

Consumer attitudes and understanding of low-sodium claims on food: an analysis of healthy and hypertensive individuals^{1–3}

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ABSTRACT

Background: Sodium-related claims on food labels should facilitate lower-sodium food choices; however, consumer attitudes and understanding of such claims are unknown.

Objectives: We evaluated consumer attitudes and understanding of different types of sodium claims and the effect of having hypertension on responses to such claims.

Design: Canadian consumers ($n = 506$), with and without hypertension, completed an online survey that contained a randomized mock-package experiment, which tested 4 packages that differed only by the claims they carried as follows: 3 sodium claims (disease risk reduction, function, and nutrient-content claims) and a tastes-great claim (control). Participants answered the same questions on attitudes and understanding of claims after seeing each package.

Results: Food packages with any sodium claim resulted in more positive attitudes toward the claim and the product healthfulness than did packages with the taste control claim, although all mock packages were identical nutritionally. Having hypertension increased ratings related to product healthfulness and purchase intentions, but there was no difference in reported understanding between hypertensives and normotensives. In general, participants attributed additional health benefits to low-sodium products beyond the well-established relation of sodium and hypertension.

Conclusions: Sodium claims have the potential to facilitate lower-sodium food choices. However, we caution that consumers do not seem to differentiate between different types of claims, but the nutritional profiles of foods that carry different sodium claims can potentially differ greatly in the current labeling environment. Additional educational efforts are needed to ensure that consumers do not attribute inappropriate health benefits to foods with low-sodium claims. This trial was registered at clinicaltrials.gov as NCT01764724. *Am J Clin Nutr* 2013;97:1288–98.

INTRODUCTION

The causal relation between excess dietary sodium, high blood pressure, and subsequent cardiovascular disease has been well established (1–3). Globally, mean sodium intakes for all age and sex groups greatly exceed the upper limit (2.3 g/d) (4, 5). Thus, the creation of a healthy food environment for population-wide sodium reduction has been emphasized by international scientific bodies (6) and national (7–10) and local (11) governments worldwide.

The majority of sodium in a Western diet comes from processed foods (12, 13). Because the food label is often the main source of nutrition information for consumers (14), the WHO has

recommended that actions be taken to ensure that nutrition information on food labels is accurate, standardized, and comprehensible (15).

On Canadian and US food products, sodium can be communicated through the mandatory Nutrition Facts table (NFT)⁴ and through voluntary nutrition claims that are similar in many regards. The NFT identifies the amount of sodium per serving and 13 other core nutrients. Health claims, which are “any statement or representation that states, suggests or implies that a relation exists between a food or component of that food and health,” are used on the food label to communicate health benefits of a lower sodium intake (16, 17). Canada allows a disease risk reduction (DRR) claim on sodium and reduced risk of hypertension (17). Nutrient-function claims, which are a subset of health claims, state specific benefits of foods on normal function and biological activities in the body (16). Nutrient-content (NC) claims, such as low in sodium, do not mention health and are not considered a health claim; however, if the awareness of the specific diet-health relation is high, a mere mention of the specific nutrient will infer health benefits (18–20). Sodium claims are prevalent in the North American market place; ~5–7% of products were shown to carry a claim that mentioned sodium (21, 22), but North American data on the acceptability or comprehensibility of these claims are scarce and outdated. In addition,

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⁴ Abbreviations used: DRR, disease risk reduction; NC, nutrient content; NFT, Nutrition Facts table.

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evidence has suggested that people who are living with a disease or a risk factor, such as hypertension, would be more aware, perceive, and rely on food labels differently than the general public does (23–27). The prevalence of hypertension in North America is ~23–30% of the adult population (28, 29), but the effect of hypertension status on attitudes and understanding of sodium claims remains unknown. In light of the paucity of data, this article reports the results of a randomized controlled package experiment to address the following research questions:

- 1) Do consumers respond differently (ie, attitudes, understanding, and purchasing intentions) when exposed to different types of claims (ie, DRR, function, and NC claims) related to sodium?
- 2) Do hypertensive respondents respond differently than normotensive individuals to different types of sodium claims?
- 3) Do sociodemographic characteristics, familiarity of a product, beliefs regarding diet and health, and food-label behaviors modulate consumer responses to sodium claims?

SUBJECTS AND METHODS

Participants

A subsample from the Advanced Foods and Materials Network's Canadian Consumer Monitor Panel was used. The panel is a nationally representative consumer survey panel of >30,000 Canadian adults. Panelists, who considered themselves primary household grocery shoppers, were recruited by a professional recruiting firm and agreed to participate. A series of online surveys on consumer attitudes toward food were administered to the same panelists every 8–10 wk beginning in June 2010. Typically, 3000–7000 panelists responded per survey. The current survey was the eighth survey that was administered to the Canadian Consumer Monitor Panel from the end of September 2011 to the end of October 2011.

Experimental design

A subsample of respondents to this survey ($n = 987$) was randomly selected and exposed to 4 mock packages in random order that showed different sodium claims. The study design was adapted from an earlier study conducted in Belgium (30). Adaptations included the use of label formats and Canadian approved claims that better reflected the Canadian labeling environment. The survey was designed as a repeated-measures mock-package experiment to test different claim types. Data from the baseline survey that captured demographic variables and data from a more detailed survey on attitudes toward sodium were linked to the current survey. Only panelists who answered all 3 surveys were included in the final analysis.

