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# Low/No Calorie Sweetened Beverage Consumption in the National Weight Control Registry

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## Abstract

**Objective—**The aim of this cross-sectional study was to evaluate prevalence of and strategies behind low/no calorie sweetened beverage (LNCSB) consumption in successful weight loss maintainers.

**Methods—**An online survey was administered to 434 members of the National Weight Control Registry (NWCR, individuals who have lost ≥13.6 kg and maintained weight loss for > 1 year).

**Results—**While few participants (10%) consume sugar-sweetened beverages on a regular basis, 53% regularly consume LNCSB. The top five reasons for choosing LNCSB were for taste (54%), to satisfy thirst (40%), part of routine (27%), to reduce calories (22%) and to go with meals (21%). The majority who consume LNCSB (78%) felt they helped control total calorie intake. Many participants considered changing patterns of beverage consumption to be very important in weight loss (42%) and maintenance (40%). Increasing water was by far the most common strategy, followed by reducing regular calorie beverages.

**Conclusions—**Regular consumption of LNCSB is common in successful weight loss maintainers for various reasons including helping individuals to limit total energy intake. Changing beverage consumption patterns was felt to be very important for weight loss and maintenance by a substantial percentage of successful weight loss maintainers in the NWCR.

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Additional Supporting Information may be found in the online version of this article.

## Introduction

Low/no calorie sweetened beverages (LNCSB) are beverages sweetened with one or more high intensity sweeteners in place of energy yielding sugars. These beverages are widely available and consumed; recent National Health and Nutrition Examination Survey (NHANES) data suggests 28% of US adults consume beverages sweetened with low/no calorie sweeteners on a daily basis (1). It is likely many individuals consume these products in the belief that they will help them limit their total calorie intake and/or control their weight. However, the role of these products in aiding weight loss or weight loss maintenance is controversial. While a few short-term laboratory based feeding studies in humans have suggested low/no calorie sweeteners may stimulate hunger (2-4), most other studies have found consumption of low/no calorie sweetened foods or beverages did not increase hunger or subsequent food intake (5-9). Some longitudinal studies have linked low/no calorie sweeteners with weight gain and increased cardio-metabolic risk (10-13), leading to concerns that these products may be contributing to the obesity epidemic (14). However, several interventional studies have shown that low/no calorie sweeteners can be an effective part of weight loss (15-19) and weight loss maintenance (15) programs.

Phelan et al (20) compared the use of fat- and sugar-modified foods and beverages in weight loss maintainers (n=172) and always-normal weight controls (n=131) using 24 hour dietary recalls. Compared to normal weight controls, weight loss maintainers reported consuming three times more daily servings of artificially sweetened soft drinks suggesting these products may be an important weight control strategy among weight loss maintainers. However, detailed information about the types of LNCSB consumed and the extent to which these individuals use LNCSB as part of their weight loss maintenance program is lacking.

The National Weight Control Registry (NWCR) was established in 1993 to investigate characteristics and behaviors of individuals successful at long-term weight loss maintenance (21). With approximately 10,000 participants to date, the NWCR is the largest longitudinal study of successful weight loss maintainers. To qualify, individuals must have lost ≥ 13.6 kilograms and maintained this weight loss for≥ 1 year. Current information on beverage consumption in the NWCR is limited to data obtained from the Block Food Frequency Questionnaire (22) administered upon registry entry and at 1, 3, and 5 years follow-up. This questionnaire assesses frequency of caloric beverage consumption as well as water, coffee and tea but does not assess consumption of LNCSB. The purpose of this current study was to examine consumption of specific categories of LNCSB in a sample of individuals who have been successful in maintenance of a reduced body weight, as well as to explore the strategies and motivation behind consumption of LNCSB in this population. An understanding of the use of LNCSB in weight loss maintainers could lead to more effective exploration of these products in obesity prevention and treatment research protocols.

## Methods

### Overview of study design

Focus group interviews were initially performed by an experienced qualitative researcher to investigate motivations and strategies behind the use of LNCSB in successful weight loss

maintainers. Based on review of this qualitative data, a web based survey was developed and administered to a larger sample of NWCR members to: (1) obtain data on the prevalence of regular consumption of LNCSB in the NWCR, (2) explore reasons for choosing to consume LNCSB, and (3) evaluate the extent to which participants felt changes in beverage consumption played a role in weight loss and weight loss maintenance.

