

Sodium Levels in Canadian Fast-food and Sit-down Restaurants

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ABSTRACT

OBJECTIVE: To evaluate the sodium levels in Canadian restaurant and fast-food chain menu items.

METHODS: Nutrition information was collected from the websites of major sit-down (n=20) and fast-food (n=65) restaurants across Canada in 2010 and a database was constructed. Four thousand and forty-four meal items, baked goods, side dishes and children's items were analyzed. Sodium levels were compared to the recommended adequate intake level (AI), tolerable upper intake level (UL) and the US National Sodium Reduction Initiative (NSRI) targets.

RESULTS: On average, individual sit-down restaurant menu items contained 1455 mg sodium/serving (or 97% of the AI level of 1500 mg/day). Forty percent of all sit-down restaurant items exceeded the AI for sodium and more than 22% of sit-down restaurant stir fry entrées, sandwiches/wraps, ribs, and pasta entrées with meat/seafood exceeded the daily UL for sodium (2300 mg). Fast-food restaurant meal items contained, on average, 1011 mg sodium (68% of the daily AI), while side dishes (from sit-down and fast-food restaurants) contained 736 mg (49%). Children's meal items contained, on average, 790 mg/serving (66% of the sodium AI for children of 1200 mg/day); a small number of children's items exceeded the children's daily UL. On average, 52% of establishments exceeded the 2012 NSRI density targets and 69% exceeded the 2014 targets.

CONCLUSION: The sodium content in Canadian restaurant foods is alarmingly high. A population-wide sodium reduction strategy needs to address the high levels of sodium in restaurant foods.

KEY WORDS: Sodium; restaurants; fast foods; Canada

La traduction du résumé se trouve à la fin de l'article.

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High dietary sodium intake, a causal risk factor for hypertension,¹ is the leading preventable risk factor for death worldwide.² Sixty-two percent of strokes and 49% of coronary heart disease are attributed to hypertension.³ While it is recommended that individuals should aim to consume around 1500 mg of sodium and no more than 2300 mg each day,⁴ the average Canadian currently consumes 3400 mg per day.⁵ Reducing Canadians' dietary sodium intake by 1800 mg/day has been estimated to result in an annual health care savings of \$2.33 billion.⁶

Seventy-seven percent of dietary sodium is derived from processed and restaurant foods.⁷ Hence, eating out has been shown to be associated with higher dietary sodium intakes.⁸ On any given day, approximately 25% of Canadians eat something prepared in a fast-food outlet and an additional 21% eat something prepared in a sit-down restaurant, cafeteria or other food venue.^{9,10} In response to this situation, Canada's Sodium Working Group created a plan to track sodium reductions;¹¹ however, the Federal Health Minister prematurely disbanded the sodium working group before it could establish the sodium monitoring system. Furthermore, in 2011 the Federal Health Minister rejected the sodium reduction monitoring plan proposed by federal and provincial officials.¹² With these setbacks, the current sodium levels in Canadian restaurant foods remain unknown.

In the US, the National Salt Reduction Initiative (NSRI) was the first to develop voluntary targets for sodium reduction in restaurant foods.¹³ However, there have been no published analyses

examining the current sodium levels in relation to these targets. Therefore, considering the prevalence of eating outside the home,⁹ as well as the pervasiveness of hypertension and its associated health risks,¹⁴ characterizing the sodium content of food items from sit-down and fast-food restaurants is exceedingly important. Furthermore, because of the lack of progress towards reducing sodium levels in Canadian restaurant foods, a comprehensive baseline assessment of current sodium levels in restaurant foods is necessary in order to create reformulation strategies and to monitor progress.

