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Research report

Assessment of consumers' level of engagement in following recommendations for lowering sodium intake

Julio Ernesto Mendoza [a,*], Grietje Anna Schram [b], JoAnne Arcand [c], Spencer Henson [a], Mary L'Abbe [c]

[a] Department of Food, Agricultural and Resource Economics, University of Guelph, 50 Stone Road East, 309 J.D. MacLachlan Building, Guelph, ON N1G 2V7, Canada
[b] Division of Human Nutrition, Wageningen University, Bellamystraat 27 BIS, 3514 EK Utrecht, The Netherlands
[c] Department of Nutritional Sciences, Faculty of Medicine, University of Toronto, Room 315, FitzGerald Building, 150 College Street, Toronto, ON M5S 3E2, Canada

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ABSTRACT

Population-wide sodium reduction strategies encourage consumer participation in lowering dietary sodium. This study aims to measure and rank consumers' level of engagement in following 23 recommendations to reduce dietary sodium and to compare variation in level of consumers' engagement by sociodemographic sub-groups. The study included 869 randomly selected participants of an online food panel survey from Ontario during November and December 2010. Rasch modelling was used for the analysis. Consumers were less likely to be engaged in 9 out of the 23 recommendations, in particular those related to avoiding foods higher in sodium and implementing sodium reduction strategies while eating in restaurants. Higher level of consumers' engagement was observed in relation to food preparation practices, including use of low sodium ingredients. In comparison to the relevant reference group, men, older individuals, with lower educational level, single, and those who do not prepare food from scratch showed an overall lower level of engagement in following recommendations to lowering dietary sodium, particularly related to avoiding processed foods. These data provide novel insights and can inform public education campaigns, and highlight the need for interventions and programs targeted at the food supply that can assist consumers in lowering their sodium intake.

Introduction

The negative health and economic consequences of high sodium intake are widely recognized, including high blood pressure, stroke, cardiovascular disease, premature mortality and high health care costs (Bibbins-Domingo, Chertow, et al., 2010; Ezzati, Lopez, Rodgers, Vander Hoorn, & Murray, 2002; Joffres, Campbell, Manns, & Tu, 2007; Lawes et al., 2006; Penz, Joffres, & Campbell, 2008; Strazzullo, D'Elia, Kandala & Cappuccio, 2009). Sodium-related increases in blood pressure are common in adults and are increasingly prevalent in children (Yang, Zhang, Kuklina, Fang, et al., 2012). Sodium reduction results in desirable blood pressure lowering effects in both normotensives and hypertensives (He & MacGregor, 2002). Therefore, on a population level, sodium reduction strategies are considered a viable and effective intervention for reducing cardiovascular disease risk (Health Canada, 2010; Joffres et al., 2007).

A multi-stakeholder approach has been taken by many countries to facilitate population-wide sodium reduction, requiring action by policy makers, health practitioners, the food industry and the public (He & MacGregor, 2009). Canada's Sodium Reduction Strategy, for example, aims to have 50% of the population consuming less than 2300 mg by 2016, and includes recommendations targeted at the food supply, research and education and awareness (Health Canada, 2010). Consumer education constitutes a large proportion of sodium reduction efforts. Such education focuses on increasing sodium knowledge and teaching tips and skills to promote effective sodium reduction practices while purchasing food, preparing food and eating outside the home. Adherence to a lower sodium diet, however, has been documented as a major challenge, largely due to the high levels of sodium in processed and prepared foods. Indeed, the majority of Canadians, and individuals in other countries, consume sodium levels that exceed recommendations (Garriguet, 2007; WHO, 2011) which to some extent may be due to non-adherence with sodium reduction recommendations.

Despite the efforts to reduce sodium intake at the population level, there is still a significant gap between the recommended sodium intake for a healthy diet and actual consumption, (Garriguet, 2007; WHO, 2011) and the average levels of hypertension in the population is still very high (Health Canada, 2010). According to Wilkins et al. (2010), one in five Canadians (19%) has high blood pressure and the 83% of them are aware of their condition and most of them receive treatment.