Sodium claims and mock labels

We tested the following 3 sodium claims: 1) a DRR claim approved by Health Canada, 2) a fictitious function claim, and 3) an existing NC claim (**Figure 1**). The fourth claim was a tastes great claim and served as a control. The design of mock packages (OnBrand) was based on similar Canadian food products identified in a database of label information from >10,000 Canadian food products (22). Such foods provided the basis of the product design, net weight, generic name, and NFT information.

The product name was fictitious to avoid the effect of branding. An enlarged version of the claim appeared beside the product to ensure legibility on the computer screen.

The evaluation of different claim types was the primary objective; therefore, the nutritional profile was identical for each mock soup package regardless of the claim it carried. Nonetheless, links were made available below each mock package to view the NFT in a separate pop-up window, if the panelists wished to do so.

Survey structure: mock-package experiment

After exposure to each mock package, participants were asked the same set of questions. A conceptual framework on the effect of health claims on consumers by Wills et al (31) guided the scope of questions. This framework proposed that attitudes of consumers toward a claim is dependent on their understanding of the claim, which in turn, may affect the attitude toward the product carrying the claim and subsequently affect purchasing intentions and, ultimately, behavior. Empirical evidence has supported the positive relation between purchasing intent and behavior (32), and this relation is the cornerstone of many theoretical models of consumer behavior.

Dependent consumer variables

After participants viewed each mock package, they answered the following questions by using 5-point Likert scales in which 1 denoted the least or negative end of the scale and 5 denoted the most or positive end of the scale. The following 3 questions evaluated the attitude of participants toward the claim: 1) How much do you like the claim on the package? 2) Is the wording clear on this claim? and 3) Do you trust the claim is true? The following single question evaluated the attitude of participants toward the product: How healthy do you think this food is for you? The following 3 questions evaluated purchasing intentions: 1) Assume this product has a cost similar to other canned soups; how likely would you buy this food? 2) Would the claim on the package above influence your decision to buy this food? and 3) How useful is this claim in helping you decide whether or not to buy this food?

The understanding of participants of the claim was evaluated by using the following 3 methods: a subjective measure whereby the clarity of the wording of the claim was rated, as described previously; an objective measure that used an open-ended question that asked participants: If you had to explain the claim to a friend, what would you tell them? (33); and an indirect method of evaluating consumer understanding of the health benefits communicated by the claims was facilitated by having participants rate, on 5-point Likert scales, the perceived benefit of the consumption of the product for the following subpopulations: 1) all people, 2) healthy people, 3) people who wanted to lose weight, 4) people with high blood pressure, 5) people with high blood cholesterol, 6) people with heart disease, 7) people who were constipated, and 8) people with diabetes (34). The multiple approaches used to examine claim understanding provided a comprehensive examination of understanding.

Product and consumer variables

To test independent effects of primary variables (ie, claim type and hypertensive status), product variables such as the product

category, functional ingredients, nutritional profile, and other attributes were kept constant in all the mock packages.

After the mock-package experiment was completed, information on key participant characteristics, such as personal relevance, familiarity of the product (ie, canned soup), and personal beliefs that have been shown to contribute to attitudes and understanding of health claims were obtained. Participants were asked to report if they have been diagnosed with hypertension. The familiarity of the product was determined by asking participants how frequently they consumed canned or packaged soup in the previous 12 mo.

Personal beliefs and barriers were determined through statements in which participants rated their level of agreement [from 1 (completely disagree) to 5 (completely agree)]. Statements evaluated their beliefs on food and health (what I eat has a major impact on my personal health), perceived control of their own health (I feel I have control over my personal health), belief in functional foods (some foods contain healthy ingredients that can lower my risk of disease and improve my long term health), belief in the utility of claims on food labels to choose healthier foods (health-related claims on food labels help me choose healthier

foods), and a barrier to the use of health claims on food labels (health-related claims are just gimmicks that food companies use to sell more food). Furthermore, information on relevant behaviors when the use of health claims was obtained (I look for health-related statements on packages when I am choosing foods at the grocery store [from 1 (never) to 5 (always)]). In total, the survey contained 110 questions over 16 screens and took ~15–20 min to complete.

Participant characteristics

Demographic information of participants was obtained from the baseline survey that was completed on entry to the Canadian Consumer Monitor panel. Information about the beliefs of participants regarding lowering sodium to improve health, their concern about the amount of sodium in their diet, and the perceived magnitude of the effect of sodium on health was obtained from a detailed survey on consumer attitudes on sodium (35). Additional information on behaviors regarding sodium, such as if participants sought or bought foods with sodium NC claims on the label, was also obtained.