The objective of this study was to systematically evaluate the sodium levels in a wide variety of meal items, baked goods, side dishes and children's items from Canadian sit-down and fast-food restaurants. Sodium levels were evaluated in relation to the AI (daily adequate intake level, 1500 mg per day) and UL (daily tolerable upper intake levels of 2300 mg per day);⁴ in addition, the number of restaurants that exceeded the NSRI targets was determined. We

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Table 1. Sodium Levels in Canadian Sit-down Restaurant Menu Items Compared to the Daily Dietary Reference Intake (DRI) Recommendations

Food Category	n	Sodium Levels per Category per Serving (mg/serving)								% of Menu Items Exceeding the Daily Sodium DRI Levels†	
		Mean±SD	%AI*	Min	10 th Percentile	25 th Percentile	50 th Percentile	75 th Percentile	Max	AI: 1500 mg	UL: 2300 mg
Stir fry entrées	22	2360±1102	157	687	840	1705	2210	2922	4380	77	45
Sandwiches/wraps	164	1826±928	122	170	850	1223	1612	2270	6523	57	23
Ribs	29	1775±1031	118	320	520	1040	1430	2090	4599	45	24
Pasta entrées (including meat/seafood)	111	1760±799	117	380	840	1150	1570	2260	4940	56	23
Multiple-meat and/or seafood entrées	27	1746±918	116	495	760	1030	1557	1997	4000	59	11
Tacos/burritos	12	1530±455	102	941	971	1244	1430	1780	2330	42	8
Hamburgers	65	1517±568	101	733	940	1140	1412	1810	3880	40	8
Breakfast	120	1473±670	98	210	625	1014	1355	1932	3180	43	13
Pasta (just containing sauce/cheese)	75	1411±644	94	439	750	880	1310	1700	3360	35	12
Salads with meat/seafood	96	1242±584	83	110	590	849	1191	1536	3243	28	3
Chicken entrées	57	1130±682	75	127	310	680	980	1540	3210	26	7
Seafood entrées	50	939±736	63	119	196	306	755	1260	2980	24	6
Beef entrées	79	889±751	59	55	160	311	700	1300	3780	18	5
Salad entrées	44	856±448	57	170	301	544	812	1130	2260	7	0

* Mean sodium level in category, expressed as a percentage of the daily adequate intake (AI) for adults (1500 mg per day) as defined by the Institute of Medicine (IOM).⁴

† Percentage of products in the category that exceeded the daily adult AI (1500 mg/day) or UL (2300 mg/day) per serving.

hypothesize that sodium levels in food from restaurant and fast-food chains will be high and may exceed the daily recommended intake levels.

METHODS

Database construction

This study was a systematic, cross-sectional survey of sodium levels in Canadian restaurant foods. Using the 2010 Directory of Restaurant and Fast-Food Chains in Canada,¹⁵ 172 fast-food and sit-down restaurants were identified as having 20 or more locations nationally. The website of each of these restaurants was visited in order to determine if nutrition information was available online or if the restaurants indicated that information was available in-store. When an establishment had a .ca and .com web-address, data were derived from the .ca address. In total, 95 establishments provided nutrition information online. Of the top 50 restaurants (according to number of locations),¹⁵ 42 (84%) provided nutrition information online and thus were included in the study. Restaurants that were not included due to lack of data tended to be smaller chains. Of the total 95 restaurants, 4 were excluded because their data were specific to the US, 3 were excluded because they were coffee shops that only provided data for a limited number of generic beverages, and 1 cafeteria supplier was also excluded. Data were collected between September and December 2010 (with the exception of 4 establishments, whose data were retrieved in early 2011). In total, over 9,000 food items from 65 fast-food restaurants (FFR) (including fast-casual and coffee shops) and 20 sit-down restaurants (SDR, defined by the presence of table service) were included in the database. Most establishments provided data for the 13 nutrients commonly found on the Nutrition Facts Table as well as calories and serving size. Food items were categorized according to the establishment and sub-categorized according to the type of food, as well as whether the food was considered a side dish, main entrée including side dishes, main entrée without side dishes, or single items that could be purchased individually. When necessary, establishments were contacted via phone and/or e-mail to verify categorizations. To ensure that the

data were entered accurately by the first author, sodium levels were compared to the original website sources. In addition, sort and rank procedures were used to check for outliers, 5% of the database was checked by a third party, and calculations were done using Atwater Factors to check for potential errors. When necessary, establishments were contacted to confirm suspicious outliers. Further details concerning the food categories and a list of establishments included in this study have been described elsewhere.¹⁶