A recent Canadian survey found that 67.0% of respondents were concerned about dietary sodium and 59.3% were currently taking

* Corresponding author.
E-mail address: mendozaj@uoguelph.ca (J.E. Mendoza).

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action to limit sodium intake, particularly among the elderly and those with hypertension (Arcand et al., 2013). However, there is limited data available regarding the extent to which consumers engage in various actions or recommendations to limit sodium consumption. Implementing personal actions to lower sodium intake may prove challenging for many individuals since sodium is widespread in across the food supply and because consumers are increasingly reliant on processed and prepared foods items. It is important to understand which actions consumers are taking for sodium reduction, so that tailored educational campaigns can be created to meet population needs. The purpose on this study is to describe and rank 23 dietary recommendations for reducing sodium intake in relation to the level of extent to which consumers engage in such behaviours, and to determine any differences by gender, level of education, age, marital status and by those who prepare versus those to do not prepare most of their food from scratch.

Methods

Participants

Data was obtained from an online sodium-focused survey administered to members of the Ontario Consumer food panel during November and December 2010. Panel participants were recruited through random digital dialling by a market research company. Stratification of the panel by gender, age and educational level in order to reflect the demographic profile of Ontario based on 2006 Census of Canada (Statistics Canada, 2007) occurred during recruitment. In comparison to the Ontario population, the sample used in this study was overrepresented by women, people above 50 years old and with a university certificate/diploma or degree and underrepresented by men, persons with high school or less and age below 40 years old (see Table 1). The survey was sent to a sample of 4679 Ontarians. A total of 1385 surveys were completed (30% response rate).

Knowledge of the relation between sodium and high blood pressure was assumed based on studies indicating that most Canadian are knowledgeable of issues related food nutrition and health (Henson, Blandon, & Cranfield, 2010; Henson, Blandon, Cranfield, & Deepananda, 2010). In addition, this assumption was validated by using questions assessing respondents' knowledge of the relationship between sodium consumption and high blood pressure and other related diseases. For example for the question how much do you think sodium affects your health? The majority (86%) answered 3 or higher (on a scale from 1 = 'a little' to 5 = 'a great deal'). Likewise, 71% of respondents agreed to some extent (3 or higher in a 5 point Likert scale) that their health will improve if they reduce their sodium consumption (see Table 2).

Table 1
Demographic characteristics of participants and comparison with Ontario population.

Characteristics	Sample survey (n = 1368) (%)	Ontario population (%)[a]
Gender		
Male	32.7	49.5
Female	67.3	50.5
Age		
20–29	5.9	19
30–39	15.4	21
40–49	23.2	26
50–59	28.9	21
60–69	26.6	13
Education		
Less than high school	1.7	22.2
High school graduation certificate or equivalent	15.0	26.8
Trades certificate diploma	8.5	7.99
University Certificate/Diploma below Bachelor level/College	27.2	18.4
University	47.5	26.6

[a] Statistics Canada – 2006 Census. Catalogue Number 92-591-XWE.

Questionnaire

The questionnaire asked about behaviours and attitudes towards dietary sodium. Survey questions were developed based on expert opinions and were adapted from national surveys and studies on sodium (CASH, 2010; Grimes, Riddell, & Nowson, 2009; Health Canada, 2010; Hypertension Canada, 2010a, 2010b; Public Health Agency of Canada, 2009). Each question was reviewed and pilot tested among a small group of participants from Guelph, Ontario. Snap 10 Professional Survey Software and Webhost (Snap Surveys Ltd., 2009) were used for designing the survey and for collecting data. Participants provided informed consent at the time of survey completion. Research ethics board approval was obtained from the University of Guelph.

Variables

Level of engagement in following recommendations for lowering sodium intake

Participants were asked to what extent they personally have followed each of 23 recommendations aimed at reducing dietary sodium (Table 2). The exact wording of the question was "Below are given some of the common recommendations for reducing the amount of sodium that people eat. To what extent have you personally followed each of these recommendations over the last year?" The recommendations were presented on a Likert scale format with a response set with values from 1 to 5 (from 1 = not at all

Table 2
23 Dietary recommendations for reducing sodium intake.

