

# Perceived Healthiness of Sweeteners among Young Adults in Canada

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## ABSTRACT

**Purpose:** To compare the perceived healthiness of different sweeteners relative to table sugar and examine efforts to consume less sugars and sweeteners.

**Methods:** As part of the 2017 Canada Food Study online survey, 1000 youth and young adults were randomized to rate the healthiness of 1 of 6 sweeteners (aspartame, sucralose, stevia, agave, high-fructose corn syrup, “raw” sugar) or 1 sweetener brand name (Splenda) compared with “table sugar”.

**Results:** Perceptions of sweeteners varied widely. For example, the majority of respondents perceived high-fructose corn syrup (63.9%) and aspartame (52.4%) as less healthy than table sugar, whereas almost half (47.8%) perceived raw sugar as being healthier than table sugar. No assessed socio-demographic variables were significantly associated with perceived healthiness of sweeteners compared with table sugar ( $P \geq 0.05$ ). More consumers had attempted to consume less sugar (65.4%) compared with less “artificial” (31.2%) or “natural” (24.0%) low-calorie sweeteners.

**Conclusions:** Perceptions of sweetener healthiness may be related to sweeteners’ perceived level of “naturalness” rather than energy content. This has important implications for understanding consumer preferences, particularly given greater use of low-calorie sweeteners in the food supply and policy developments such as sugar taxes and enhanced sugar labelling.

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## RÉSUMÉ

**Objectif.** Comparer la qualité nutritionnelle perçue de différents édulcorants à celle du sucre de table, et examiner les efforts visant à réduire la consommation de sucres et d’édulcorants.

**Méthodes.** Dans le cadre de l’enquête en ligne de l’Étude sur les aliments au Canada de 2017, 1 000 jeunes gens et jeunes adultes ont été répartis de façon aléatoire dans le but d’évaluer la qualité nutritionnelle de l’un de six édulcorants (aspartame, sucralose, stevia, sucre d’agave, sirop de maïs à haute teneur en fructose, sucre brut) ou d’une marque d’édulcorant (Splenda) comparativement à celle du « sucre de table ».

**Résultats.** La perception des édulcorants variait grandement. Par exemple, la majorité des répondants percevaient le sirop de maïs à haute teneur en fructose (63,9 %) et l’aspartame (52,4 %) comme étant moins santé que le sucre de table, alors que près de la moitié des répondants (47,8 %) percevaient le sucre brut comme étant plus santé que le sucre de table. Aucune variable sociodémographique évaluée n’a été associée de manière significative à la qualité nutritionnelle perçue des édulcorants comparativement à celle du sucre de table ( $P \geq 0,05$ ). Davantage de consommateurs ont essayé de diminuer leur consommation de sucre (65,4 %) que d’édulcorants hypocaloriques « artificiels » (31,2 %) ou « naturels » (24,0 %).

**Conclusions.** La perception de la qualité nutritionnelle des édulcorants pourrait être liée à l’aspect « naturel » perçu plutôt qu’à la teneur en énergie. Cela a des répercussions importantes sur la compréhension des préférences des consommateurs, particulièrement étant donné l’utilisation plus importante des édulcorants hypocaloriques dans l’approvisionnement alimentaire et l’élaboration de politiques comme les taxes sur le sucre et l’étiquetage plus détaillé sur le sucre.

