

ORIGINAL RESEARCH ARTICLE

Sustained behaviour change in healthy eating to improve obesity outcomes: It is time to abandon willpower to appreciate wanting

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The purpose of this study was to report on a nationally representative survey of the experience of Canadian adults regarding food cravings and the impact of these cravings on behaviour and quality of life. A total of 1532 respondents (16% of members of an online panel emailed an invitation and link) completed a nationally distributed survey. Almost two-thirds of the sample reported experiencing cravings, with women being more likely to report cravings than men. Of those with cravings, 83.1% reported moderate or strong cravings. Cravings impacted eating behaviours and quality of life, especially for those with strong cravings. Cravings were associated with being bored, emotional or watching TV. Those who identified themselves as overweight or as trying to lose weight were more likely to have cravings. Of those reporting to be overweight and trying to lose weight few experienced distress because of lack of access to help and rates of interest in being guided by healthcare professionals were low, except in those with strong cravings. These results reinforce the notion that eating behaviour may differ from other behaviours in that there is a strong drive to eat that is difficult to control for many individuals. Behavioural interventions targeting healthy eating should be developed to address this construct of drive to eat, that is, food cravings.

KEYWORDS

cravings, overweight, quality of life

1 | INTRODUCTION

Obesity management has benefitted from many research developments over the past 15 years. These developments include: better understanding of the cardiovascular risks associated with obesity (hazard ratios for incident cardiovascular disease, CVD, 1.21/1.32 [men/women] for individuals with overweight; 1.67/1.85 for individuals with obesity and 3.14/2.53 for individuals with morbid obesity)¹; how excess adipose tissue impairs health via metabolic and inflammatory consequences resulting from the over secretion of peptides by enlarged fat cells, along with ectopic deposition of lipids (eg, in the liver)²; as well as the reframing of obesity as a chronic medical disease^{3,4} (see, for instance, the definition of adiposity-based chronic disease).⁵

Viewing obesity as a chronic medical condition facilitates a comprehensive, evidence-based approach to management by the medical community. A cornerstone of any obesity management intervention is

the behaviour of the individual. All pathways to success involve action on the part of the individual. Healthy eating is a critical component of all behavioural interventions for obesity, whether solo or as part of a medical or surgical intervention. Recent research has demonstrated neurological substrates that drive both homeostatic and hedonic drives to eat. Hypothalamic neurons integrate internal and external nutritional information and mediate hindbrain and cortico-limbic systems.⁶ Neurobehavioural evidence suggests that obese individuals may experience changes in the way the appetite system works to increase what is called incentive salience (wanting).⁷⁻¹³ Incentive salience is experienced as cravings and help us to understand how powerful the motivation to eat is.

A behavioural consequence of these neurobiological findings is appreciating just how strong a reinforcer food becomes, both as a consequence (operant conditioning, as when an individual uses food as a reinforcer) as well as an unconditioned stimulus to establish non-conscious behavioural habits (classical conditioning, as in the

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phenomenon of cued eating¹⁴). The implication of these data is that eating behaviour may not be like other behaviours, in that action tendencies that guide us towards poor food choices are mediated by active neurological systems that are supported by powerful learning paradigms in environments with high accessibility to unhealthy food. In this study, we were specifically interested in understanding more about food cravings in the general population. Given how powerful the hedonic drive to eat is, how prevalent is it and how does it impact the typical individual?

The literature on food cravings has focused on both neurological (referenced above) as well as psychological aspects. The experience of cravings has been shown to be common in numerous nonclinical samples, including individuals in the general community,¹⁵⁻¹⁷ university students¹⁸ and young women.¹⁹ Gendall et al¹⁹ describe cravings as normative, not pathological, with the implication that cravings will likely need to be addressed in obesity management and healthy eating interventions at a population level and not just with select individuals. In this way, cravings may differ from more pathological eating, such as binge eating disorder, which has a low base rate and may be appropriately addressed by referring to specialty mental health providers.

Food cravings have been demonstrated to be associated with body mass index (BMI) and obesity,^{15,16} likely due to the tendency for cravings to be for calorie dense foods.²⁰⁻²² Further, dieting has been shown to increase cravings,²³ and those experiencing cravings appear to benefit less from weight management, either via diet^{24,25} or bariatric surgery.²⁶

If we hope to be successful in supporting sustained behaviour change in healthy eating as part of obesity management, it will be important to understand the nature of this behaviour change goal. Given the evidence on the power of cravings to impact on food choices, obesity and weight management, it is appropriate to question whether the behaviour change goal of healthier eating is equivalent to other behavioural goals, such as medication taking or physical activity. Are there factors at play that make sustained changes in eating behaviour particularly challenging? How important will it be to address the hedonic drive to eat when supporting persons living with obesity to make, and maintain, changes to their diet? Understanding what it means to take on an eating change goal will be important in regards to goal setting, action planning, problem solving and evaluation of the outcomes of behavioural interventions.