Requiring modification of food preparation
1.Cook with fresh foods
2. Drain and rinse canned vegetables and beans before use
3. Limit the use of high sodium ingredients such as stocks or bouillon cubes during cooking
4. Avoid the use of condiments such as soy sauce, pickles, ketchup and mustard
5. Use spices and/or seasoning rather than salt during cooking
6. Use a salt substitute instead of table salt
7. Do not add salt during cooking
8. Use vegetable/olive oil instead of margarine/butter
9. Do not add salt at the table

Requiring avoidance of higher sodium food items
10. Limit the consumption of salty cold cuts (salami, bacon, ham, smoked meats, etc.)
11. Avoid the consumption of processed foods
12. Limit the consumption of bread
13. Avoid ready-to-eat dishes, like pasta, poultry and red meat mixed dishes
14. Avoid salty snacks
15. Avoid eating pizza
16. Limit the consumption of cheese

Requiring modification for food selection at the grocery store or while eating out
17. Read the information about sodium on the packaging labels when shopping for food.
18. At restaurants ask for salt not to be used in preparing your meal
19. Ask for sauces/dressings on the side of your plate when eating out
20. At restaurants ask for low-sodium options on the menu
21. Buy foods labelled as low or reduced sodium
22. Choose low/reduced sodium brands when a choice of particular food products is available
23. Choose vegetable juices that are low in sodium

to 5 = completely). Recommendations and strategies were derived from those issued by Health Canada (Health Canada, 2010; Public Health Agency of Canada, 2009); and non-governmental organizations (AWASH, 2007; CASH, 2010; Fischer & Frewer, 2009; Grimes et al., 2009; Henson, Blandon, & Cranfield, 2010; Henson, Blandon, Cranfield, & Deepananda, 2010). A higher, more positive a score, indicated a lower probability of engagement in a particular behaviour or recommendation; whereas a lower, negative score indicated a greater probability of engagement (Bond & Fox, 2001; Green & Frantom, 2002; Linacre, 2010). Additional information about age, income, marital status, gender and average number of meals prepared from scratch was also collected.

Levels of engagement by group

A differential item functioning (DIF) test, at the 95% confidence level, was performed as part of the Rasch model (below) to compare the levels of engagement between sub-groups (Bond & Fox, 2001; Higgins, 2007). The category coded as zero (0) was used as the base for comparison: gender (male = 0, female = 1), age (<50 years = 0, ⩾50 = 1), education (⩽High school = 0, postsecondary Certificate/Diploma or University = 1), marital status (single, divorced or widower = 0, Married or common law = 1) and the variable "food preparation" was assessed by asking "average number of meals produced from scratch at home in a week" which had as answer options None = 1, Less than half = 2, About half = 3, More than half = 4 and All = 5. This variable was re-coded into two categories (<50% = 0; and ⩾50% = 1) to allow for maximum difference between groups and to allow a more concise presentation of the results. Respondents in final dataset used in the Rasch model (n = 869) were 66% female, more than half were 50 years of age or older, 86% had an education level higher than high school, 75% were married and 72% cook more than 50% or more of their food from scratch.

Analysis

The Rasch model was used to estimate the extent to which study subjects followed each of the 23 recommendations for reducing dietary sodium and to compare the differences between sub-groups. The model transforms raw ordinal data from the Likert scale rating scale into log odd ratios (logits) in order to place persons and recommendations on an equal interval scale (Fox & Jones, 1998). Fitness of the Rasch model data was improved by excluding observations with incomplete responses, outliers and inliers based on preliminary person measure results generated by the Rasch model (Table 3). (i.e. person measure outfit mean squares greater than 2.0 logits[1]). A detailed description of the Rasch model has been published by Bond and Fox (2001), Linacre (2010) and others, and its application to evaluate dietary recommendations are described by Henson, Blandon, and Cranfield (2010), Henson, Blandon, Cranfield, and Deepananda (2010) and Kulasekera (2010). WINSTEPS version 3.70 was the software used for these calculations (Linacre, 2010).

