,690 $\pm$ 297	1.6 $\pm$ 0.4	9.5 $\pm$ 2.2
French hot dog ( $n=4$ )	156 $\pm$ 9	1,875 $\pm$ 182	2.9 $\pm$ 0.1	15.6 $\pm$ 1.6
Hot dog ( $n=4$ )	184 $\pm$ 36	1,987 $\pm$ 332	2.9 $\pm$ 0.7	14.7 $\pm$ 1.9
Pizza pepperoni ( $n=4$ )	414 $\pm$ 40	5,608 $\pm$ 662	8.2 $\pm$ 2.2	15.0 $\pm$ 5.0
Pizza, vegetarian ( $n=4$ )	548 $\pm$ 112	5,223 $\pm$ 1,489	7.6 $\pm$ 2.6	14.7 $\pm$ 4.7
Pizza with meat/fish ( $n=4$ )	586 $\pm$ 106	5,683 $\pm$ 731	11.3 $\pm$ 4.3	19.5 $\pm$ 6.6

5–6 g per day. The extrapolation assumes that the salt content per MJ is similar in all meals consumed during the day. This does not have to be true. Beverages, for instance, contain very little salt. The hot meals had the highest salt content, whereas salad had the lowest. Thus, if a hot meal is consumed both as lunch and dinner then the daily salt intake is expected to be even higher than the extrapolated mean intake of 14.6 g per day and the opposite must be true if mainly salad meals are consumed. The salt content in breakfasts have not been investigated, but is expected to vary according to the kind of food eaten; some breakfast cereals, e.g. corn flakes have a high salt content whereas others, e.g. oat have a very low content (13).

A limit at 1.0 g salt per 100 g has been set for the use of Keyhole labeling (a label which emphasizes the better choice within a food group) for ready-prepared dishes in Denmark (17). More than half (61%) of the worksite canteen meals was at or below this limit. However, the limit seems rather high as one meal with a content of 1.0 g salt per 100 g can provide an amount close to the daily recommended intake. Expressed per energy unit, the content of salt is very high in the worksite canteen meals.

In order to reach the recommendation of salt intake, salt intake from all sources must be reduced including meals consumed within and outside the homes. To our knowledge, no intervention studies with focus on salt

**Table 5.** Salt content in fast food meals

	Food amount (g per meal)	Energy content per meal (kJ per meal)	Salt content per meal (g per meal)	Salt content per 10 MJ (g per 10 MJ)
Sausage with bread, ketchup, mustard, and remoulade	233	2,473	4.7	19
Sausage with bacon, bread, ketchup, mustard, and remoulade	296	3,184	6.3	20
Fillet of fish, two pieces with chips, remoulade, and lemon	450	5,687	4.4	7.7
Spring rolls with soy sauce, mixed salad, creme fraiche dressing	366	3,083	6.5	21
Kebab mix with raw onions, dressing, and mixed salad	450	5,598	5.9	10.5
Half grilled chicken with chips, remoulade, ketchup, and cucumber salad	635	6,536	7.8	11.9
Chicken nuggets with sweet-sour sauce, chips, bread, and mixed salad	531	5,098	9.1	17.9

intake has been carried out in worksite canteens. A study that focused on fat and salt content in school cafeterias (18) found at follow up among the 88 participating schools that none reached the goal of less than 2.5 g salt in a lunch meal, although they have paid attention on several guidelines to lower salt intake (18).

No data exist for the number of persons eating a meal daily in a worksite canteen in Denmark. Fast food is eaten frequently in many countries and the frequency of fast food use has increased dramatically since the 1970s (7). In Denmark, the intake of fast food among 4–18-year old boys and girls has increased from 1995 to 2004 (19, 20), and the actual intake in the group 15–18-year old is a little above 100 g a day. The present study shows, not surprisingly, a high content of salt in fast food meals. Thus, a pizza meal, for instance, can provide up to twice the recommended daily intake.

In the USA it has been found that the intake of salt was significantly higher among individuals who eat fast food regularly than among individuals who don't eat fast food (20). Likewise, a study found that salt intake was significantly higher among young women who were classified as having a fast food eating pattern than among women classified with other eating patterns (8). In contrast, no difference in salt intake was found between a day when fast food was eaten and a day fast food was not eaten in another USA study (21). Fast food consumption has been related to higher energy intake, overweight, and poor diet quality (22), and the risk of hospital admissions for acute coronary heart disease was higher in regions with greater numbers of fast food services than in regions with few (23). The reason why fast food is regarded as unhealthy is mainly the high content of fat, trans fatty acids and energy, and the high salt content is another reason why fast food in general is an unhealthy choice.

*In conclusion*, the content of salt is high in both canteen meals and fast food. If the recommendation for salt intake should be reached it is necessary to lower the salt content in these meals.

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The authors have no conflicts of interest and did not receive any funding or benefits from industry to conduct this study.

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