## Online survey design

The web based survey was designed to collect basic demographic and weight history data and to assess three main areas related to beverage consumption.

The first section was designed to quantitate frequency of consumption of various types of low/no calorie sweetened and unsweetened beverages (including soda, juice drinks, sports drinks, energy drinks, tea, coffee, and plain, carbonated and flavored waters) as well as assess intake of comparable caloric beverages (including sugar-sweetened soda, juice drinks, sports drinks, energy drinks, tea, and coffee as well as 100% fruit juice and alcohol) in this population for comparison. Participants were asked to report usual frequency of consumption over the past year within each specific beverage category and could select from the following options: two or more servings a day, one serving a day, 4-6 servings a week, 2-3 servings a week, one serving a week, 1-3 servings a month, less than 1-3 servings a month, or never.

In the second section, participants who indicated they consumed LNCSB at least once per week were asked to select their three most important or most frequent reasons for choosing LNCSB from a list of 21 options developed from focus group data, or to write in their own response. They were also asked to indicate whether they believe consuming LNCSB helped them reduce total calorie/food intake.

In the third section, participants were asked several questions designed to elicit whether changes in beverage consumption played a role in either their initial weight loss, or their ongoing weight loss maintenance. They were asked to respond on a scale of 1-7 where ‘1’ is “Not Important at All” and ‘7’ is “Extremely Important” how important they felt changes in their beverage consumption patterns were in: (1) losing weight or (2) maintaining weight loss. If they responded a 2 or higher, they were prompted to select the most important or frequent change they made from a list of five options developed from focus group data (increasing consumption of water, reducing consumption of regular calorie/nondiet beverages, increasing consumption of low/no calorie or diet beverages, switching to reduced fat milk/dairy beverages, or switching to low/no calorie sweetener when adding a sweetener to a beverage) or to write in their own response.

## Online survey administration

Between November 2012 and March 2013 the online survey was sent to a random sample of current NWCR members who had consented for online participation and indicated they would be interested in completing supplemental surveys. Each participant received an e-mail describing the survey with a unique link to the survey and responses were transmitted over a secure, encrypted connection. The survey took approximately 15-20 minutes to complete, and participants were not compensated. To reduce bias within survey questions in which

participants were asked to select a response from a list of options, the order of presentation of response options was shuffled for each participant. We invited 676 registry subjects to participate and 486 (71.9%) accessed the survey. Approval for survey administration was obtained from the Miriam Hospital Institutional Review Board.

### Statistical analysis

We targeted a sample size of at least 400 NWCR members to ensure 80% power to detect a statistically significant difference for a small to medium Cohen's effect size (23) using a two-sided test with an alpha level of 0.05. For a 1:3 split of the sample (as observed for the comparisons by gender), the minimum detectable effect size (MDES) (Cohen's d) is 0.32 for a two-tailed independent samples *t*-test. For a 2:2:1 split of the sample (as observed for the comparisons by BMI category) the MDES (Cohen's f) is 0.16 for a three group ANOVA analysis. For the chi square test with two degrees of freedom, the MDES (Cohen's w) is 0.16. Statistical analyses were performed using SAS Version 9.3 (SAS Institute, Cary, NC, USA). Data are presented as mean ± standard deviation (SD) for continuous measures or percentages for categorical responses. For comparisons by gender, independent samples *t*-tests were used for continuous variables and Pearson Chi-Square tests were used for categorical variables. For comparisons by BMI category, ANOVA was used for continuous variables and Pearson Chi-Square tests were for categorical variables.

## Results

### Descriptive characteristics

Four hundred and eighty six NWCR members accessed the online survey. Six participants completed only demographic data, three had missing or invalid weight data, and 43 no longer met NWCR entry criteria (maintenance of a 13.6 kg weight loss) and were excluded from the analysis. Thus, our final sample consisted of 434 participants (311 women and 123 men). Self-reported height and weight were used to divide participants into BMI categories: normal weight (BMI <25, $n$ = 171, 39.4%), overweight (BMI ≥25 to <30, $n$ = 166, 38.2%) and obese (BMI ≥30, $n$ = 97, 22.4%).