Desired characteristics of a multi-item scale, used in Rasch modelling, include unidimensionality, high internal reliability and high construct validity (Bond & Fox, 2001). Principal component analysis was used to determine the source of variance in the data, in particular for identifying if more than one dimension is present in the data (e.g. violation of the unidimensionality assumption). The Rasch model also generates infit and outfit mean square statistics that indicates how well the data fit the model. Acceptable values of these statistics range from 0.5 to less than 2.0 logits (Linacre, 2010). The Rasch model also assesses internal reliability of the scale by calculating person and item separation reliability (Fox & Jones, 1998; Linacre, 2010). Values greater than 0.80 are indication of good reliability of the construct.

Validity of the construct was assessed using the differential item functioning test and the infit and outfit mean-square statistics, both generated by the Rasch model. The underlying assumption is that the differences in item measures (i.e. level of engagement) should not be significantly different between subsamples of the population (Bond & Fox, 2001). The DIF test indicates if the items being evaluated present different levels of engagement for different groups of people. When significant and large differences are detected, the common procedure is to calibrate the instrument (e.g., by eliminating problematic items from the scale or by rewording them) until the size of the differences in level of engagement are small (less than 0.5 logits) and not statistically significant (p *value* <0.05) for any of the items in the scale (Linacre, 2010).

The Rasch model was chosen as the ideal test since its probabilistic nature allows optimization of important information from responses which otherwise will be lost (Fischer & Frewer, 2009; van Alphen, Halfens, Hasman, & Imbos, 1994). This is the case in traditional scale analysis when scores are summated and averaged under the assumptions that each of them has equal weight or impact on the scale score (e.g. 1 unit) and distances between adjacent levels on a response set are also equal (Fischer & Frewer, 2009). In addition, the Rasch model allows the identification of biases in the items of a scale, as well as determination of which of the items contribute to the definition of the trait under investigation. Another advantage of the model is that it does not allow deliberate or unconscious deception, guessing that may affect the integrity of the responses provided (Fox & Jones, 1998; Linacre, 2010; Green & Frantom, 2000).

Results

Rasch model fit

The unidimensionality and reliability assumptions of the construct were satisfied. Results from the principal components analysis of the residuals (Table 4) indicate that 51.8% of the total variance was explained by the data (the Rasch dimension) which was close to the expected explained variance from the model (52%). Importantly, the first contrast only explained 4.3% of the unexplained variance, which is the most significant indicator that the data meet the unidimensionality requirements (Linacre, 2010). The test of reliability has a value of 0.89 indicating high reliability of the construct. The Rasch model did not meet the requirement of invariability of measures, although this is not uncommon in studies using socio-economic and demographic variables (Henson, Blandon, & Cranfield, 2010; Henson, Blandon, Cranfield, & Deepananda, 2010; Bond & Fox, 2001; Kulasekera, 2010).

Table 3
Summary statistics for person and item measures (in logits).

	Item measure[a]	Infit MNSQ[b]	Outfit MNSQ[c]
Mean	0.0	1.02	0.99
Max	2.62	1.68	1.63
Min	−1.29	0.65	0.67

[a] The estimated calibration for items (recommendations).
[b] An information-weighted fit statistic, which is more sensitive to unexpected behaviour affecting responses to items near the person's measure level.
[c] An outlier-sensitive fit statistic, more sensitive to unexpected behaviour by persons on items far from the person's measure level.

[1] Observation with high infit and outfit mean square values are considered as outliers that affect the fir of the Rasch model.

Table 4
Standardized residual variance (in Eigenvalue units).