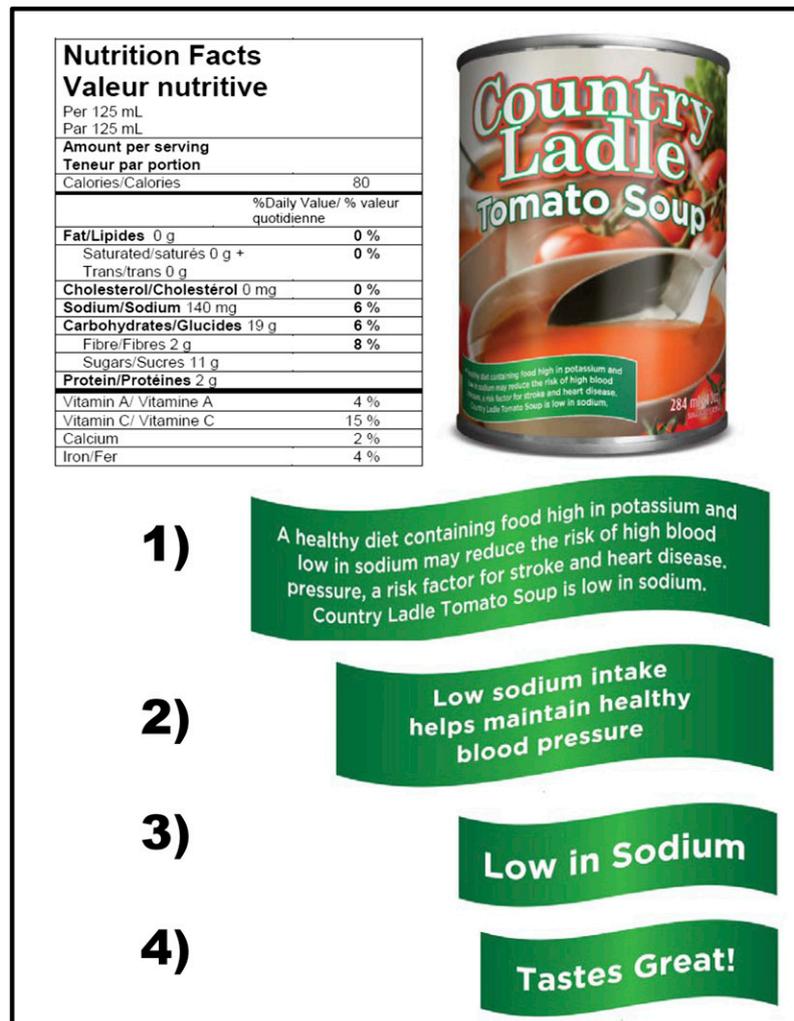


FIGURE 1. Mock packages used in the survey. Mock packages were identical except for the claim on the front of the package. Each survey panelist evaluated soups with each of the 4 tested claims that were administered in random order; the following 4 tested claims are displayed: disease risk reduction claim (1), function claim (2), nutrient-content claim (3), and taste control claim (4). Participants had the choice of viewing the Nutrition Facts table by clicking on a link below the mock package. The Nutrition Facts table was identical for each mock package.

Procedures

Before administration, the survey underwent a plain-language review, French translation, and pilot testing (~58 individuals from an existing panel from Guelph, Ontario). Minor issues regarding the clarity of wording of 2 survey questions were identified and addressed in the final version administered to the Consumer Monitor Panel. Snap 10 Professional Survey Software and WebHost system (Snap Surveys Ltd) were used to electronically design and publish surveys, manage complete and incomplete responses, and collect response data into an extractable database.

Each panelist was assigned a participant identification number and provided a unique electronic link to the password-protected online survey by e-mail. Panelists who did not complete the survey after the first e-mail invite received up to 3 weekly e-mail reminders to complete the survey. Completion of the survey was voluntary, and there was no time restriction during the 4-wk window. Respondents had the option to complete the surveys in either English or French and were able to revise responses up until the panelist clicked the submit button. All panelists who participated in the survey were entered in a lottery draw for a chance to win 1 of 2 draws for a monetary prize. Any personal information was stored in secured password-protected servers at the University of Guelph, and all response data were coded by participant identification numbers.

Consent was obtained from all participants at recruitment and was available with each survey. This form informed participants on the survey length, investigators involved, and measures to protect participant anonymity. The study protocol was approved by the Research Ethics Boards at the University of Toronto and the University of Guelph.

Data analysis

The analysis included both complete and incomplete surveys. Descriptive statistics (means \pm SDs) were performed on all rating questions. Mean differences in attitude and understanding rating questions in the 4 tested claims were determined by least-squares means multiple-comparisons analysis with Bonferroni adjustments. Fixed effects of the claim type and blood pressure status were estimated by using a repeated-measures analysis (PROC MIXED, SAS version 9.3, 2010; SAS Institute Inc) with age, sex, education, and caregiver of a child <18 y old included as covariates in the model. Personal beliefs and relevant reported behaviors were included in the model when a significant fixed effect was observed in one or more outcome variables. Statistical analyses were conducted with SAS version 9.3 software (2010; SAS Institute Inc).

Responses to the open-ended question that probed understanding were analyzed by researchers, and key themes were identified. Responses were coded thematically and quantified.

RESULTS

Participants

A total of 987 respondents completed the survey with the mock-package experiment on sodium claims; of these subjects, only 506 respondents who completed all 3 surveys (a survey with the mock-package experiment, a detailed survey on attitudes

toward sodium, and a survey that collected demographic data) were included in the analysis. Baseline characteristics of participants are presented in **Table 1**. Of 506 respondents, 71% of subjects reported having normal blood pressure, whereas 29% of subjects reported that they have been diagnosed with high blood pressure or hypertension by a health professional.

Attitudes toward claims

The type of claim had a significant effect on the perceived attractiveness, credibility, and clarity of the wording of claims ($P < 0.0001$; **Table 2**). Participants rated the taste control claim as the least attractive, whereas NC and DRR claims were both rated as the most attractive. All claims that mentioned sodium were shown to be equally credible and deemed more credible than the taste control claim. The wording of the NC claim was shown to be clearer than that of all other claims tested. There was no difference in clarity in DRR, function, or taste control claims.