Demographic characteristics and weight history are shown in Table 1. Mean ± SD age of participants was 52.4 ±11.6 years with women slightly younger than men ($P$ 0.0007). Overall, 92.6% of participants were Caucasian and 83.4% had a college level or higher degree. Mean ± SD of current BMI was 27.0 ± 4.9 kg/m$^2$ with women slightly lower than men ($P$ 0.0250). Mean ± SD weight loss was 34.2 ± 18.5 kg maintained for 7.8 ± 5.2 years. These parameters are similar to those reported for the NWCR as a whole (21).

### Beverage consumption

The proportion of participants reporting different frequency levels of consumption within each beverage category assessed is presented for the sample as a whole in Table 2.

The proportion of participants that reported regular consumption (defined as ≥ once a day) of each specific beverage category (overall and by BMI category) is presented in Table 3. Bottle or tap water was consumed regularly by the greatest percent of participants (91.7),

followed by unsweetened coffee (36.4%), low/no calorie or diet soda (26.0%), low/no calorie or diet sweetened coffee (24.7%), unsweetened tea (19.8%), low/no calorie or diet sweetened tea (11.5%), and low/no calorie or diet sweetened flavored water (10.8%). All other beverages surveyed were consumed regularly by <10% of respondents. In particular, very few participants reported regular consumption of regular calorie soda (0.9%), mixed drinks (0.7%), hard liquor (0.7%), regular calorie sports drinks (0.7%), low/no calorie energy drinks (0.2%), regular calorie energy drinks (0%), or regular calorie fruit juice drinks (0%). Overall, 52.5% reported regular consumption of a combined category of LNCSB and 10.4% reported regular consumption of a combined category of sugar-sweetened beverages (SSB) with no significant differences by gender or BMI category. The proportion of participants that reported regular consumption of each specific beverage category was also compared by gender. A significantly greater proportion of women reported regular consumption of water, unsweetened tea, low/no calorie or diet sweetened tea, and unsweetened flavored carbonated water, while a significantly greater proportion of men reported regular consumption of unsweetened coffee, 100% fruit juice, mixed drinks, low/no calorie or diet sports drinks, and regular calorie sports drinks (Supporting Information Figure S1).

While the proportion of participants that reported regular (≥ once a day) consumption of a combined category of all LNCSB did not differ by BMI category (overall *P* 0.5074), the proportion reporting regular consumption of low/no calorie or diet soda was significantly different across BMI category (25.7% of normal weight, 21.1% of overweight, and 35.1% of obese, overall *P* 0.0447). Pair-wise comparisons showed a significantly greater proportion of obese reporting regular consumption of low/no calorie or diet soda compared to overweight (*P* 0.0130). The only other beverages that differed in proportion reporting regular consumption by BMI category were wine (overall *P* 0.0018) and unsweetened tea (overall *P* 0.0235) with pairwise comparisons showing significantly greater proportion of normal weight subjects reporting regular consumption compared to overweight and obese for both beverage categories.

### Reasons for choosing LNCSB

Of participants who reported consuming LNCSB at least once per week (*n* = 287), 78.1% indicated they felt it helped them control or reduce their total food or calorie consumption with no significant differences by gender or BMI category. Participants who reported consuming LNCSB at least once per week were asked to select from a list of 21 options their top three reasons for choosing a low/no calorie or diet sweetened beverage (Table 4). The most frequently selected responses were: “because it tastes good” (54.4%) “to satisfy thirst” (40.4%), “familiar/habitual/part of routine” (26.5%), “to try to reduce the calories I consume” (22.0%), “to go with meals” (20.6%), “to help me avoid gaining weight” (19.2%), and “to energize me/get me going” (17.8%). Other responses were selected by <15% of participants. Men were more likely to select “to try to reduce the calories I consume” (*P* 0.0180), “to hydrate after exercise” (*P* 0.0422), or “because a physician/friend/nutritionist recommended it” (*P* 0.0224) while women were more likely to select “to tide me over between meals” (*P* 0.0218) or “to help me unwind/relax” (*P* 0.0471). There were no significant differences by BMI category (data not shown).