Exclusion and inclusion criteria

Food categories containing 10 or more items were included, with the exception of: children's meal categories, in which all categories containing 3 or more items were included, and side dishes, in which categories with 8 or more items were included. In total, the analysis included 20 SDR and FFR categories, 5 baked-good categories, 14 side-dish categories and 19 children's meal categories. Side dishes, main entrées without side dishes, and single items that can be purchased individually were included in the analysis, while main entrées including side dishes were excluded, as were beverages, appetizers and condiments. When items were available in multiple sizes, all sizes were included. As a result, a total of 4,044 food items were included in the study. Frozen dessert and beverage categories were not reported as these foods are not common sources of sodium.

NSRI targets

Foods were compared to the US NSRI targets because restaurant sodium reduction targets or guidance values have not yet been established in Canada. The NSRI targets were set in 2009 and provide recommendations for sodium reductions per serving and per 100 g, referred to as "serving targets" and "density targets", respectively. Targets that were established for 2012 and 2014 were used to benchmark the current levels in Canadian restaurants. The density targets recommended a mean sodium per 100 g for all items in each food category at each establishment. These were based on a percent reduction from the market share-weight mean sodium density (calculated using the restaurant's total sales volume as of 2008) in 25 different food categories. Serving targets were also set for the

Table 2. Sodium Levels in Canadian Fast-food Restaurant Menu Items Compared to the Daily Dietary Reference Intake (DRI) Recommendations

Food Category	n	Sodium Levels per Category per Serving (mg/serving)								% of Menu Items Exceeding the Daily Sodium DRI Levels†	
		Mean±SD	%AI*	Min	10 th Percentile	25 th Percentile	50 th Percentile	75 th Percentile	Max	AI: 1500 mg	UL: 2300 mg
Meal items											
Stir fry entrées	38	1953±312	130	1396	1673	1695	1953	2090	2740	95	18
Poutine/fries with toppings	51	1547±680	103	610	650	990	1380	2090	2760	41	18
Nachos	10	1402±878	93	435	493	600	1313	2108	3100	40	10
Tacos/burritos	144	1322±304	88	304	440	682	1207	1742	3996	33	10
Sandwiches/wraps	611	1287±595	86	46	625	862	1200	1565	3600	28	8
Salads with meat/seafood	116	1282±405	85	380	830	953	1208	1539	2313	29	1
Hot dogs	20	1158±268	77	810	835	880	1124	1390	1618	5	0
Hamburgers	81	1131±366	75	510	680	850	1150	1400	2300	12	1
Sushi	23	790±239	53	380	490	680	710	940	1355	0	0
Stir fry entrées (low sodium/no sauce)	63	790±381	53	26	307	440	850	1110	1510	0	0
Chicken	65	733±392	49	0	250	430	690	960	1850	4	0
Salad entrées	51	732±383	49	50	355	484	637	900	1945	8	0
Breakfast items	219	713±427	48	0	250	420	620	960	2240	6	0
Pasta entrées	32	675±317	45	200	320	432	635	820	1360	0	0
Pizza (one slice of a medium pizza)	369	475±213	32	180	270	340	430	560	1740	0	0
Baked goods											
Muffins	117	423±171	28	80	240	330	387	507	1110	0	0
Other baked goods (tea biscuits, brownies, tarts, scones, loafs)	63	383±270	26	45	110	180	310	530	1090	0	0
Donuts	95	326±133	22	41	220	255	286	360	997	0	0
Pastries	31	307±93	21	95	170	240	320	360	510	0	0
Cookies	73	179±101	12	70	100	120	140	200	630	0	0