Most clinical approaches to obesity management are stepped approaches. Lifestyle interventions are generally considered first line interventions, followed by medication if lifestyle intervention is not successful, and followed by bariatric surgery when a combined lifestyle and medication intervention fails. Given recent evidence that both bariatric surgery and some types of medication reduce the drive to eat^{27,28} the prevalence and impact of cravings in the general population might support a reconsideration of this stepped model. For instance, those with powerful cravings that impact negatively on quality of life might be better treated with a combined lifestyle and medication intervention²⁹ as a first line intervention. In these individuals lifestyle interventions might be more successful if cravings are reduced with medication, and cravings may be a major limiting factor in the efficacy of behavioural interventions.

WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT

- Obesity management rests on behaviour change. Healthy eating is considered a foundation for obesity management yet sustaining healthy eating changes over time appears to be very challenging.
- Recent research has identified neurobiological substrates of both homeostatic and hedonic eating systems. Hedonic eating appears to be dominant in obesity.
- Behavioural correlates of hedonic eating are reflected in the power of food as a reinforcer (operant conditioning) as well as a source of conditioned behaviour (classical conditioning).

WHAT THIS STUDY ADDS

- This survey assessed the prevalence, nature and impact of food cravings as experienced by the general Canadian population.
- The results of this study document the high prevalence of food cravings and the negative impact that cravings, especially strong cravings, have on behavioural and psychological factors.

Given that obesity and overweight affect large segments of the population, an important question to ask is how common cravings are in the general population. To date, there are no published studies looking at representative population sampling on this issue. This study was designed to collect general information on the frequency, and impact of cravings in the general population in Canada. We also were interested in examining the relationship between cravings and self-perceived overweight/obesity. Given that reframing obesity as a medical condition offers new treatment paths for individuals, we were interested in understanding the attitude of those who consider themselves overweight and are trying to lose weight towards professional management options.

As an exploratory, survey-based study there were no hypotheses per se associated with the methodology. That being said, the following questions framed the methods and analyses of this study:

Question 1: How commonly are cravings of varying strengths (low, moderate or high) reported in the Canadian population? In addition, does the prevalence of cravings differ between men and women?

Question 2: What are the characteristics of food cravings? Specifically, how common are experiences of loss of control over eating, including difficulty stopping eating, as well as difficulty controlling thoughts about eating? Further, does the strength of cravings impact these experiences?

Question 3: What are the situations that trigger or increase food cravings and does strength of cravings impact these triggers?

Question 4: How do cravings impact quality of life and is the extent of impact related to strength of cravings? Here we asked how cravings impacted perceptions of happiness and guilt.

Question 5: Is there a relationship between the experience of cravings and self-perceptions of being overweight as well as a relationship between attempting to lose weight and the experience of cravings?

Question 6: Do those who consider themselves overweight and are trying to lose weight feel helpless because obesity is not treated like other diseases such that access to professional support and medical management is limited? Further we asked about attitudes toward medically recommended treatments. Finally, we were interested in seeing how these beliefs were impacted by strength of cravings.

2 | METHODS

2.1 | Participants and procedure

The goal of this study was to analyse the results of a general survey of Canadians' experience with food cravings. This was a general sample, not a clinical sample, as clinical samples are not representative of the population. Connected to a launch of a pharmaceutical product, a public surveying company (Leger) was contracted to administer a survey broadly. Leger is a large Canadian polling, research and strategic marketing company. Leger operates an online survey panel of over 400 000 Canadians, who join the panel and receive rewards (money, Air Miles or Aeroplan points) for completing surveys. Membership is contingent upon completing three surveys per year. Personally identifiable information is not included in the surveys administered by Leger. This information is available to the company for its internal purposes (data gathered in the survey is anonymous).