Healthfulness of the product

Participants considered the soup that carried the DRR claim to be the most healthful, whereas the soup with the taste control claim was considered to be the least healthful, and soups that carried either NC or the function claim were rated intermediate in healthfulness (Table 2).

Claims and purchasing intentions

Participants were more influenced by nutrition claims and reported higher purchasing intentions for soups that carried either an NC or DRR claim compared with one that carried a function claim. Soups that carried any sodium claim scored higher in purchasing intentions than did the taste control claim ($P < 0.0001$; Table 2).

There was an interaction between claim type and blood pressure status on the perceived usefulness of the claim in making purchasing decisions ($P = 0.01$; **Figure 2**). In hypertensives, all sodium claims were rated similar and were perceived as being more useful than the taste control claim. In contrast, normotensives also perceived any claim that mentioned sodium as more useful than the taste control except that the DRR and NC were

TABLE 1
Demographic information of participants included in the final analysis¹

Sample characteristic	Values
Sample size (<i>n</i>)	506
Age (y)	52 \pm 12 ²
Sex [<i>n</i> (%)]	
M	185 (37)
F	321 (63)
Caregiver of a child or youth <18 y old [<i>n</i> (%)]	152 (30)
Education [<i>n</i> (%)]	
High school or less	83 (16)
Trades	64 (13)
College	177 (35)
University	182 (36)
Reported having hypertension [<i>n</i> (%)]	135 (29)

¹ Respondents who completed all 3 surveys

² Mean \pm SD.

TABLE 2
Ratings of consumer attitudes of 3 types of sodium claims and a taste control claim¹

	Claim types				<i>P</i> -claim ²	<i>P</i> -hyp ³
	Disease risk reduction	Function	Nutrient content	Taste control		
Attitudes toward the claim						
Attractiveness	3.04 ± 1.15 ^c	2.71 ± 1.21 ^b	3.11 ± 1.13 ^c	2.20 ± 1.13 ^a	<0.0001	0.43
Credibility	2.92 ± 1.11 ^b	2.94 ± 1.19 ^b	2.89 ± 1.05 ^b	2.13 ± 1.05 ^a	<0.0001	0.08
Clarity	3.49 ± 1.21 ^a	3.33 ± 1.34 ^a	3.76 ± 1.37 ^b	3.48 ± 1.37 ^a	<0.0001	0.34
Attitudes toward the product						
Healthiness	3.25 ± 1.01 ^c	3.03 ± 1.03 ^b	3.09 ± 0.94 ^b	2.75 ± 0.99 ^a	<0.0001	0.04
Purchasing intentions and claims' effect on making purchasing decisions						
Purchase intentions	2.96 ± 1.23 ^c	2.78 ± 1.18 ^b	2.90 ± 1.13 ^c	2.49 ± 1.13 ^a	<0.0001	0.18
Claim's influence	2.87 ± 1.26 ^c	2.63 ± 1.31 ^b	2.94 ± 1.17 ^c	2.01 ± 1.17 ^a	<0.0001	0.03
Usefulness ⁴	2.91 ± 1.28	2.57 ± 1.29	2.92 ± 1.12	1.89 ± 1.12	—	—

¹ All values are means ± SDs. *n* = 506. ^{a,b,c}Values with different superscript letters within a row are significantly different from each other by using least-squares means multiple comparison with Bonferroni adjustments.

² *P* values for the main effect of a claim type; the model was controlled for hypertension status, age, sex, education, caregiver status, select beliefs, and behaviors (exact variables included in the model are shown in Table 3).

³ Hyp, hypertension. *P* values for the main effect of hypertension status; the model was controlled for claim type, age, sex, education, caregiver status, select attitudes, and behaviors (exact variables included in the model are shown in Table 3). Significant values indicate that hypertensives rated mock packages higher than did normotensives.

⁴ Interaction between a claim type and hypertension status was detected for the usefulness of a claim toward making purchasing decisions (*P* = 0.01; see Figure 2).

both rated higher than the function claim. Furthermore, hypertensives rated the function claim as being more useful than normotensives did.

Differences in ratings of claims between hypertensive and normotensive respondents

Overall, hypertension status modulated attitudes toward the product and perceived effect of claims on purchasing intentions.

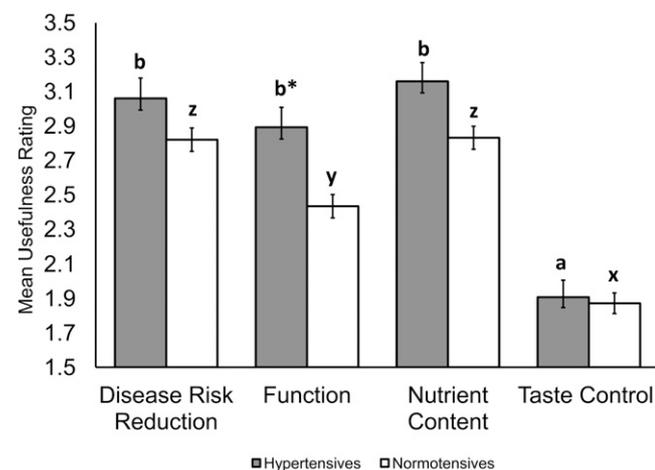


FIGURE 2. Effects of hypertension status and claim type on perceived usefulness of claims when participants made purchasing decisions. A significant claim type and hypertension status interaction was observed for ratings of perceived usefulness (*P* = 0.01). ^{a,b}Gray bars (mean ± SEM ratings by hypertensives; *n* = 135) with different superscript letters are significantly different, *P* < 0.05 (least-squares means multiple comparison with Bonferroni adjustments). ^{x,y,z}White bars (mean ± SEM ratings by normotensives; *n* = 337) with different superscript letters are significantly different, *P* < 0.05 (least-squares means multiple comparison with Bonferroni adjustments). *Significantly different from normotensives, *P* < 0.05 (least-squares means multiple comparisons with Bonferroni adjustments).