* Mean sodium level in category, expressed as a percentage of the daily AI for adults (1500 mg per day) as defined by the IOM.⁴
 † Percentage of products in the category that exceeded the daily adult AI (1500 mg/day) or UL (2300 mg/day) per serving.

maximum amount of sodium per serving for all items (1500 mg/serving for 2012, and 1200 mg/serving for 2014).¹³

Food items in the database were subcategorized according to the 25 food categories for which NSRI targets have been established. When necessary, the establishment’s menus were consulted and in some instances, establishments were contacted (via telephone or e-mail) to ensure accurate categorization. Several items were not included in the NSRI target analysis, for example, those that were in categories for which targets had not been established (such as pasta and salads), children’s items, and foods whose densities could not be calculated because the serving size was unknown.

Data analysis

Descriptive statistics, including mean sodium per serving, sodium per 100 g and %AI (sodium per serving divided by 1500 mg) were calculated for all menu items (not including accompaniments), side dishes, children’s meal items and children’s side dishes. The proportion of menu items that exceeded the daily sodium AI and UL were tabulated. The mean sodium density in each sodium reduction target category was calculated for both SDR and FFR establishments and the number of establishments whose mean sodium density exceeded the US NSRI targets was tabulated. The number of establishments with items that exceeded the serving targets was also tabulated. All data were analyzed using Statistica 10 software (Tulsa, OK).

RESULTS

Sodium in single menu items compared to recommended daily intake levels

The mean, percentiles and range of sodium levels for each category from SDR as well as the mean sodium as a percentage of the AI

and percentage of items in the category that exceeded the daily sodium AI and UL were determined (Table 1). On average, 40% of SDR menu items exceeded the AI for sodium, while 13% exceeded the UL. More than 22% of SDR sandwiches/wraps, ribs, and pasta entrées with meat/seafood exceeded the UL for sodium. Categories where the mean sodium per serving exceeded the daily recommended AI of 1500 mg were stir fry entrées, 2360 mg (157% AI); sandwiches/wraps, 1826 mg (122%); ribs, 1775 mg (118%); pasta entrées with meat/seafood, 1760 mg (117%); multiple-meat and/or seafood entrées, 1746 mg (116%); tacos/burritos, 1530 mg (102%); and hamburgers, 1517 mg (101%). On average, SDR meal items (not including side dishes) contained 1455 mg sodium/serving, or 97% of the adult daily AI. Categories with the lowest sodium levels per serving were seafood, 939 mg (63%); beef, 889 mg (59%); and salad entrées, 856 mg (57%).

Table 2 shows that similar trends were seen in FFR, although sodium levels tended to be lower. On average, FFR meal items provided 68% (1011 mg per serving) of the AI (daily recommended amount of sodium). The highest categories were stir fry entrées, 1953 mg (130% AI); poutine/fries with toppings, 1547 mg (103%); nachos, 1402 mg (93%); tacos/burritos, 1322 mg (88%); sandwiches/wraps, 1287 mg (86%) and salads with meat/seafood, 1282 mg (85%). The range of sodium per serving within menu item categories varied from a 2-fold difference among stir fry entrées to a 78-fold difference among sandwiches/wraps. Despite the fact that SDR had more sodium per serving compared to FFR, additional analysis (not shown) did not show a clear trend explaining this finding. In some instances it was due to a larger serving size, while in other instances it resulted from a higher sodium density, or a combination of both larger serving size and higher sodium density.

Table 3. Sodium Levels in Canadian Fast-food and Sit-Down Restaurant Side Dishes Compared to the Daily Dietary Reference Intake (DRI) Recommendations