### Role of changes in beverage consumption in weight loss and weight loss maintenance

All participants were asked to rate on a scale of 1-7 from not important at all to extremely important "how important was making changes in your beverage consumption in losing weight?" and "how important was making changes in your beverage consumption in maintaining your weight loss?". Overall, 41.7% and 39.6% felt that making changes in beverage consumption was very important (6 or 7 on a scale of 1-7) for losing weight or maintaining weight loss respectively with no significant differences by gender or BMI category. Only 14.3% and 13.8% felt changes in beverage consumption were not important at all (1 on a scale of 6-7) in losing weight or maintaining weight loss respectively. Participants who responded a 2 or higher ($n$ = 369 for weight loss, $n$ = 372 for weight loss maintenance) were asked to select the most important or most frequent change they made in their beverage consumption patterns from a list of five options. The three most frequently selected responses were: increasing consumption of water (selected by 48.2% for weight loss, 52.2% for weight loss maintenance), reducing consumption of regular calorie/non diet beverages (21.1% for weight loss, 18.6% for weight loss maintenance), and increasing consumption of low/no calorie or diet beverages (8.7% for weight loss, 7.8% for weight loss maintenance).

## Discussion

In addition to water, successful weight loss maintainers consume a wide variety of noncaloric beverages on a regular basis. In particular, consumption of LNCSB is common with ∼53% of participants consuming LNCSB once a day or more. In comparison, based on 2007-2008 NHANES data, only ∼28% of US adults report daily consumption of beverages sweetened with low/no calorie sweeteners (1). Other studies have also found higher rates of consumption of LNCSB in successful weight loss maintainers. Phelan et al. (20) found that weight loss maintainers consumed nearly three times more artificially sweetened soft drinks than normal weight controls (0.91 vs. 0.37 servings per day, $P$ 0.0026) as well as a trend towards greater consumption of a combined category of other artificially sweetened drinks (0.21 vs. 0.07 servings per day, $P$ 0.0654). In a large cohort of US adults from the Coronary Artery Risk Development in Young Adults (CARDIA) study, there was a near-significant trend for weight loss maintainers to consume more servings per day of diet beverages than weight loss re-gainers (1.4 versus 0.99, $P$ = 0.08) (24).

Of participants in our sample that reported consuming LNCSB at least once a week, the majority (78%) indicated consuming these beverages helped them control or reduce total food or calorie intake suggesting these beverages could play a role in a weight control program. Common reasons reported for choosing LNCSB in our sample focused around factors related to taste, satisfying thirst/to go with meals, familiar/habitual/part of routine, and reducing calories/avoiding weight gain. Enjoyment provided by consumption of LNCSB may be particularly important when dealing with the continuous challenge of controlling energy intake during weight loss/weight loss maintenance. Although this study does not have any ability to determine what, if any, role that low/no calorie sweeteners played in the success of participants in maintaining significant weight loss, it does suggest that consumption of LNCSB can be part of a successful weight loss maintenance program. The

data on consumption patterns of LNCSB in successful weight loss maintainers, combined with other research showing no negative impact of these beverages on weight (19,25,26), might provide some reassurance to those deciding whether to consume these beverages during weight loss and weight loss maintenance.

SSB are typically defined as any non-diet, non-alcoholic beverage items and beverage concentrates with added sugars (27). In our sample of successful weight loss maintainers, few participants (∼10%) report regular (≥ once a day) consumption of SSB. These rates are much lower than those observed in the general US population of a comparable age; 2007-2008 NHANES data suggests 50% of the US population over age 35 consumes SSB on a given day (27). It has also been estimated that 25% of Americans over age 2 years obtain ≥200 calories/day from SSB and 5% obtain ≥567 calories/day from SSB (28). Although the impact of SSB consumption on obesity is actively debated (29-32), decreasing SSB consumption may reduce overall energy intake and help some individuals achieve/maintain weight loss (though a similar result could theoretically be achieved by reducing calories from other sources) (32). Phelan et al. (20) reported weight loss maintainers consume significantly fewer daily servings of sugar-sweetened soft drinks than normal weight controls (0.07 vs 0.16 servings per day; $P = 0.03$). Further, in the CARDIA cohort, higher odds of successful weight loss maintenance were related to (among other factors) less SSB consumption (24). The low levels of SSB consumption in our sample also suggest this may be one of many important strategies required for long-term weight loss maintenance.