The survey was conducted using LegerWeb (Leger's online panel with a retention rate of 90%) between 6 and 9 November 2017. Potential respondents were randomly selected from the panel and sent an email invitation and link. Sampling continued until the target of 1500 respondents were met and quotas for gender and region (matching the Canadian population) were applied. As this panel is voluntary, for the sole purpose of completing surveys for rewards, and the fact that all data collected in the survey were anonymous, we did not seek ethical approval for this survey. The analyses presented here are secondary use of anonymous data, falling under Article 2.4 of the Tri-Council Policy Statement, which states, "REB (Research Ethics Board) review is not required for research that relies exclusively on secondary use of anonymous information, or anonymous human biological materials, so long as the process of data linkage or recording or dissemination of results does not generate identifiable information."³⁰

Inclusion criteria for joining the Leger web panel included legal residents of Canada who have reached the age of majority in their province and who are willing to complete at least three surveys per year. Members provide their name, gender, date of birth, province of residence, postal code, email address and type of reward they would like to receive (dollars, Air Miles, Aeroplan). Exclusion criteria include employees of Leger, its parent companies, branches, affiliates and

providers connected to Legerweb.com websites as well as family and household members of the employee.

2.2 | Survey

Basic demographic data were anonymously collected on the following variables: gender, age, marital status, province/territory of residence, occupation, income level and first language.

Next, respondents were asked to make judgments about their weight, causes for excess weight and if they were trying to lose weight. Self-reported and self-defined weight status was reported as very overweight, overweight, somewhat overweight, healthy weight, somewhat underweight, underweight, very underweight (including "I don't know" and "I prefer not to answer"). For analysis, groups were categorized into overweight and healthy weight.

Respondents then completed questions regarding the experience of food cravings. Supplement 1 summarizes the survey items (Table S1). Respondents were asked, "Do you experience food cravings (a powerful desire for foods you enjoy)?" They then rated the strength of these cravings and identified the situations that trigger or increase cravings. For those reporting cravings, this was followed by questions asking about the nature of the experience of the cravings, including if the respondent experienced loss of control over eating, and the nature of their thoughts about food. Next, questions about the impact of cravings on quality of life, guilt, control of eating and perceived impact of cravings on attempts to control weight were posed. Finally, several questions were asked concerning attitude to health professional treatment and support for weight management.

2.3 | Analyses

Data were reported as percentage responses to the various questions. Comparison between groups was conducted using chi-square analyses.

3 | RESULTS

3.1 | Respondents

The survey for this study was grouped with several other questionnaires into a small packet that was distributed by Leger, via email, to 9587 panel members. Of these, 2113 (22%) completed some components of the package and a total of 1532 respondents completed the food cravings survey (response rate 16%). Demographic results are presented in Table 1, along with Statistics Canada data on the general population.³¹ Gender was well balanced in this sample and matched the general population. Respondents tended to be older rather than younger ($P < 0.001$), relative to the general population, although all age ranges were represented. The majority of respondents were married ($P < 0.001$) and the distribution of marital status closely resembled the Canadian population. Regional participation was reflective of the Canadian population, with Ontario and Quebec being the largest group of respondents ($P < 0.001$). The sample was well educated, relative to the general population, with 40.0% having completed University level education and very few respondents with less than high school ($P < 0.001$). As well, the sample was wealthier than the general population, where

TABLE 1 Demographics of the sample

	2018 Canadian Statistics ³¹ (www.150.statscan.gc.ca)	%(N)	P-value
Gender			$\chi^2 = 0.17$; 0.683
Male	49.6	49.5 (758)	
Female	50.4	50.5 (774)	
Age (>18 years)			$\chi^2 = 46.88$; <0.001
18-34	26.4	18.6 (285)	
35-44	16.9	14.9 (229)	
45-54	17.5	20.5 (314)	
55-64	17.5	20.2 (309)	
65+	21.6	25.8 (395)	
Marital status			$\chi^2 = 804.61$; <0.001
Married/partner	61.2	67.4 (1021)	
Single	22.7	19.9 (302)	
Separated/divorced/widowed	16.2	12.6 (191)	
Region			$\chi^2 = 851.50$; <0.001
Atlantic	6.5	6.6 (101)	
Quebec	22.9	27.8 (426)	
Ontario	38.7	39.3 (602)	
Manitoba/Saskatchewan	6.8	8.3 (127)	
Alberta	11.7	8.2 (126)	
British Columbia	13.1	9.8 (150)	
Education			$\chi^2 = 851.50$; <0.001
Grade School ⁷	11.5	0.4 (6)	
High School	23.7	22.8 (349)	
College/Diploma	34.3	36.2 (554)	
Bachelor's	(BA+) 28.5	26.3 (403)	
Master's	–	10.8 (165)	
PhD	–	2.9 (44)	
Income			$\chi^2 = 926.03$; <0.001
<20 000	29.6	6.2 (95)	
20 000-<39 999	(20-34 999) 21.05	13.1 (200)	
40 000-<59 999	(35-49 999) 16.2	18.2 (279)	
60 000-<79 999	(50-74 999) 16.4	14.8 (226)	
80 000-<99 999	(75-99 999) 8.4	13.0 (199)	
100 000+	8.3	22.2 (340)	
Prefer not to answer	–	12.6 (193)	
First language			$\chi^2 = 1555.48$; <0.001
French	20.6	25.4 (388)	
English	56.0	66.0 (1009)	
Both	0.5	3.1 (47)	
Other	1.8	5.5 (84)	

Significant findings are bolded.