Food Category	n	Sodium Levels per Category per Serving (mg/serving)								% of Menu Items Exceeding the Daily Sodium DRI Levels†	
		Mean±SD	%AI*	Min	10 th Per-centile	25 th Per-centile	50 th Per-centile	75 th Per-centile	Max	AI: 1500 mg	UL: 2300 mg
SDR soup	98	1060±553	71	161	510	745	975	1240	3200	13	5
FFR soup	204	1029±438	69	455	750	810	920	1080	3630	8	2
SDR fries	28	884±457	59	45	85	659	900	1151	1758	7	0
Mashed potatoes	16	834±389	56	350	432	555	820	920	1660	13	0
Onion rings	15	749±426	50	226	330	437	626	830	1760	13	0
Roasted potatoes	8	720±439	48	110	110	414	680	1007	1450	0	0
FFR fries	37	719±489	48	108	165	400	610	980	2120	8	0
Rice	25	622±623	41	0	12	140	630	841	2535	12	4
Salad	93	487±374	32	25	125	280	424	574	2810	1	1
Baked potato with toppings	14	464±370	31	40	80	170	449	660	1482	0	0
Coleslaw	15	382±205	25	67	160	230	360	520	890	0	0
Vegetables	45	262±370	17	0	16	42	140	341	2150	2	0
Baked potato	9	165±236	11	1	1	28	40	220	666	0	0

* Mean sodium level in category, expressed as a percentage of the daily AI for adults (1500 mg per day) as defined by the IOM.⁴

† Percentage of products in the category that exceeded the daily adult AI (1500 mg/day) or UL (2300 mg/day) per serving.

Table 4. Sodium Levels in Children's Meal Menu Items and Side Dishes From Canadian Fast-food and Sit-down Restaurants Compared to the Daily Dietary Reference Intake (DRI) Recommendations for Children Aged Four to Eight

Food Category	n	Sodium Levels per Category per Serving (mg/serving)								% of Menu Items Exceeding the Daily Sodium DRI Levels†	
		Mean±SD	%AI*	Min	10 th Per-centile	25 th Per-centile	50 th Per-centile	75 th Per-centile	Max	AI: 1200 mg	UL: 1900 mg
Sit-down restaurant children's meal items											
Tacos/burritos	3	1231±592	103	670	670	670	1174	1850	1850	33	0
Pizza	11	1076±529	90	470	545	849	990	1199	2100	18	18
Chicken	6	1021±633	85	430	430	525	865	1420	2020	33	17
Sandwiches/wraps	16	932±284	78	330	710	771	877	1123	1640	5	0
Chicken nuggets/strips	13	888±287	74	210	628	744	880	1040	1380	8	0
Hamburgers	12	815±376	68	237	465	595	699	1020	1580	17	0
Breakfast	17	798±288	67	170	424	587	790	1020	1250	6	0
Pasta	28	705±493	59	115	220	345	640	945	2423	11	4
Seafood	4	520±440	43	70	70	154	499	886	1012	0	0
Fast-food restaurant children's meal items											
Sandwiches/wraps	30	768±219	64	276	390	552	710	894	1106	0	0
Hamburgers	13	623±143	52	400	470	550	630	650	940	0	0
Chicken nuggets/strips	7	567±237	47	210	210	408	520	800	900	0	0
Tacos/burritos	6	465±199	39	300	300	320	390	592	800	0	0
Children's side dishes											
Fries (SDR)	7	536±378	45	67	67	250	469	890	1127	0	0
Soup (SDR)	9	507±159	42	120	120	520	540	580	680	0	0
Fries (FFR)	5	372±237	31	71	71	270	299	560	660	0	0
Potatoes (SDR)	6	388±198	32	129	129	206	405	531	650	0	0
Salads (SDR)	11	358±313	30	75	122	125	280	420	1190	0	0
Vegetables (SDR)	10	165±214	14	1	1	15	80	255	550	0	0

* Mean sodium level in category, expressed as a percentage of the daily AI for children (1200 mg per day) as defined by the IOM.⁴

† Percentage of products in the category that exceeded children's daily AI (1200 mg/day) or UL (1900 mg/day) per serving.

On average, side dishes provided 49% (736 mg) of the AI (daily recommended amount of sodium) (Table 3). A number of side dishes, including some fries, soups and salads, also exceeded the daily sodium UL. Side dishes that had the lowest sodium per serving were coleslaw (382 mg), vegetables (262 mg) and baked potatoes (165 mg).