	Empirical		Model
	Eigenvalues[A]	Percent (%)	Percent (%)[B]
Total raw variance in observations[a]	47.7	100.0	100.0
Raw variance explained by measures[b]	24.7	51.8	52.5
Raw unexplained variance (total)[c]	23.0	48.2	47.5
Unexplained variance in 1st contrast[d]	2.1	4.3	9.0

[A] Variance components for the observed data.
[B] Variance components expected for these data if they exactly fit the Rasch model, i.e., the variance that would be explained if the data accorded with the Rasch definition of unidimensionality.
[a] It is the sum-of-squares of the observations around their central values.
[b] It is the sum-of-squares of the difference between the observations and their Rasch predictions, the raw residuals.
[c] It is the summed Rasch-model variances of the observations around their expectations, the unexplained residual variance predicted by the Rasch model.
[d] It reports the size of the first Principal Component Analysis component. This is termed a "contrast" because the substantive differences between persons that load positively and negatively on the first component are crucial. If high (more than 3 Eigenvalues), it may reflect a systematic second dimension (Linacre, 2010).

Level of engagement in following recommendations to reduce dietary sodium

Respondents demonstrated a lower level of engagement for nine out of the 23 recommendations (Fig. 1). These recommendations were related to food selection such as limiting intake of pizza, cheese, and bread, which are significant sources of sodium in the Canadian diet (Fischer, Vigneault, Huang, Arvaniti, & Roach, 2009). Lower engagement was also observed for actions related to eating in restaurants such as asking for lower sodium menu options and asking for sauces on the side. In contrast, subjects were more engaged in implementing recommendations primarily related to household practices used when preparing food such as using fresh foods, avoiding ready-to-eat dishes, using spices instead of salt during cooking, and draining and rinsing canned vegetables.

Comparison of level of engagement by sub-groups

There were several differences in the level of engagement among sub-groups (Table 5). For variable age, five items showed significant difference (α, 0.05) in level of engagement between the two subgroups. For the older group (>50 years) it was relatively more problematic to engage with recommendations related to adding salt at the table, draining and rinsing canned vegetables and beans before use and in avoiding ready to eat dishes. On the other hand, those <50 years showed a lower level of engagement with recommendations related to avoiding use of condiments, avoiding eating pizza, limiting the consumption of bread and choosing vegetable juices lower in sodium.

Respondents with a lower level of education, compared to those with a higher level of education, had a significant lower level of engagement with the recommendations related to cooking with fresh foods and avoiding ready-to-eat dishes.

Males, compared to females, had a lower level of engagement as it relates to replacement of table salt for salt substitutes and asking for salt not to be used in food preparation were while dining in restaurants. On the other hand, recommendations related to draining and rinsing canned vegetables and beans before use and in asking for sauces/dressing on the side of the plate when eating out showed a lower level of engagement among females with respect to men.