A substantial number of participants considered making changes in beverage consumption patterns to be very important in losing weight (41.7%) or maintaining weight loss (39.6%). Increasing consumption of water was identified most commonly as the most important or frequent change (reported by 48.2% and 52.1%, respectively, for weight loss and weight maintenance), followed by reducing consumption of regular calorie/nondiet beverages (reported by 21.1% and 18.5%, respectively, for weight loss and weight maintenance). Randomized controlled trials also support the concept that changes in beverage consumption can play a role in weight loss. Decreasing SSB consumption (33) and replacement of caloric beverages with diet beverages (19) have been shown to be effective in promoting modest short-term weight loss, however, additional randomized studies are needed to examine the long-term weight and health effects of these strategies.

Interestingly, obese participants were more likely to report regular consumption of low/no calorie or diet soda, though there were no differences by BMI category in consumption of any other LNCSB. Other studies have found adults who are overweight or trying to lose weight report the highest levels of artificially sweetened beverage consumption (13,34,35). While it has been suggested LNCSB could stimulate appetite and contribute to weight gain (perhaps by increasing cravings for sugar or increasing insulin levels) these hypotheses have not been supported by human studies to date (25,36,37). While some longitudinal studies have linked low/no calorie sweeteners with weight gain and increased cardio-metabolic risk (10-12), reverse causality is an issue in interpreting this data as individuals at higher risk for weight gain may choose to consume these products in an attempt to control weight (26). A recent review (26) concluded that higher-quality studies suggest either no effect of noncalorically sweetened beverages on weight change or obesity risk, or, perhaps, a

protective effect possibly because of replacing calorically dense alternatives. It is therefore more likely that the higher consumption of low/no calorie or diet soda in obese participants in our study reflects the use of these beverages as a strategy implemented by individuals of a higher body weight who desire further weight loss, or as a strategy implemented once individuals begin to regain weight. Future prospective research is needed to adequately address this question.

This study is the first to our knowledge to explore motivations and strategies behind the consumption of LNCSB in successful weight loss maintainers. It is important to point out that participants in this study were derived from the NWCR, a self-selected sample of weight loss maintainers who may be more determined in their efforts than the general population of weight loss maintainers. In the present study, 93% of the sample was Caucasian and 83% highly educated (college degree or higher). Thus, findings from the present study may not be applicable to all individuals desiring to maintain a weight loss.

## Conclusions

Subjects successful at weight loss maintenance primarily consume reduced calorie or non-caloric beverages (including LNCSB) and report low consumption of SSB. The majority (78%) of subjects who consume LNCSB felt that they helped them control or reduce their total food or calorie intake suggesting that these beverages could play a role in a weight control program. Changes in patterns of beverage consumption (specifically increasing water and to a lesser extent, reducing regular calorie/nondiet beverages) may also be important strategies for weight loss and maintenance.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