Sodium in children's meal items compared to recommended daily intake levels

On average, children's menu items provided 790 mg sodium per serving, or 65% of the AI (daily recommended amount of sodium, 1200 mg for children aged four to eight), while children's side dishes contained 377 mg (31% of the AI). In SDR, 33% of chicken items, as well as 18% of pizza meals and 17% of hamburgers exceeded the children's daily sodium AI (Table 4). Very few menu items exceed-

ed the children's UL (1900 mg per day), although sodium levels were exceedingly high (>2000 mg) in some SDR children's pizza items.

Sodium levels in restaurant foods compared to NSRI targets

A total of 1,759 items from the 25 NSRI target categories were available for analysis (Table 5). On average, 52% of establishments exceeded the 2012 density targets in any given category. Categories where the majority of establishments exceeded the 2012 density targets were bakery products such as sweet yeast breads and cookies (where 75% of items exceeded targets), fried potatoes (73%), other sandwiches (72%), french fries (71%), sandwiches with luncheon meat (65%), and pizza (62%). On average, 69% of establishments exceeded the 2014 density targets. Categories where the

Table 5. Canadian and US Restaurant Sodium Levels in Comparison to the US National Salt Reduction Initiative (NSRI) Targets

	Restaurants in Category		Meal/ Menu Items	Mean Sodium Level (mg/100 g)		2012 Sodium Density Targets		2014 Sodium Density Targets		2012	2014
	n	n		Canada*	US†	Target (mg/100 g)‡	% Canadian Restaurants > Target§	Target (mg/100 g)‡	% Canadian Restaurants > Target§	Serving Targets % Canadian Restaurants With Items >1500 mg/ Serving	Serving Targets % Canadian Restaurants With Items >1200 mg/ Serving
Hamburgers	19	41	413	403	380	42	330	68	20	40	
	17	85	507	539	460	59	410	71	80	88	
Chicken	18	32	674	738	670	50	590	56	32	47	
	6	23	626	688	620	50	550	83	17	33	
Seafood	11	32	428	518	440	36	390	45	27	36	
	8	10	655	751	680	37	560	50	38	38	
Sandwiches	33	154	520	572	520	45	460	67	67	91	
	32	204	677	628	590	41	500	62	84	97	
Breakfast sandwiches	14	61	549	503	480	64	430	64	57	79	
	32	175	458	415	390	72	370	75	56	78	
Breakfast sandwiches	4	28	637	836	770	0	630	25	25	25	
	13	61	509	657	560	46	520	46	46	62	
Pizza	8	16	470	530	460	62	390	75	13	0	
	5	66	393	601	510	20	450	40	80	100	
Mexican	6	49	427	464	410	50	350	84	33	50	
	31	60	440	347	290	71	240	71	13	26	
Potatoes	11	18	640	518	460	73	380	82	36	27	
	30	267	359	395	340	57	280	87	32	55	
Bakery products	3	4	471	457	410	67	360	67	0	0	
	3	5	561	543	470	67	410	100	0	0	
Sweet yeast breads	12	49	358	290	280	75	250	75	0	0	
	27	171	309	288	280	48	250	59	0	7	
Pies and turnovers	18	34	196	231	220	50	200	50	0	0	
	3	7	733	932	800	33	700	67	0	0	
Cookies	12	58	381	354	310	75	260	92	0	0	

* In some categories, the Canadian mean sodium density includes multiple sizes of the same items.
 † US data are from the New York City Department of Health and Mental Hygiene's "National salt reduction initiative restaurant food categories and targets".¹³ The American mean sodium density is market share weighted, Canadian data are not.
 ‡ The targets are market share weighted and apply to the mean sodium in all of a restaurant's items in each food category.
 § Density targets apply to the mean sodium among all of the restaurant's items in each food category. These data represent the percentage of restaurants where the mean for the items in the category for a particular restaurant exceeded the target for that category.
 || Serving targets represent the maximum sodium that is allowed per serving for all items. These data represent the percentage of restaurants that had items that exceeded serving targets.

majority of items exceeded the 2014 density targets were: cookies (92%), soups (87%), tacos (84%), bone-in breaded chicken (83%), and fried potatoes and onion rings (82%). With respect to serving targets, categories in which the majority of establishments contained items that exceeded the targets were cheeseburgers (80% exceed 2012 target and 88% exceed 2014 target), chicken and fish sandwiches (67%, 91%), sandwiches with ham and cheese (84%, 97%), and burritos (80%, 100%), respectively.