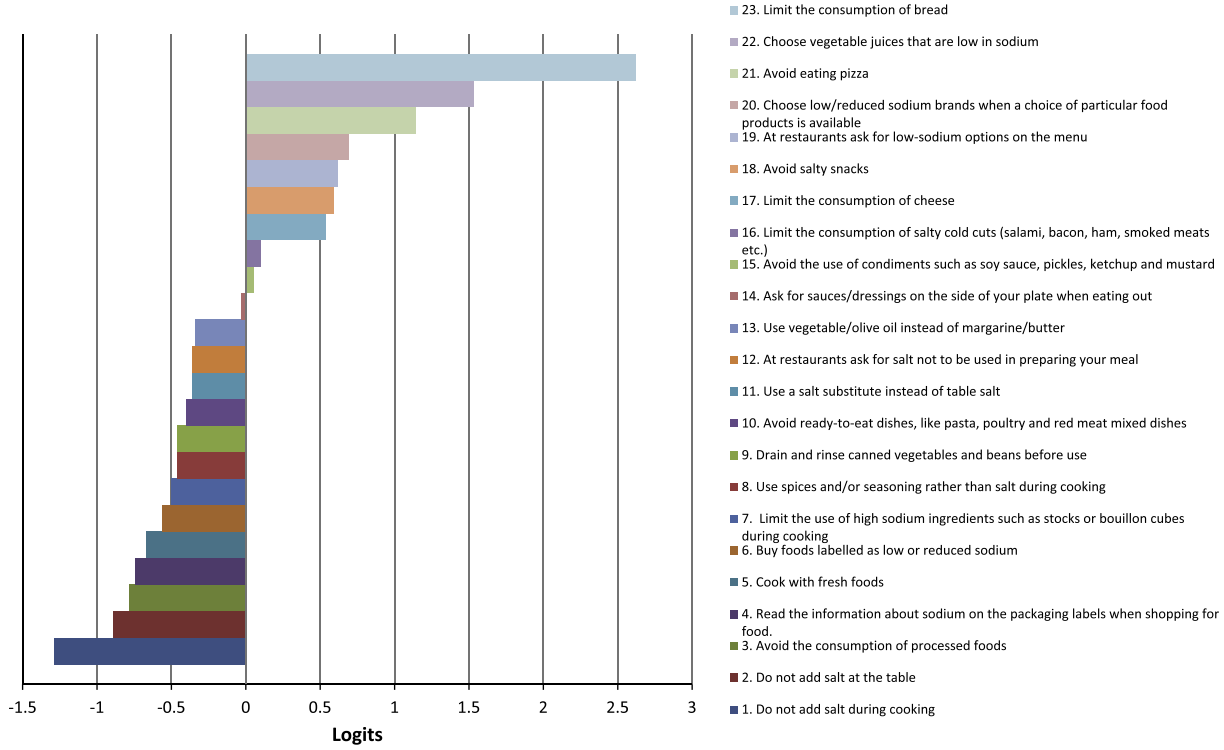

Fig. 1. Consumers' level of engagement in following recommendation to reduce dietary sodium. High positive scores indicate low level of engagement; i.e. higher level of 'resistance' to follow a particular recommendation. The recommendation that on average presented the highest scores were related to avoiding foods higher in sodium and implementing sodium recommendations while eating in restaurants. In contrast, some of the recommendations with higher levels of engagement (low scores) were those related to food preparation practices such as selection of low sodium ingredients.

Table 5
Differences in level of engagement scores (in logits) by age, education, gender, marital status, and food preparation variables (Differential Item Functioning (DIF) contrasts).

	Recommendations	Age		Education		Gender		Marital status[d]		Food preparation	
		⩾50[a]	s.e.[A]	>HS [b]	s.e.[A]	Fem[c]	s.e.[A]	Married [d]	s.e.[A]	⩾50% [e]	s.e.[A]
1	Do not add salt during cooking	0	0.07	−0.24	0.1	0	0.07	0	0.09	−0.37	0.09
2	Do not add salt at the table	**−0.25**	0.07	0.1	0.1	−0.09	0.07	−0.06	0.09	**−0.38**	0.09
3	Avoid the consumption of processed foods	0	0.07	0.06	0.09	0	0.07	0	0.12	**0.61**	0.11
4	Read the information about sodium on the packaging labels when shopping for food.	**0.22**	0.07	−0.04	0.1	0	0.07	−0.07	0.1	0.02	0.09
5	Cook with fresh foods	−0.15	0.08	**0.18**	0.11	0	0.08	**0.32**	0.15	**0.72**	0.14
6	Buy foods labelled as low or reduced sodium	0	0.07	0	0.1	0	0.07	0.09	0.11	0.16	0.11
7	Limit the use of high sodium ingredients such as stocks or bouillon cubes during cooking	0	0.07	−0.07	0.1	0	0.07	0.06	0.1	**−0.14**	0.1
8	Use spices and/or seasoning rather than salt during cooking	−0.11	0.07	0	0.1	−0.07	0.08	−0.23	0.13	**−0.22**	0.12
9	Drain and rinse canned vegetables and beans before use	**−0.25**	0.07	0.11	0.1	**0.19**	0.07	0.03	0.09	−0.1	0.09
10	Avoid ready-to-eat dishes, like pasta, poultry and red meat mixed dishes	**−0.2**	0.07	**0.21**	0.1	0.1	0.07	**0.23**	0.1	**0.6**	0.1
11	Use a salt substitute instead of table salt	−0.27	0.08	−0.16	0.11	**−0.28**	0.08	−0.16	0.1	**−0.39**	0.1
12	At restaurants ask for salt not to be used in preparing your meal	0.21	0.17	−0.09	0.22	**−0.37**	0.16	0.03	0.23	**0.35**	0.33
13	Use vegetable/olive oil instead of margarine/butter	−0.17	0.07	0.03	0.09	−0.12	0.07	0.17	0.1	−0.11	0.1
14	Ask for sauces/dressings on the side of your plate when eating out	0.05	0.07	−0.05	0.09	**0.17**	0.07	0.15	0.09	−0.11	0.09
15	Avoid the use of condiments such as soy sauce, pickles, ketchup and mustard	**0.16**	0.07	−0.07	0.1	0	0.07	−0.08	0.11	0	0.11
16	Limit the consumption of salty cold cuts (salami, bacon, ham, smoked meats, etc.)	**0.07**	0.07	−0.09	0.1	**0.21**	0.07	**−0.23**	0.11	0.06	0.1
17	Limit the consumption of cheese	**0.08**	0.07	−0.09	0.1	0	0.07	−0.15	0.11	0.03	0.11
18	Avoid salty snacks	**0**	0.07	0	0.09	−0.09	0.07	−0.07	0.11	0.09	0.11
19	At restaurants ask for low-sodium options on the menu	−0.03	0.09	0	0.14	**−0.25**	0.1	**0.28**	0.15	−0.1	0.15
20	Choose low/reduced sodium brands when a choice of particular food products is available	0	0.07	0	0.1	0.1	0.07	−0.05	0.1	0.17	0.09
21	Avoid eating pizza	**0.25**	0.07	0.16	0.11	−0.03	0.08	0	0.11	0.19	0.12
22	Choose vegetable juices that are low in sodium	**0.26**	0.07	0	0.09	0.1	0.07	0.06	0.09	0	0.09
23	Limit the consumption of bread	**0.15**	0.07	0	0.1	0	0.07	−0.12	0.1	−0.13	0.1