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**Table 1**

**Participant characteristics**

| | Overall (*n*=434) | | Female (*n*=311) | | Male (*n*=123) | | |
|---|---|---|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***P*-value[a]** |
| **Age** | 52.4 | 11.6 | 51.2 | 11.0 | 55.6 | 12.5 | 0.0007 |
| **Weight (kgs)** | 77.7 | 16.6 | 73.3 | 14.8 | 89.0 | 15.6 | <0.0001 |
| **BMI** | 27.0 | 4.9 | 26.6 | 5.1 | 27.8 | 4.6 | 0.0250 |
| **Weight Change From Max (kgs)** | 34.2 | 18.5 | 34.2 | 18.5 | 34.3 | 18.6 | 0.9474 |
| **Weight Maintenance Duration (years)** | 7.8 | 5.2 | 7.8 | 5.1 | 7.6 | 5.5 | 0.6506 |
| **Gained > 5 lbs in past year** | 159 | 36.6 | 115 | 37.0 | 44 | 35.8 | 0.8143 |
| | ***N*** | **%** | ***N*** | **%** | ***N*** | **%** | |
| **Race** | | | | | | | 0.8333 |
| **White/Caucasian** | 402 | 92.6 | 288 | 92.6 | 114 | 92.7 | |
| **Hispanic** | 8 | 1.8 | 6 | 1.9 | 2 | 1.6 | |
| **African American** | 10 | 2.3 | 8 | 2.6 | 2 | 1.6 | |
| **Asian or Pacific Islander** | 4 | 0.9 | 2 | 0.6 | 2 | 1.6 | |
| **Native American** | 5 | 1.2 | 4 | 1.3 | 1 | 0.8 | |
| **Other** | 4 | 0.9 | 2 | 0.6 | 2 | 1.6 | |
| **Prefer to not answer** | 1 | 0.2 | 1 | 0.3 | 0 | 0.00 | |
| **Education** | | | | | | | 0.0899 |
| **High school graduate or less** | 9 | 2.1 | 7 | 2.2 | 2 | 1.6 | |
| **Technical school or trade school graduate** | 15 | 3.5 | 11 | 3.5 | 4 | 3.23 | |
| **Some college** | 48 | 11.1 | 35 | 11.3 | 13 | 10.6 | |
| **Graduated from college** | 117 | 27.0 | 87 | 28.0 | 30 | 24.4 | |
| **Some postgraduate work** | 52 | 12.0 | 38 | 12.2 | 14 | 11.4 | |
| **Masters Degree (e.g., MBA, MA, MS)** | 129 | 29.7 | 98 | 31.5 | 31 | 25.2 | |
| **Doctorate Degree (e.g., PhD, MD)** | 64 | 14.8 | 35 | 11.3 | 29 | 23.6 | |
| **Marital Status** | | | | | | | 0.3795 |
| **Married** | 286 | 65.9 | 197 | 63.3 | 89 | 72.4 | |
| **Separated** | 6 | 1.4 | 4 | 1.3 | 2 | 1.6 | |

| | Overall (*n*=434) | | Female (*n*=311) | | Male (*n*=123) | | |
|---|---|---|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | ***P*-value[a]** |
| **Divorced** | 38 | 8.8 | 30 | 9.7 | 8 | 6.5 | |
| **Widowed** | 16 | 3.7 | 12 | 3.9 | 4 | 3.3 | |
| **Unmarried, Living Together** | 24 | 5.5 | 21 | 6.8 | 3 | 2.4 | |
| **Never Married** | 64 | 14.8 | 47 | 15.1 | 17 | 13.8 | |

[a]Independent samples t-tests were used to compare females versus males continuous variables. Pearson Chi-Square tests were used to compare females versus males on categorical variables.

**Table 2**

**Overall proportion of participants reporting different frequencies of consumption within specific beverage categories (*n* =434)**