In addition to perceived usefulness, hypertensives also perceived claims to be more influential on purchasing intentions than normotensives did (Table 2, Figure 2). When controlled for claim type, sociodemographics, and select beliefs and behaviors as outlined in Table 3, hypertensives rated the claim's influence higher by 0.19 points compared with that of normotensives (*P* = 0.03; Table 3, Figure 2). Similarly, hypertensives perceived all mock packages to be more healthful and rated 0.17 points higher than normotensives did (*P* = 0.04; Table 3, Figure 2). There was no effect of hypertension when it came to attitudes toward the claims, such as perceived attractiveness, credibility, and clarity of the claim (Table 3).

Understanding of claims: perceived benefits for other health conditions

Respondents felt that claims tested would benefit people with a range of health conditions (Table 4). Although all mock packages were identical in nutritional profile, respondents consistently rated any soup that carried an NC or DRR more beneficial for all people, healthy people, people who wished to lose weight, people who had high blood pressure, people who had high cholesterol, or people who had diabetes than the soup that carried the taste control claim. Soups with the function claim were rated intermediate except for benefits for constipation, which the package that carried the function claim was rated similar to mock packages with DRR or NC claims.

Furthermore, hypertensive respondents rated products that carried any of the tested claims as more beneficial to all people, healthy people, people with high cholesterol, and people with heart problems than normotensive respondents did (Table 4).

Open-ended evaluation of claim understanding

The open-ended question was used to obtain a more objective measure of understanding because open-ended questions are ideal

TABLE 3
Estimates of fixed effects¹

	Attractiveness	Credibility	Clarity	Healthiness	Purchase intention	Claim's influence	Usefulness
Main effects							
Claim type ²							
Disease risk reduction claim	0.83 ± 0.06**	0.80 ± 0.06**	-0.02 ± 0.07	0.48 ± 0.04**	0.48 ± 0.05**	0.85 ± 0.06**	Significant claim type and blood pressure interaction (Figure 2)
Nutrient-content claim	0.52 ± 0.06**	0.82 ± 0.06**	-0.18 ± 0.07*	0.28 ± 0.04**	0.28 ± 0.04**	0.62 ± 0.06**	
Function claim	0.90 ± 0.06**	0.77 ± 0.06**	0.26 ± 0.06**	0.33 ± 0.04**	0.40 ± 0.05**	0.94 ± 0.06**	
Hypertensives compared with normotensives	0.06 ± 0.08	0.14 ± 0.08	0.09 ± 0.10	0.17 ± 0.08*	0.13 ± 0.10	0.19 ± 0.09*	
Covariates							
Age	0.00 ± 0.00	-0.01 ± 0.00*	-0.01 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Sex (M compared with F)	-0.01 ± 0.07	0.11 ± 0.07	-0.08 ± 0.09	-0.05 ± 0.07	-0.11 ± 0.09	0.00 ± 0.08	-0.08 ± 0.08
Education³							
High school or less	0.27 ± 0.11*	0.18 ± 0.11	0.21 ± 0.13	0.06 ± 0.11	0.06 ± 0.13	0.10 ± 0.11	0.15 ± 0.11
Trades	0.26 ± 0.12*	0.21 ± 0.11*	0.21 ± 0.14	0.11 ± 0.11	0.03 ± 0.14	0.11 ± 0.12	0.20 ± 0.12
College	0.16 ± 0.08	0.07 ± 0.08	0.14 ± 0.10	0.15 ± 0.08	0.11 ± 0.10	0.04 ± 0.09	0.14 ± 0.09
Caregiver of a child <18 y old	0.13 ± 0.08	0.05 ± 0.08	0.20 ± 0.10*	0.05 ± 0.08	0.03 ± 0.10	0.10 ± 0.09	0.08 ± 0.09
Attitudes and beliefs							
Effect of food on health	-0.09 ± 0.06	-0.11 ± 0.06	-0.11 ± 0.07	-0.14 ± 0.06*	-0.12 ± 0.07	-0.09 ± 0.06	-0.14 ± 0.06*
Effectiveness of functional foods	0.05 ± 0.05	0.00 ± 0.05	0.16 ± 0.06*	0.12 ± 0.05*	0.07 ± 0.06	0.00 ± 0.06	0.01 ± 0.06
Helpfulness of claims	0.31 ± 0.04**	0.26 ± 0.04**	0.11 ± 0.04*	0.22 ± 0.03**	0.30 ± 0.05**	0.42 ± 0.04**	0.41 ± 0.04**
Claims are just gimmicks	0.00 ± 0.04	-0.10 ± 0.03*	-0.12 ± 0.04*	-0.06 ± 0.03	0.00 ± 0.04	0.05 ± 0.04	0.01 ± 0.04
Consumer behaviors							
Frequency consumption of soup	0.06 ± 0.02*	0.04 ± 0.02*	0.08 ± 0.02*	0.11 ± 0.02**	0.12 ± 0.02**	0.06 ± 0.02*	0.06 ± 0.02*
Seek for sodium nutrient-content claims when choosing lower sodium foods	0.09 ± 0.03*	0.00 ± 0.03	0.02 ± 0.04	0.03 ± 0.03	0.08 ± 0.04*	0.15 ± 0.04**	0.09 ± 0.03*

¹ All values are fixed effects ± SDs from repeated-measures ANCOVA (n = 506). *P < 0.05, **P < 0.0001.