35.2% earned more than \$80 000 per year ($P < 0.001$). The majority of the respondents had English as their first language ($P < 0.001$), consistent with the general Canadian population.

Question 1: How commonly are cravings of varying strengths (low, moderate of high) reported in the Canadian population? In addition, does the likelihood of cravings differ between men and women?

Significantly more respondents reported having food cravings (62.6%) than did not (36.4%; $\chi^2 = 106.60$, $P < 0.001$). For those that report cravings ($N = 959$), 16.9% report low cravings, 69.9% report moderate cravings and 13.2% report high cravings ($\chi^2 = 571.91$,

$P < 0.001$). Women (66.8%) were more likely than men (58.35) to report cravings ($\chi^2 = 12.63$, $P = 0.002$). There were gender differences in strength of cravings as well ($\chi^2 = 11.23$, $P = 0.004$). Women were more likely to report strong cravings (16.3% compared to 9.6% of men), and men were more likely to report low level of cravings (19.4% compared to 14.7% of women). Moderate cravings were reported by equivalent numbers of men (71.0%) and women (69.0%).

Question 2: What are the characteristics of food cravings?

Respondents reported on features associated with cravings and results are shown in Table 2. Those who experience cravings differ

TABLE 2 Characteristic of cravings

Characteristics of food cravings	Do not have cravings (N = 557)	Have cravings (N = 959)	P-value	Strength of craving (N = 959)			
				Low (N = 160)	Moderate (N = 662)	High (N = 125)	P-value
If you eat what you are craving, you often lose control and eat too much	16.52%	53.10%	$\chi^2 = 195.85; <0.001$	36.3%	51.1%	83.2%	$\chi^2 = 68.61; <0.001$
Once you start eating, you have trouble stopping	9.52%	33.5%	$\chi^2 = 115.51; <0.001$	14.4%	30.8%	71.2%	$\chi^2 = 110.23; <0.001$
You cannot stop thinking about eating no matter how hard you try	4.13%	22.5%	$\chi^2 = 91.38; <0.001$	3.1%	19.9%	60.8%	$\chi^2 = 142.72; <0.001$
If you give in to a food craving, all control is lost	6.46%	24.2%	$\chi^2 = 80.13; <0.001$	4.4%	20.1%	70.4%	$\chi^2 = 186.75; <0.001$
Whenever you have a food craving, you keep thinking about eating until you actually eat the food	13.29%	41.8%	$\chi^2 = 147.40; <0.001$	18.1%	39.6%	84.0%	$\chi^2 = 133.25; <0.001$
Situations that trigger or increase food cravings (N = 959)							
When I am bored		55.2%		41.9%	55.9%	68.8%	$\chi^2 = 20.97; <0.001$
Watching television		51.3%		45.6%	52.1%	54.4%	$\chi^2 = 2.36; 0.257$
When I am very emotional (happy, sad, fearful, depressed, anxious)		38.4%		22.5%	37.8%	60.8%	$\chi^2 = 43.79; <0.001$
Going out with friends/being social		23.4%		16.9%	23.9%	28.8%	$\chi^2 = 5.92; =0.052$
Issues with partner/spouse		10.2%		3.8%	10.0%	20.8%	$\chi^2 = 222.33; <0.001$
At work		11.7%		9.4%	11.5%	15.2%	$\chi^2 = 2.36; 0.308$
Dealing with my children		4.2%		1.9%	3.9%	8.8%	$\chi^2 = 8.80; =0.012$
Do not know		5.7%		9.4%	5.1%	3.2%	$\chi^2 = 5.94; 0.051$

Significant findings are bolded.

from those who do not on all measures of eating behaviour; including feelings of losing control and overeating, difficulties in stopping eating once it starts, and being dominated by thoughts of food. These challenging characteristics of eating behaviour in the face of cravings are strongly associated with the strength of the cravings. On all measures, there are step-wise increases such that those with moderate cravings experience more difficulties than those with mild cravings, and those with strong cravings experience more difficulties than those with moderate cravings (all comparisons significantly different).