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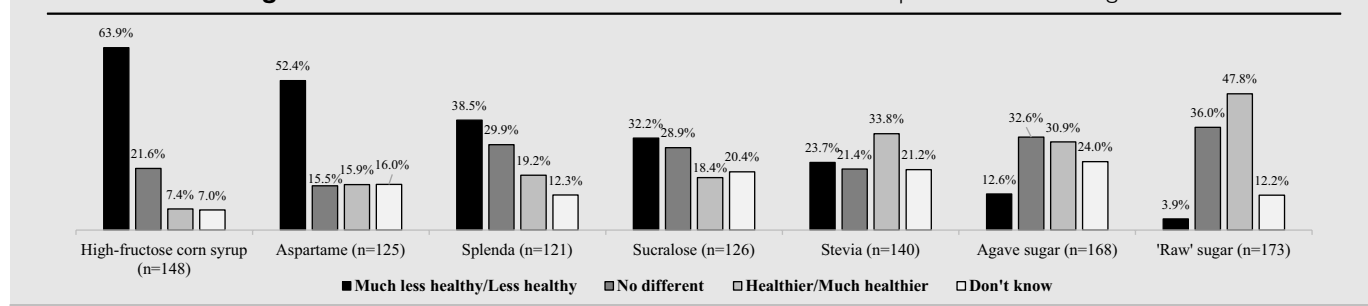
## INTRODUCTION

Sugar consumption has consistently been linked to increased risk of overweight, obesity, and diabetes [1, 2]. Added sugars are pervasive in the food supply [3–5], and consumers are increasingly seeking to reduce their sugar consumption [6, 7], consistent with public health recommendations [8]. To do so, consumers may avoid foods with caloric sweeteners (CSs) or choose products containing low-calorie sweeteners (LCSs), which are sweet compounds providing few or zero calories per gram [9]. LCSs are predominantly used in diet beverages [4, 5, 10, 11] and are increasingly used in jurisdictions that have implemented sugar taxes [12, 13]. However, the health effects of LCSs are unclear, with no scientific consensus on the relationship between LCSs and glucose or energy

regulation, diabetes, body mass index (BMI) or weight gain or management [1, 14–22].

Few studies have examined consumer attitudes towards sweeteners. In the United States, more consumers had negative perceptions of added sugars compared with LCSs [6], yet almost three-quarters of parents believed LCSs were unsafe for their children [23]. Northern Irish consumers had polarized perceptions of LCSs [24] as did dietitians from 5 European countries [25].

The objectives of this study were (i) to compare the perceived healthiness of different sweeteners relative to regular table sugar, including socio-demographic correlates of these perceptions and (ii) to examine efforts to consume less sugars and (or) sweeteners.

**Figure 1.** Perceived healthiness of different sweeteners compared with table sugar.

## METHODS

Data were collected online in October–December 2017 as part of the Canada Food Study (CFS). Respondents were aged 16–30 at recruitment in 2016 (16–32 in 2017). Respondents provided informed consent and received \$20 after completion. The study received ethics clearance through a University of Waterloo Research Ethics Committee (ORE #21631). Additional study details are available in the Technical Report (<http://canadafoodstudy.ca/studydocs/>).

### Measures

**Perceived healthiness of sweeteners:** Respondents were randomly assigned to 1 of 7 sweetener conditions (“raw” sugar, high-fructose corn syrup (HFCS), aspartame, agave, stevia, sucralose, or Splenda) and asked, “Compared to ‘regular’ table sugar, do you think [sweetener] is...” (recoded as: 1 = Healthier/Much healthier; 0 = No different/Less healthy/Much less healthy/Don’t know). Note that Splenda is the brand name for sucralose and was included to test whether consumers have different perceptions of healthiness of the brand versus scientific name of sweeteners. The sweeteners are described in Supplementary Table 1<sup>1</sup>.

**Efforts regarding sweetener consumption:** Efforts regarding sweetener consumption were assessed by asking, “Have you made an effort to consume more or less of the following in the past year: Sugar/Added sugar; ‘Artificial’ low-calorie sweeteners like aspartame; ‘Natural’ low-calorie sweeteners like stevia?” (recoded as: 1 = Consume less; 0 = Consume more/No effort made).

**Socio-demographic data:** Socio-demographic data included age, sex, highest attained education level, ethnicity, and BMI classification (based on reported body height and weight); see Supplementary Table 2<sup>1</sup> for response options.