² The reference category was the taste control claim (effect fixed to zero).

³ The reference category was university level education (effect fixed to zero).

TABLE 4
Ratings for perceived benefits of 3 types of sodium claims and a taste control claim¹

Perceived benefits	Claim types				<i>P</i> -claim ²	<i>P</i> -hyp ³
	Disease risk reduction	Function	Nutrient content	Taste control		
All people	3.38 ± 1.23 ^c	3.19 ± 1.30 ^b	3.30 ± 1.22 ^b	2.85 ± 1.25 ^a	<0.0001	0.02
Healthy people	3.44 ± 1.22 ^c	3.25 ± 1.28 ^b	3.37 ± 1.22 ^c	2.99 ± 1.25 ^a	<0.0001	0.01
People who wanted to lose weight	3.23 ± 1.31 ^c	3.03 ± 1.33 ^b	3.14 ± 1.29 ^{bc}	2.71 ± 1.33 ^a	<0.0001	0.06
With hypertension	3.51 ± 1.39 ^c	3.22 ± 1.43 ^b	3.42 ± 1.34 ^c	2.54 ± 1.35 ^a	<0.0001	0.11
With high cholesterol	3.29 ± 1.36 ^c	3.03 ± 1.35 ^b	3.18 ± 1.36 ^c	2.68 ± 1.33 ^a	<0.0001	0.02
With heart problems	3.42 ± 1.39 ^c	3.15 ± 1.39 ^b	3.33 ± 1.35 ^c	2.57 ± 1.33 ^a	<0.0001	0.03
With constipation	2.63 ± 1.30 ^b	2.54 ± 1.27 ^b	2.64 ± 1.31 ^b	2.35 ± 1.22 ^a	<0.0001	0.18
With diabetes	2.74 ± 1.37 ^c	2.56 ± 1.32 ^b	2.64 ± 1.31 ^b	2.21 ± 1.17 ^a	<0.0001	0.21

¹ All values are means ± SDs. *n* = 506. ^{a,b,c}Values with different superscript letters within a row are significantly different from each other by using least-squares means multiple comparison with Bonferroni adjustments.

² *P* values for the main effect of a claim type; the model was controlled for hypertension status, age, sex, education, caregiver status, select beliefs, and behaviors.

³ Hyp, hypertension. *P* values for the main effect of hypertension status; the model was controlled for claim type, age, sex, education, caregiver status, select attitudes, and behaviors. Significant values indicate that hypertensives rated mock packages higher than did normotensives. No interaction between claim type and hypertension status was observed.

for capturing the range of possible claim misunderstandings. Of the 987 panelists who participated in the survey with the sodium-claims mock-package experiment, ~65% (*n* = 643–656) of respondents completed the open-ended question for each of the 4 tested claims. The top 10 identified themes in response to each sodium claim are presented in **Table 5**. Key observations from identified themes could be made. As claims became longer, participants avoided paraphrasing or stating the claim verbatim and opted to describe the meaning as indicative of a good or healthy choice (NC claim: 7%; DRR claim: 17%). It was particularly noticeable that, in the long DRR claim, respondents tended to focus on the NC statement of the product rather than the health benefits. Although there was no comparative language (ie, lower in sodium) used in any claim tested, respondents often stated that sodium claims indicated that the product was lower than the average or regular soup.

A significant number of respondents provided a criticism of claims, with 20% of subjects who noted that the function claim was a general statement that did not make a connection to the food product. In the current study, information on potassium was not included on the NFT, and 10% of participants noticed that potassium was mentioned in the DRR claim and looked for more information about the potassium content of the product. In US and Canadian regulations, if the health claim mentions potassium, the amount of potassium must be declared on the NFT. In addition, a significant number of respondents assumed that the function claim meant that the product was low in sodium (21%).

Effect of consumer variables

Demographic characteristics had little influence on attitudes (Table 3), although subjects with lower levels of education rated the attractiveness of claims higher than did subjects with a university degree. Older participants tended to rate claims slightly less credible than did younger individuals. Subjects who reported caring for someone <18 y of age reported higher ratings of clarity of the wording of the claim than did subjects who were not caregivers of children and youth.

Certain personal background beliefs and behaviors were influential on attitudes toward sodium claims.

- 1) The stronger the individual's attitudes and beliefs in the ability of a food to affect his or her personal health, the lower the ratings were in the perceived healthiness of a product and usefulness of claims and benefit to people with heart problems, constipation, and diabetes.
- 2) The stronger the individual's attitudes and beliefs in the effectiveness of functional foods, the higher ratings were for the healthiness of the product and clarity of the wording of the claim.
- 3) The stronger the individual's attitudes and beliefs in the helpfulness of claims in making purchasing decisions, the higher ratings were for every question asked in the survey.
- 4) The stronger the individual's attitudes and beliefs in claims being a gimmick, the lower ratings were for credibility and perceived benefits for all people.