Also reported in Table 2 are the situations most associated with cravings (Question 3). For all who report cravings, triggers revolve around being bored (55.2%), watching TV (51.3%), when emotional (38.4%) and in social situations (23.4%). Those with high cravings are much more likely to report experiencing cravings when bored ($\chi^2 = 20.97, P < 0.001$) and when emotional ($\chi^2 = 43.79, P < 0.001$), as well as when dealing with family members (spouse: $\chi^2 = 222.38, P < 0.001$; children: $\chi^2 = 8.80, P = 0.012$).

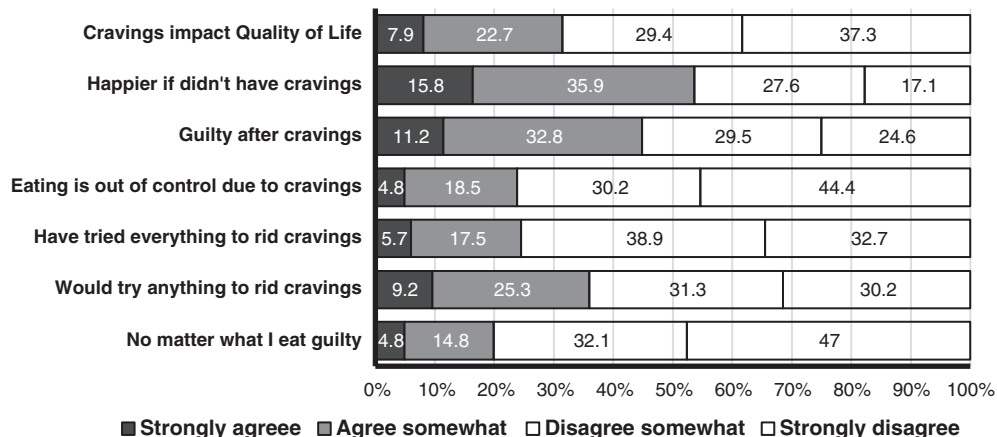


FIGURE 1 Psychological impact of food cravings as expressed by percentage agreement with psychological impact characteristics

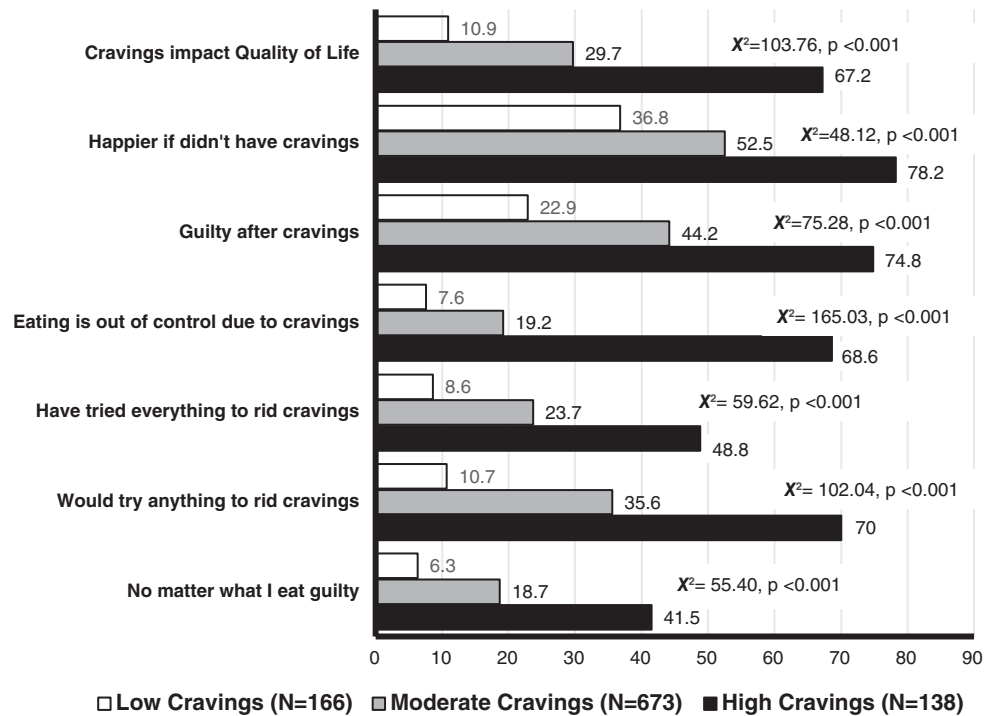


FIGURE 2 Psychological impact based on strength of food cravings

Question 4: How do cravings impact quality of life?