DISCUSSION

This study provides the first systematic assessment of sodium levels in a wide variety of menu items from Canadian sit-down and fast-food restaurants, which can be used as a baseline to assess progress in this sector, as it appears that Health Canada has discontinued further work in this area. The results showed that the average sodium levels in Canadian restaurant foods were extremely high. A large number of menu items (that in most cases do not constitute an entire meal, such as a hamburger not including the fries that may be consumed alongside it), and even a number of side dishes and children's items, exceeded the daily recommended AI and UL, and also exceeded the US NSRI sodium reduction targets that have been established for 2012 and 2014. Considering the prevalence of food consumed outside the home,⁹ along with the high rates of hypertension and cardiovascular disease¹⁴ and the associated economic consequences,⁶ the results of this study demonstrate the need for increased efforts focusing on restaurants as a key area where sodium reduction is necessary and has to date been overlooked.

It has been recommended that many groups, including: individuals that are 51+ years old, African Americans, as well as individuals with chronic kidney disease, high blood pressure (approximately 19% of the Canadian population)¹⁷ or diabetes (26% of Canadians have diabetes or prediabetes),¹⁸ should consume no more than 1500 mg daily.¹⁹ Thus, considering that 40% of SDR menu items and 18% of FFR menu items (that in many cases do not constitute an entire meal) exceeded this daily cut-off (1500 mg), our data suggest that eating out on a regular basis can be harmful, particularly among the large proportion of at-risk adults.

The large range of sodium within food categories supports Dunford et al.'s conclusion that this variation demonstrates both the technical feasibility and taste acceptability of lower sodium products.²⁰ Large ranges in sodium content also suggest that general advice about selecting low-sodium options is not sufficient without on-site menu labelling. For example, SDR salad entrées had the lowest mean sodium (856 mg per serving), yet some items still contained up to 2260 mg per serving. Therefore, because of the wide range of sodium per serving, on-site sodium labelling in restaurants may be necessary in order to clearly inform customers of the sodium content of menu options and enable them to make healthy choices.

In their study of fast-food purchases, Johnson et al.²¹ found that excess sodium not only was the result of large portion sizes but was also due to a high sodium density. The data in Table 4 show that the average sodium density in many restaurants exceeds the recommended targets for reduction. Therefore, because of the high sodium density, reduction strategies cannot exclusively rely on decreasing portion sizes but must also emphasize decreases in sodium density as a means to decrease sodium levels per serving.

The high sodium levels within children's items (meal items on average contained 32% of the daily recommended amount of sodium while children's side dishes contained 16%) suggest the need to establish reduction targets specifically for children's items, as it has been shown that frequent consumption of fast food among adolescents may alter taste perception and promote an increased preference for salt.²² Nevertheless, it has been demonstrated that small to moderate sodium reductions that are introduced slowly are not easily detected²³ and can lead to a preference for a lower-sodium diet.²⁴