Certain reported behaviors of respondents were associated with attitudes toward sodium claims.

- 1) The more frequent the respondent reported the consumption of canned soup, the higher the respondent rated the claims in every question asked in the survey;
- 2) The more frequent the respondent reported seeing sodium NC claims when choosing lower sodium foods, the higher the individual rated the intention to purchase, influence of a claim on purchasing intentions, attractiveness of the claim and usefulness of the claim for making purchasing decisions, and perceived benefit for all people, healthy people, and people who want to lose weight.

DISCUSSION

In this mock-package experiment, we showed that all claims that mentioned sodium resulted in more-positive attitudes toward the claim, overall product healthfulness, and purchasing intentions than did the taste claim (control), although all mock packages were identical in nutritional composition and labeling except for the tested claims. The results of this study have implications for the following 2 important aspects that relate to



TABLE 5Top 10 key themes identified in response to the open-ended question to evaluate understanding of sodium claims¹

Key themes	<i>n</i> (% of total responses)
In response to the NC claim	
1) The soup was or claimed to be low in sodium or salt or contained little to no salt	239 (37)
2) Lower in sodium than the average, regular, or normal canned soup	90 (14)
3) Advised friend to check or demonstrated that they, themselves, checked the NFT	80 (12)
4) The soup was a healthy, healthier, or good choice	48 (7)
5) Questioned what constituted low sodium	40 (6)
6) The soup had reduced, lower, or less sodium	32 (5)
7) Showed distrust in the claim or on all claims in general (ie, marketing scam)	19 (3)
8) Questioned or thought the soup was a high-sodium product	19 (3)
9) Made additional judgments on other nutrients besides sodium (on the basis of the NFT)	17 (3)
10) Benefits people who need or want to watch their sodium intake	14 (2)
In response to the function claim	
1) Noted that the claim was a general statement or a health fact and did not connect the statement to the product (ie, did not state soup was low sodium)	143 (22)
2) Soup was or claimed to be low in, less, or lower in sodium or lower sodium than other, average, or regular-version soups	138 (21)
3) Advised friend to check or showed that they, themselves, checked the NFT	90 (14)
4) Explained that low sodium or lowering sodium in a diet will maintain, control, or keep blood pressure low or that too much salt is harmful for maintaining healthy blood pressure	66 (10)
5) Showed distrust in the claim or in all claims in general	46 (7)
6) The soup was a healthy, healthier, or good choice	37 (6)
7) Soup helps to maintain healthy (low or normal range) blood pressure, is good for blood pressure, or is good for people with high blood pressure	34 (5)
8) Thought the statement was true or fact	34 (5)
9) Claim advises to consume less salt, felt it was healthier to consume less salt, or believed low sodium is good for you	33 (5)
10) Made additional judgments on other nutrients besides sodium (on the basis of the NFT)	22 (3)
In response to the DRR claim	
1) Acknowledged that the product was or claimed to be low or less in sodium or salt	191 (30)
2) The soup was a healthy, healthier, or good choice	111 (17)
3) Advised friend to check or showed that they, themselves, checked the NFT	83 (13)
4) Questioned the potassium content of the soup	65 (10)
5) Showed distrust in the claim or in all claims in general	49 (8)
6) Lower in sodium than the average, regular, or normal canned soup	42 (7)
7) The soup alone or as a part of a diet will prevent or will not contribute to blood pressure, heart disease, or stroke	27 (4)
8) Made additional judgments on other nutrients besides sodium (on the basis of the NFT)	27 (4)
9) Criticized the claim for being too wordy	25 (4)
10) Good for those with or concerned with high blood pressure, heart disease, or stroke	20 (3)

¹ Some open-ended responses from participants contained multiple key themes. DRR, disease risk reduction; NC, nutrient content; NFT, Nutrition Facts table.

claims on food labels: 1) the high awareness of the health effects of sodium on blood pressure and 2) implications of these results on the use of a stealth sodium-reduction strategy in the food supply.

First, the similar response to all 3 types of sodium-nutrition claims may have been due to the high level of awareness of health effects of overconsuming sodium on blood pressure. Over the past decade, a population-wide sodium reduction has been recommended, and increasingly, initiatives are being implemented in countries such as the United Kingdom, Finland, parts of the United States, and Canada (9–11). Because mean sodium intakes in Canada for all age and sex groups greatly exceed the upper limit (7, 36), Blood Pressure Canada and 16 health-related organizations released a policy statement that called for Canadians to reduce their daily sodium intake to the recommended range from 1500 to 2300 mg (37, 38). In response, Health Canada formed a multisectoral Sodium Working Group in 2008, which developed a sodium-reduction strategy for Canada (7). The strategy, which was released in 2010, included education, a staged and targeted voluntary sodium reduction in the food supply, and research. Although the Sodium Working Group was disbanded prematurely before monitoring and evaluation plans could be realized, the policy process was highly publicized, which likely contributed to the increased awareness in the Canadian population.