Respondents who experience cravings (N = 959) were asked a number of questions regarding the impact of their cravings on their psychological experience. These results are reported in Figure 1 and indicate that the experience of cravings is negative for a substantial proportion of those who experience them. Thirty percent (30.6%) agree that cravings negatively affect their quality of life and 51.7% agree that they would be happier if they did not have cravings. A substantial proportion of respondents feel guilty after experiencing cravings (44%) and 34.5% report that they would “do anything” to rid themselves of cravings.

Next, we examined the impact that strength of cravings had on quality of life. In Figure 2, the percentage of respondents with cravings who agreed (somewhat or strongly) to each psychological feature is presented. There is a strong association between strength of craving and negative psychological impact. On all items, there was a stepwise impact whereby strong cravings were reported to have more impact than moderate cravings, which in turn had greater negative impact than low cravings (significant for all factors).

Question 5: Is there a relationship between the experience of cravings and self-perceptions of being overweight and attempting to lose weight?

Of the total respondents, 58.4% (53.9% of men, 64.0% of women) considered themselves overweight; 36.3% (41.4% of men, 32% of women) considered themselves a healthy weight, and 4.2% (4.7% of men, 3.9% of women) considered themselves underweight. The gender difference was significant ($\chi^2 = 16.18, P < 0.001$) in that more women considered themselves overweight and more men considered themselves a healthy weight. Those who considered themselves overweight were significantly more likely to report food cravings (Table 3). Further, self-perceived overweight was significantly associated with strength of cravings (Table 3). Over 80% of those with strong cravings considered themselves overweight. Of those who considered themselves overweight and trying to lose weight, significantly more experienced cravings compared to those overweight and not trying to lose weight. Finally, there was a significant association between being overweight and trying to lose weight and experiencing strong cravings

TABLE 3 Relationship between food cravings and weight

	Food cravings (N = 959)	No food cravings (N = 557)	P-value	With cravings (N = 909)			P-value
				Low (N = 159)	Moderate (N = 654)	High (N = 124)	
Overweight (N = 894)	68.5%	55.6%	$\chi^2 = 24.59; < 0.001$	57.5%	65.8%	80.2%	$\chi^2 = 15.76; < 0.001$
Healthy weight (N = 556)	31.0%	43.5%		42.5%	34.2%	19.8%	
Overweight and trying to lose weight (N = 554)	73.5%	26.2%	$\chi^2 = 18.18; < 0.001$	39.6%	50.0%	69.4%	$\chi^2 = 25.20; < 0.001$
Overweight and not trying to lose weight (N = 331)	59.8%	39.3%		60.4%	50.0%	30.6%	

Significant findings are bolded.

TABLE 4 Relationship between food cravings and attitudes to medical management in those reporting overweight and trying to lose weight (N = 554)

	Strongly agree	Agree somewhat	Disagree somewhat	Strongly disagree	P-value	Agree as function of strength of craving			
						Low	Moderate	High	P-value
I feel helpless because I do not have access to the medication or treatments I need to fulfil my weight loss goals	5.2%	11.6%	22.6%	30.9%	$\chi^2 = 208.81; <0.001$	17.0%	18.0%	50.0%	$\chi^2 = 33.21; <0.001$
I feel helpless that I do not have access to the professional support I need to fulfil my weight loss goals	5.8%	15.0%	24.4%	25.6%	$\chi^2 = 165.59; <0.001$	25.5%	22.4%	56.2%	$\chi^2 = 32.04; <0.001$
I feel helpless because obesity is not treated like other chronic conditions where there are medications to help	9.4%	17.3%	21.5%	19.3%	$\chi^2 = 67.44; <0.001$	25.6%	36.2%	60.3%	$\chi^2 = 17.77; <0.001$
	Very likely	Likely	Not very likely	Not at all likely	P-value	Likely as function of strength of craving			
						Low	Moderate	High	P-value
Take a doctor recommended treatment scientifically and clinically validated to help manage weight	23.6%	33.2%	22.2%	17.1%	$\chi^2 = 128.24; <0.001$	48.7%	58.5%	74.7%	$\chi^2 = 12.69; =0.002$
Take a doctor prescribed treatment vs an over the counter product for weight loss	24.4%	31.6%	19.3%	21.5%	$\chi^2 = 120.95; <0.001$	54.2%	55.5%	72.0%	$\chi^2 = 7.53; =0.023$

Significant findings are bolded.