Number in bold indicates statistically significant difference in scores ($p \leqslant 0.05$) between the base group and the reference group.
Numbers in parentheses correspond to the joint standard error of the difference in DIF contrasts between sub-groups (e.g. value of −0.25 logits means that the reference group (⩾50 has lower level of engagement with this recommendation; positive bold value indicates otherwise).
[A] Join standard error of the DIF contrast (between groups).
[a] 50 years of age or older.
[b] Higher than high school.
[c] Female.
[d] Married or common law.
[e] 50% or more food prepared from scratch.

In comparing level of engagement with the recommendations by marital status, unmarried respondents had lower level of engagement with recommendations related to cooking with fresh foods and to avoiding ready-to-eat dishes, whereas married individuals had lower level of engagement with respect to recommendations related to using spices/seasoning instead of alt during cooking.

When comparing those who cook >50% of their food from scratch, with those who do not, a lower level of engagement was seen with avoiding salt at the table or when cooking. On the other hand, those who cook <50% of their food from scratch showed a lower level of engagement with recommendations regarding avoidance of processed foods, particularly ready-to-eat dishes, cheese and cooking with fresh foods.

Discussion

This is the first known study to provide a detailed analysis of the level of engagement in personal actions to lower dietary sodium as well as comparisons between sociodemographic groups. These results provide novel insight into the differences in levels of engagement with specific actions to lower sodium in the diet, and can inform public policy and health awareness campaigns in relation to population-wide sodium reduction initiatives.