The high awareness of the relation between dietary sodium and hypertension could also explain why the NC claim was rated as high as or higher than the DRR claim. The mere mention of sodium inferred a heart health benefit of the mock packages. This finding questioned the validity of having less stringent nutrient criteria that products must meet to carry sodium NC compared with DRR claims. The less-stringent criteria likely explain why NC claims are much more prevalent on food labels than are DRR claims, with 4.5% of products with NC claims compared with only 0.1% of products with sodium-related DRR claims (22). Foods that carry the NC claim only have to satisfy one criteria solely on the basis of the sodium content of the food and could, eg, be high in saturated fat or other unhealthy nutrients. However, in the United States, NC claims must be accompanied with a disclosure statement when the product exceeds specified threshold levels of total fat (13 g), saturated fat (4 g), cholesterol (60 mg), and sodium (480 mg). In contrast, foods that carry the sodium DRR claim, by Canadian regulations, must contain $\geq 10\%$ of a recommended intake for a vitamin or a mineral and ≤ 2 g SFAs and *trans* fatty acids in addition to being low in sodium (< 140 mg) (17, 39). Similarly, under US regulations (39, 40), claims for low sodium and reduced risk of high blood pressure under the Nutrition Labeling and Education Act and Food and Drug Administration Modernization Act have additional criteria for fats and cholesterol in addition to a criterion for sodium. This difference in criteria for DRR compared with NC claims points to a weakness in the NC claim regulations. When the nutrient-disease relation is widely recognized, consumers rate products equally healthy, but the nutritional criteria for NC claims are much less stringent than those of comparable DRR claims. This difference raises the following public health question: If there is a market tendency to take advantage of inferred health benefits associated with NC claims, would it be of public health interest to apply similar criteria to NC as DRR claims? More-stringent criteria on NC claims may be needed to

avoid the presence of unhealthy nutrients that counter the benefits of low sodium.

Second, the fact that all sodium claims elicited higher purchasing intentions than did the control tastes great claim contradicts the often-stated industry strategy of the use of a stealth approach to sodium reduction in food products. The industry believes the advertisement of reductions in sodium will lead to lower sales because of misconceptions over the poor taste of lower-sodium products (41). Data from our study showed that consumers were attracted to and considered sodium claims useful and influential in their intended purchasing decisions. Thus, our results suggested that, as public health efforts continue to promote dietary sodium reduction, there would be a benefit to the industry in communicating the sodium content on the labels of their low-sodium food products, which may also stimulate the reformulation or introduction of additional lower-sodium products in the market place.

In line with previous studies that suggested claims may better resonate in individuals who live with a risk factor or disease, our results showed that having hypertension increased ratings in certain perceptions related to product healthfulness and purchasing intentions. In a recent Dutch study, having diabetes increased the perceived personal benefit and willingness of subjects to purchase a product in response to whole grains and glycemic control claims (25). In a New Zealand study, hypertensives were also shown to have a higher preference for low-sodium options than were normotensives (42). In the current study, although there were more-positive attitudes in hypertensives, there was no indication of major differences in the understanding of the claims (ie, perceived clarity).

In general, participants in our study considered the NC claim to be the most direct and clear. More participants attempted to directly paraphrase the NC claim when they explained it to a friend. For the more-complex claims, the function claim, and, even more so, the DRR claim, explanations became increasingly generic, and respondents used terms such as good or healthy choice. This result was consistent with previous findings that Canadian consumers prefer shorter claims and find them easier to understand (43). Any sodium claim led consumers to attribute additional health benefits, eg, for diabetes and weight loss, beyond the well-established relation regarding sodium and hypertension or heart disease. This effect has been coined the halo effect (ie, rating the product higher on other health attributes not mentioned in the claim) (34, 44). Although all packages were identical in nutritional profiles and had the same NFT, compared with the taste control claim, all sodium claims, especially NC and DRR claims, were rated higher in perceived benefits for all conditions examined. This finding also provided support for more-stringent criteria for foods with sodium claims as well as additional educational efforts to ensure consumers do not attribute inappropriate health benefits to foods with low-sodium claims.

Consumer reactions to claims depended more on their general attitudes toward food and health and their belief in the usefulness of health claims on food labels than on demographics. Similar to previous studies (25, 30), demographics such as age, education, sex, and caregiver status did not have significant effects on most perceptions toward claims. However, familiarity and personal beliefs about food effects on health and helpfulness of claims were most influential on perceptions.



Limitations of the current study pertained to its focus on one diet-health relation and one product (ie, soup). Research has shown that the type of food product affects the context that consumers use to interpret the claim and, thus, modifies perceptions of claims (45). Claims are best received when attached to products with a positive health image or that have a long-standing history with claims. We chose to test canned soup, which is the most common food that carries sodium claims (22). However, there is a possibility that claims may test differently on alternative products. Other potential limitations included the reliance on self-reported measures of blood pressure status, and the mock-package experiment did not truly mimic a real shopping environment, although it more accurately measured purchasing evaluations that were based on product-label claims than mere opinion surveys. All food packages were professionally designed on the basis of existing Canadian products and were consistent with regulatory requirements, which were strengths of the current study. Other advantages of the current study involved the mock-package design that quantified a number of attitudes and understanding characteristics in different types of claims by using both quantitative and qualitative methods. The use of a combination of approaches ensured a comprehensive examination of the research questions. Finally, there is great public health significance in the investigation of sodium claims to help inform labeling and sodium-reduction food policy because these types of claims are present in the market place and can be used to propel population dietary sodium reductions forward.

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