(69.4% of those with strong cravings were trying to lose weight compared to 39.6% of those with low cravings, Table 3).

Question 6: Do those considering themselves overweight and trying to lose weight feel helpless because obesity is not treated like other diseases such that access to professional support and medical management is limited?

The survey also queried respondents about attitudes toward professional support regarding weight management. Respondents who report being overweight and trying to lose weight (N = 554) were asked to rate their sense of helplessness regarding professional support for obesity and their weight loss goals. These respondents were also asked about their attitudes to engaging with medically recommended treatment. Results are depicted in Table 4.

Those who consider themselves overweight and were trying to lose weight did not link their distress to medical management. Relatively few endorsed feelings of helplessness due to lack of access to medication (16.8%) or professional support (20.8%), or due to obesity not being treated like other chronic diseases (26.7%). That being said, those with strong cravings reported significantly more helplessness on all items (over 50%, all P 's < 0.001). Attitudes to medical management in those reporting being overweight and trying to lose weight revealed that just over half of these samples endorsed being likely to follow a physicians recommendation (56.8%) and to prioritize the prescribed treatment over-the-counter treatment (56.0%). Again, strength of cravings was significantly related to likelihood of accepting medical management, with over three-quarters of the sample experiencing strong cravings being willing to follow doctor recommended approaches (Table 4).

4 | DISCUSSION

Achieving healthier weight is likely to be one of the most important achievements in the management of obesity and other chronic conditions for the foreseeable future. A cornerstone of sustained healthier weights is improvement in healthy eating. Given the powerful obesogenic environment in which we live, in combination with the evidence that the drive to eat is increased as one moves from healthy weight towards obesity, healthy eating may pose challenges as a behaviour change goal that distinguishes it from other behaviours.

The purpose of this study was to survey a representative sample of Canadians in regard to their self-reported food cravings and the psychological impact of such cravings. Our results indicated that cravings are very common and powerful; 62.6% of Canadians reported experiencing food cravings, with 83.1% of these individuals reporting either moderate or high levels of cravings. Cravings are triggered in a number of common situations, such as when bored, watching TV or when emotional. Looking at situational triggers based on strength of cravings, those reporting high cravings were more likely to experience them when bored, emotional, and when dealing with issues associated with family (spouse or children), compared to those with less strong cravings. In light of existing research showing that foods consumed in response to cravings tend to be higher in energy density than foods that are part of a regular diet^{21,25} cravings might well be seen as a risk factor for obesity in the Canadian population. Women may be particularly affected by cravings, as both the prevalence of cravings and the prevalence of strong cravings was higher in women. Lafay et al,³²

reporting on a study from France, also found gender differences in the prevalence of cravings. In their study, women were more likely to indulge in cravings in the presence of negative feelings, where men indulged in the presence of positive feelings.

Among the respondents in this survey, the experience of cravings was associated with unhealthy eating behaviour and negative psychological experiences. Of those reporting food cravings, just over half report losing control and overeating, almost half report that they keep thinking about eating until they actually eat, and one-third report trouble stopping eating once they start. Guilt is a prominent consequence of cravings, with almost half of those with cravings reporting guilt. Consistent with these findings, half of those with cravings say they would be happier without such cravings. Quality of life is impaired in one-third of those with cravings. Further, strength of craving is an important dimension impacting quality of life. On all variables assessed, there was a linear association between strength of craving and negative impact. Those with strong cravings reported impaired quality of life (67.2%), guilt (78.2%), experiencing out of control eating (68.6%). Further those with strong cravings reported having tried everything to control cravings (48.8%) and would try anything to deal with cravings (70.0%). Collectively, these data indicate that food cravings are common in the Canadian population and that they have a negative impact on eating behaviour and quality of life indicators.

Past research has shown that there is an association between cravings and obesity.^{15,16,25} Although we did not obtain measures of weight in our survey, we did ask about self-assessed weight categorization. Respondents were categorized into overweight and healthy weight based on this self-assessment. Those who reported food cravings were more likely to assess themselves as overweight. Two-thirds of those with cravings compared to one-half of those without categorizing themselves as overweight. This relationship with self-assessed weight was even stronger when the strength of cravings was taken into consideration. Four out of five respondents with strong cravings considered themselves overweight. The data from our study are consistent with existing literature in this area showing an association between weight and cravings.