Education and awareness campaigns related to sodium have been implemented as part of sodium reduction strategies; particularly in Canada, where majority of sodium reduction efforts to date have focused on public (Health Canada, 2013) education. Such campaigns are designed to promote awareness about sodium and teach practices to engage and enable individual's to effectively reduce their sodium consumption. However, our data shows that a large number of actions are not being followed by consumers, which may highlight the need for interventions beyond education. For example, consumers were least likely to engage in actions to lower sodium consumption while eating in restaurants. Since restaurant foods is very high in sodium (Scourboutakos & L'abbé, 2013); and contributes large amounts of sodium to the diet (Mattes & Donnelly, 1991), our data points to a need interventions aimed at restaurant foods. This might include adopting and implementing menu labelling policies and/or establishing sodium reduction benchmark targets, both of which were recommendations put forth by the Canadian Sodium Working Group. Such targets have been developed for packaged foods to facilitate a voluntary, incremental reduction of sodium (Health Canada, 2012). We also found that consumers were less engaged in relation to limiting the consumption of foods that are high in sodium (i.e. foods containing a high amount of sodium per serving [Ni Mhurchu et al., 2011]) or that contribute large amounts of sodium in the diet (i.e. foods contributing a large amount of sodium to the overall diet because they are consumed frequently) (Fischer & Frewer, 2009). Interventions aimed at engaging food manufacturers to reduce the amount of sodium added to processed foods would further assist consumers in lowering their sodium intakes. Despite reported efforts made by consumers (Arcand et al., 2013), dietary intakes in Canada remain high and there has been no evaluation or monitoring of intake

patterns since adoption and implementation of the Sodium Reduction Strategy.

The reasons for engaging in certain recommendations and actions, as opposed to others were not explored in this study; however, there are several possible explanations. First, there may be a lack of availability of lower sodium versions for products that contain high levels of sodium, or the perception that lower sodium alternatives are less palatable and/or more expensive than the regular ones (van Assema, Kempers, Brug, & Glanz, 1999). However, recent studies show that consumers rate low sodium products favourably and that they would be more likely to purchase a lower sodium product over the non-sodium reduced counterpart (Wong et al., 2013). The relative low level of engagement with certain recommended strategies could also be related to the type of behaviour, rather than the particular food that it is focused on (Henson, Blandon, & Cranfield, 2010). Previous studies on dietary change reported lower levels of consumers' engagement with recommendations related to avoiding or limiting preferred food products, such as snacks and processed meats (Kulasekera, 2010; van Assema et al., 1999).

Understanding variation in consumers' level of engagement in sodium reduction recommendations by sub-groups of individuals is important to target educational interventions, particularly for vulnerable or at-risk population. For example, older individuals, who are more likely to have a diagnosis of hypertension and cardiovascular disease, have reported being more likely to be limiting their sodium intake (Arcand et al., 2013). Older individuals in the present study have lower level of engagement with recommendations requiring modification of flavour of foods and avoidance of high sodium dishes such as ready-to-eat dishes. We also found that those with a high school education or less were less likely to avoid higher sodium foods and to cook fresh foods. Although difficult to assess, the price of fresh foods may be a factor in this population or they may have a lower level of nutritional knowledge (Henson, Blandon, Cranfield, & Deepananda, 2010). These results stress the importance of promoting educational programs and recommendations targeted at subgroups and audiences.

There are some limitations to our study. Our population might not reflect the entirety of the Ontario population and may not be further generalizable to all Canadians. Although we had more women, a slightly older population, and a relatively low response rate (30%), it is comparable with other surveys (Arcand et al., 2013; Public Health Agency of Canada, 2009). Furthermore, despite the analytical advantages that the Rasch model, used in this study, provides for analyzing multi-scale items (i.e. in optimizing the use of information contained in multi-items scales beyond averages and other summary statistics) some have criticized that the Rasch model requires a large number of observations and yields complex data which is difficult to interpret. Indeed, Rasch analyses have been successfully applied to relatively small set of observations (e.g., Wright & Stone used a set of responses from 35 children) (van Alphen et al., 1994), and have been used to test similar hypotheses to those presented in this analysis (Henson, Blandon, & Cranfield, 2010; Henson, Blandon, Cranfield, & Deepananda, 2010).

Conclusions

Overall, these data indicate that consumers are more likely to engage in certain actions to lower sodium over others and that significant differences in engagement exist between relevant subgroups. It is unknown the reasons why there was engagement in certain actions and not others and which (if any) actions result in significant reductions in overall sodium consumption; however these should be the topics of future research. This data further emphasizes the need for a multi-sectoral approach to sodium reduction, which will ensure the implementation of supportive policies and programs which will assist consumers in reducing their sodium consumption.

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