### Data analysis

Overall, 1022 respondents participated in the CFS 2017 survey, with 22 excluded for missing data. Estimates are weighted for sex, age, and province. The odds of reporting that each

sweetener was “healthier/much healthier than table sugar” were calculated using separate binary logistic regression models. All models were adjusted for age (continuous), sex, education, ethnicity, BMI classification, and survey device type. Adjusted odds ratios are reported. Analyses were conducted using SPSS Statistics (version 25.0, IBM Corp., Armonk, New York) with  $P < 0.05$  as the threshold for significance.

## RESULTS

Supplementary Table 2<sup>1</sup> shows the sample characteristics. Mean age was 24.3 (SD = 4.3) years.

### Perceived healthiness of sweeteners

As shown in Figure 1 and Table 1, perceived healthiness varied widely among sweeteners compared with table sugar. Of respondents in the HFCS condition, only 7.4% rated it as healthier/much healthier than table sugar, compared with almost half (47.8%) of those in the raw sugar condition. Despite Splenda being the brand name for sucralose, respondents who rated sucralose were less confident in its healthiness compared with table sugar than were those who rated Splenda (20.4% vs 12.3% responded “Don’t know,” respectively). Compared with every other sweetener condition, the HFCS condition was significantly less likely and the “raw” sugar condition significantly more likely to be rated as healthier/much healthier than table sugar (Table 1). No socio-demographic factors were significantly associated with sweetener perceptions ( $P \geq 0.05$  for all; data not shown).

### Efforts related to sweetener consumption

More than twice as many respondents had tried to consume less sugar/added sugar (65.4%) compared with artificial (31.2%) or natural (24.0%) LCSs in the past year. The majority had made no effort regarding consumption of artificial (66.2%) or natural (71.7%) LCSs, whereas 31.8% had made no effort regarding sugar intake. Very few respondents (<5%) had tried to consume more sugar or artificial or natural LCSs.

<sup>1</sup>Supplementary data are available with the article through the journal Web site at <https://dcjournal.ca/doi/suppl/10.3148/cjdr-2020-030>.

**Table 1.** Odds of perceiving the sweetener as healthier/much healthier than table sugar (n = 1000).

Variable	AOR (95% CI), P value
<b>Sweetener condition</b>	$\chi^2 (6) = 80.52, P < 0.001$
High-fructose corn syrup ( <i>ref</i> )	—ref—
Aspartame	<b>2.49 (1.13, 5.49), P = 0.024</b>
Splenda	<b>3.22 (1.49, 6.99), P = 0.003</b>
Sucralose	<b>2.87 (1.32, 6.20), P = 0.008</b>
Stevia	<b>6.95 (3.39, 14.24), P &lt; 0.001</b>
Agave	<b>5.96 (2.94, 12.08), P &lt; 0.001</b>
“Raw” sugar	<b>12.60 (6.30, 25.18), P &lt; 0.001</b>
Aspartame ( <i>ref</i> )	—ref—
Splenda	1.29 (0.66, 2.54), P = 0.454
Sucralose	1.15 (0.59, 2.25), P = 0.680
Stevia	<b>2.79 (1.52, 5.11), P = 0.001</b>
Agave	<b>2.39 (1.32, 4.34), P = 0.004</b>
“Raw” sugar	<b>5.06 (2.82, 9.06), P &lt; 0.001</b>
Sucralose ( <i>ref</i> )	—ref—
Splenda	1.13 (0.59, 2.16), P = 0.725
Stevia	<b>2.42 (1.35, 4.34), P = 0.003</b>
Agave	<b>2.08 (1.18, 3.68), P = 0.012</b>
“Raw” sugar	<b>4.40 (2.53, 7.64), P &lt; 0.001</b>
Splenda ( <i>ref</i> )	—ref—
Stevia	<b>2.16 (1.19, 3.89), P = 0.011</b>
Agave	<b>1.85 (1.04, 3.28), P = 0.036</b>
“Raw” sugar	<b>3.91 (2.23, 6.84), P &lt; 0.001</b>
Agave ( <i>ref</i> )	—ref—
Stevia	1.17 (0.71, 1.92), P = 0.547
“Raw” sugar	<b>2.11 (1.34, 3.35), P = 0.001</b>
Stevia ( <i>ref</i> )	—ref—
“Raw” sugar	<b>1.81 (1.12, 2.93), P = 0.015</b>