In addition to self-assessment of weight status, we obtained a measure of whether or not respondents were trying to lose weight. This allowed us to identify a substantial subsample of respondents who were both overweight (self-assessed) and trying to lose weight: 554. Those who were overweight and trying to lose weight were more likely to have cravings than those overweight respondents not trying to lose weight. Consistent with other findings, strength of cravings was associated with trying to lose weight (70% of those with cravings were trying relative to 40% with low cravings). These data support further examination of the role of cravings in overweight and obesity as well as in attempts to lose weight. An obvious hypothesis to be explored in future research will be the impact of modifying cravings on weight gain and the success of weight loss attempts.

Although this study was primarily focused on the prevalence and impact of food cravings, we included several measures of perceptions of the medical system in our survey. This allows us to examine those who consider themselves overweight and are trying to lose weight. These will most likely be the individuals who either seek out help or will be referred for weight management. We were interested in

understanding these individuals further. Several questions tapped into feelings of helplessness regarding access to medication and treatments, access to professional support and helplessness associated with obesity not being treated like other chronic conditions. In the cohort of individuals who consider themselves overweight and are trying to lose weight only a minority seemed to have feelings of helplessness. This is consistent with survey research that suggests people with obesity do not see a role for healthcare providers but feel that they alone are responsible for their condition.³³ Our results did show, however, increased helplessness in those with strong cravings. It may be that these individuals might be easier to engage in professional approaches to weight management. Our final two questions asked about how likely respondents who considered themselves overweight and were trying to lose weight were to follow a doctor's recommendation. Interestingly, the majority of respondents expressed that they were likely to follow recommendations, particularly if the reported strong cravings.

This study contributes to the literature in providing broad perspective of the general Canadian population. Other studies examining the issue of food cravings confirm the importance of addressing cravings. Chao et al¹⁵ surveyed a community sample in the eastern USA in a study looking at stress, self-control and eating behaviours. Using the Food Craving Inventory³⁴ they reported a relationship between BMI and food cravings. Further, high cravings were related to intake of sweets, high fats, carbohydrates and fast-food fats. A follow-up paper, using the same sample, demonstrated a relationship between chronic stress and food cravings.¹⁶ Further, food cravings were found to be partial mediators of the relationship between stress and BMI. Meule and Kübler³⁵ administered the Yale Food Addiction Questionnaire and the Food Cravings Questionnaire online to a sample of German University students and reported strong associations between addiction scores and cravings. This group further demonstrated that food cravings were associated with reduced success at dieting.²⁴

Richard et al²² conducted an interesting study in which they categorized subjects based on the Food Cravings Questionnaire and then over 7 days use ecological momentary assessment to assess snack-related thoughts and consumption and craving intensity five times each day in a small sample (N = 61). Those with high cravings were found to be more prone to think about high calorie food and consumed more snack foods in response to craving compared to those with low cravings. In a study of weight loss achievement at 6 months post bariatric surgery (sleeve gastrectomy) it was shown that the emotional food craving scale of the Food Cravings Questionnaire predicted a failure to achieve at least 40% of excessive weight loss (odds ratio, 4.19).²⁶

The data from the present study are helpful in highlighting that eating behaviour may not be like other health behaviours in that cravings are powerful drivers of behaviour that seem to be biologically mediated, powerfully cued by the environment, and that impact on weight-related behaviours. Behaviour change strategies that address the power of cravings will be helpful. For instance, goal setting activities might need to be developed differently depending on the strength of cravings, either cravings overall or cravings for particular foods. Further, interventions from the domains of the addictions as well as acceptance and commitment therapies might need to be integrated into lifestyle interventions for improving healthy eating.³⁶

This study benefits from a robust sampling methodology. However, the study is limited in that as an online study it may not be generalizable to those not internet savvy. Demographic analyses indicated that our sample was somewhat older, more educated and wealthier than the general Canadian population. This is a limitation that is likely due to the online nature of the survey. Also, in this study we did not use a validated cravings inventory, instead choosing to focus on more descriptive questions. Follow-up research should use established scales administered at a population level. Finally, a limitation of this study is that weight status was self-reported, not measured. In order to obtain a large and distributed sample of Canadians it was not feasible to assess height and weight or waist circumference. Again, follow-up research should be correct for this.

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CONFLICTS OF INTEREST

Dr M.V. has no conflicts of interest in the analysis and write up of this paper. The survey was sponsored by Valeant. Outside of the preparation of this paper, Dr M.V. sits on Ad Boards and consults to Valeant, Novo Nordisk and Sanofi. He receives travel support and periodic lecture honoraria from Valeant, Sanofi, Novo Nordisk, CSL Behring, Lifescan and Abbvie.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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