The Canadian and American mean sodium densities were often similar, even though the Canadian means were not market-share weighted (Table 5). Whether this produced inflated or conservative results is uncertain. A study of the sodium content in processed foods in the UK showed that purchase-weighted mean sodium was 18-35% higher than unweighted mean sodium levels.²⁵ This indicates that future research is needed to determine the degree to which market share influences these results. Our study examined sodium levels in chain restaurants and did not include independent establishments. Furthermore, the findings presented in this study are dependent upon the accuracy of the data provided by the establishments. In some instances, sodium levels could vary, and the validity of the industry-reported sodium data has not been verified. The use of sodium's AI and UL as benchmarks for sodium content was a very conservative approach, as these represent daily sodium intake levels and are not intended to be applied to single meal items. Furthermore, our study did not combine main entrées with the side dishes that would often accompany them, as they would typically be consumed, which would further increase the amount of sodium consumed when eating out. More research is needed to demonstrate the sodium levels in whole meals and combos served at SDR and FFR, as the data suggest that the sodium levels in complete meals would be dangerously high. Finally, even though our data were collected in 2010 and early 2011, and were compared to 2012 and 2014 targets, it is unlikely that there have been major decreases in sodium levels over the past 2 years, as Canada has not yet established targets or implemented a reduction strategy for the restaurant sector.

A strength of this study is that percentiles were reported so that the data can be used by Health Canada to set sodium reduction targets for restaurant foods, a large gap in the current Canadian sodium reduction guidance to industry that was published in 2012.²⁶ Therefore, the results presented here can be used to establish baseline sodium levels in Canadian restaurants and can guide target setting for this sector, reformulation strategies, and future longitudinal studies to assess sodium reduction progress. Given the large variability in sodium levels in restaurant foods, these results also demonstrate the value of menu labelling in aiding consumers to select lower-sodium menu options when eating out.

CONCLUSION

In conclusion, the large number of individual restaurant menu items that exceeded the daily AI and UL, along with the small number of establishments that meet the US NSRI targets, demonstrate the need for a Canadian sodium reduction strategy that also emphasizes reductions in restaurant foods along with packaged foods. Because of the prevalence of eating out, as well as the high rates of hypertension and cardiovascular disease, addressing the

exceedingly high sodium levels in restaurant foods is essential in order to decrease the burden of chronic disease.

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RÉSUMÉ

OBJECTIF : Évaluer les niveaux de sodium au menu des restaurants et des chaînes de restaurants rapides au Canada.

MÉTHODE : Nous avons recueilli en 2010 des données nutritionnelles sur les sites Web de restaurants assis (n=20) et de restaurants rapides (n=65) très fréquentés au Canada et construit une base de données. Quatre mille quarante-quatre mets, produits de boulangerie, plats d'accompagnement et mets pour enfants ont été analysés. Nous avons comparé les niveaux de sodium à l'apport suffisant (AS) recommandé, à l'apport maximal tolérable (AMT) et aux cibles de l'initiative nationale de réduction du sodium des États-Unis (NSRI).

RÉSULTATS : En moyenne, les articles au menu des restaurants assis contenaient 1 455 mg de sodium/portion (soit 97 % de l'AS de 1 500 mg/jour). Quarante p. cent des articles au menu des restaurants assis dépassaient l'AS en sodium, et plus de 22 % des plats sautés, des sandwichs ou roulés, des plats de côtes et des plats de pâtes avec viande ou poisson et fruits de mer servis dans les restaurants assis dépassaient l'AMT quotidien en sodium (2 300 mg). Les mets des restaurants rapides contenaient en moyenne 1 011 mg de sodium (68 % de l'AS quotidien), tandis que les plats d'accompagnement (des restaurants assis et rapides) en contenaient 736 mg (49 %). Les mets pour enfants contenaient en moyenne 790 mg/portion (66 % de l'AS en sodium de 1 200 mg/jour recommandé pour les enfants); un petit nombre de mets pour enfants dépassait l'AMT quotidien pour les enfants. En moyenne, 52 % des établissements dépassaient les cibles de densité de la NSRI pour 2012, et 69 % dépassaient les cibles pour 2014.

CONCLUSION : La teneur en sodium des aliments dans les restaurants canadiens est extrêmement élevée. Il faudrait une stratégie de réduction du sodium à l'échelle de la population pour s'attaquer aux niveaux élevés de sodium dans les aliments des restaurants.

MOTS CLÉS : sodium; restaurants; aliments de restauration rapide; Canada