Note: Each respondent was randomized to compare 1 sweetener to table sugar. Odds of perceiving the sweetener as “healthier”/“much healthier” than table sugar compared with “much less healthy”/“less healthy”/“no different”/“don’t know”. Note that models included all 7 sweeteners; duplicate contrasts have been omitted from the table for brevity. Significant effects indicated in bold. Models adjusted for age, sex, education, ethnicity, BMI classification, and survey completion on a smartphone vs non-mobile device ( $P > 0.05$  for all covariates; data not shown). 95% CI, 95% confidence interval;  $\chi^2$ , chi-square; AOR, adjusted odds ratio; ref, reference group.

## DISCUSSION

Among youth and young adults in Canada, attitudes towards the healthiness of different sweeteners vary widely and may not relate to energy content. Rather than perceiving LCSs to be healthier alternatives to caloric sweeteners because they provide fewer calories, consumers appear to base healthfulness perceptions on a sweetener’s level of “naturalness”, which although not measured directly, we speculate may relate to perceived level of processing. Indeed, the natural LCS (stevia) and artificial LCSs (e.g., aspartame) have similar energy content, yet approximately twice as many participants rated

stevia as healthier than table sugar compared with those in the aspartame condition. Moreover, more consumers reported trying to reduce their consumption of artificial compared to natural LCSs.

Results also suggest that the majority of young adults are trying to reduce their sugar consumption, consistent with public health recommendations [8] and previous research [7, 26]. A considerable number are also attempting to reduce their consumption of LCSs, despite the increasing use of LCSs in replacement of/in combination with CSs in North America [1, 9, 26–28]. These efforts are consistent with international research [7, 29, 30] and with new Canadian dietary recommendations to decrease sugar consumption without increasing consumption of sugar substitutes [31].

Previous research suggests that those who prefer natural products tend to consider sweeteners riskier [32]. In the current study, consumers perceived HFCS and aspartame as the least healthy compared with table sugar, while “raw” sugar, stevia, and agave were perceived as the healthiest. Despite their different caloric contributions, consumers may consider both HFCS and aspartame as artificial—and perhaps unhealthy—additives. On the other hand, the marketing of raw sugar, stevia, and agave as natural or plant-derived products [33, 34] may lead to a “health halo” whereby these sweeteners are perceived as healthier [35–37], regardless of differences in caloric contribution.

Lastly, no sociodemographic differences were observed for the perceived healthiness of sweeteners, in contrast to sex and ethnic differences observed in previous research [6, 32, 35]. It may be that there are fewer differences in perceptions among youth and young adults compared with the general population.

## Limitations

Responses may be subject to self-report bias. The words “raw”/“natural” and “artificial” have positive and negative connotations, respectively, and these terms may have influenced results. This study did not assess taste preferences or familiarity with different sweeteners, which may have influenced perceptions. Lastly, the CFS used nonprobability-based sampling and recruited 16–30-year-olds from major Canadian cities, limiting the generalizability of results.

## RELEVANCE TO RESEARCH AND PRACTICE

Dietitians should consider that factors other than energy content, such as perceptions of “naturalness”, may impact individuals’ perceptions and willingness to consume specific sweeteners. This may be particularly relevant in the context of sugar-sweetened beverage intake. As an increasing number of countries develop policies to reduce sugar consumption—including sugary drink taxes, enhanced sugar labelling, and mandatory front-of-package labelling that signals high sugar levels [12, 38–40]—research should also examine changes to

the food supply and corresponding shifts in consumer perceptions and consumption patterns.

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**Conflicts of interest:** None of the authors accept funding from the food industry. LV has conducted research examining food company policies and through this work has engaged with food industry stakeholders. The remaining authors declare that they have no competing interests.

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