| | ≥2 per % | 1 per day% | 4–6 per week% | 2–3 per week% | 1 per week% | 1–3 per month% | < 1–3 month% | Never% |
|---|---|---|---|---|---|---|---|---|
| ***LNCSB*** | | | | | | | | |
| **Low/No Calorie or Diet Soda** | 16.6 | 9.5 | 5.1 | 8.3 | 7.1 | 7.6 | 15.2 | 30.7 |
| **Low/No Calorie or Diet Sweetened Coffee** | 18.0 | 6.7 | 1.8 | 2.5 | 1.6 | 2.1 | 4.8 | 62.4 |
| **Low/No Calorie or Diet Sweetened Tea** | 6.9 | 4.6 | 2.5 | 4.2 | 3.2 | 6.0 | 13.6 | 59.0 |
| **Low/No Calorie or Diet Sweetened Flavored Water** | 6.5 | 4.4 | 2.8 | 3.5 | 2.3 | 6.0 | 12.4 | 62.2 |
| **Low/No Calorie or Diet Fruit Juice Drinks** | 0.9 | 0.9 | 0.7 | 1.6 | 1.2 | 3.9 | 16.4 | 74.4 |
| **Low/No Calorie or Diet Sports Drinks** | 0.9 | 0.2 | 0.9 | 2.1 | 2.3 | 5.5 | 9.5 | 78.6 |
| **Low/No Calorie or Diet Sweetened Flavored Carbonated Water** | 0.7 | 0.7 | 0.7 | 0.9 | 1.8 | 2.8 | 11.1 | 81.3 |
| **Low/No Calorie or Diet Energy Drinks** | 0 | 0.2 | 0.2 | 0.2 | 0.2 | 1.4 | 4.6 | 93.1 |
| ***SSB*** | | | | | | | | |
| **Regular Calorie Soda** | 0.2 | 0.7 | 0 | 0.9 | 0.92 | 1.6 | 15.9 | 79.7 |
| **Regular Calorie Sweetened Coffee** | 3.7 | 3.0 | 0 | 2.5 | 1.4 | 2.3 | 6.7 | 80.4 |
| **Regular Calorie Sweetened Tea** | 1.6 | 1.4 | 0.7 | 0.9 | 0.5 | 2.8 | 9.9 | 82.3 |
| **Regular Calorie 100% Fruit Juice** | 0.9 | 5.8 | 1.4 | 3.7 | 4.6 | 7.6 | 30.2 | 45.9 |
| **Regular Calorie Fruit Juice Drinks** | 0 | 0 | 0.5 | 0 | 0.9 | 0.7 | 10.8 | 87.1 |
| **Regular Calorie Sports Drinks** | 0.2 | 0.5 | 0 | 1.4 | 1.2 | 1.2 | 12.0 | 83.6 |
| **Regular Calorie Energy Drinks** | 0 | 0 | 0 | 0 | 0 | 0.2 | 3 | 96.8 |
| ***Unsweetened Beverages*** | | | | | | | | |
| **Bottle or Tap Water** | 80.4 | 11.3 | 2.5 | 2.1 | 1.2 | 0.9 | 1.2 | 0.5 |
| **Carbonated Water** | 3.7 | 3.5 | 1.2 | 1.8 | 1.8 | 7.1 | 11.8 | 69.1 |
| **Unsweetened Flavored Water** | 2.8 | 0.7 | 1.4 | 3.0 | 3.0 | 6.2 | 15.0 | 67.8 |
| **Unsweetened Flavored Carbonated Water** | 2.3 | 1.6 | 1.8 | 2.3 | 3.2 | 3.9 | 12.7 | 72.1 |
| **Unsweetened Coffee** | 30.2 | 6.2 | 0.9 | 3.0 | 1.6 | 3.5 | 4.6 | 50.0 |
| **Unsweetened Tea** | 11.1 | 8.8 | 6.2 | 10.8 | 3.7 | 7.4 | 12.9 | 39.2 |
| **Alcohol** | | | | | | | | |
| **Wine** | 3.7 | 4.8 | 4.2 | 11.3 | 7.4 | 13.6 | 20.3 | 34.8 |
| **Mixed Drinks** | 0.5 | 0.2 | 0.9 | 3.9 | 3.7 | 8.5 | 29.0 | 53.2 |
| **Beer** | 0.7 | 0.7 | 3.9 | 6.5 | 5.3 | 9.9 | 21.0 | 52.1 |

| | ≥2 per % | 1 per day% | 4–6 per week% | 2–3 per week% | 1 per week% | 1–3 per month% | < 1–3 month% | Never% |
|---|---|---|---|---|---|---|---|---|
| **Hard Liquor** | 0.2 | 0.5 | 1.4 | 3.2 | 2.8 | 6.2 | 23.7 | 62.0 |

**Table 3**

**Proportion of participants reporting regular (≥ once a day) consumption of specific beverage categories overall and by BMI Category[a]**

| | Overall (*n* = 464) | | Normal weight (*n* = 171) | | Over-weight (*n* = 166) | | Obese (*n* = 97) | | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | *N* | % | *N* | % | *N* | % | Overall *P*-value[b] |
| ***Individual Beverage Categories*** | | | | | | | | | |
| **Bottle or Tap Water** | 398 | 91.7 | 159 | 93.0 | 151 | 91.0 | 88 | 90.7 | 0.7371 |
| **Unsweetened Coffee** | 158 | 36.4 | 63 | 36.8 | 66 | 39.8 | 29 | 29.9 | 0.2732 |
| **Low/No Calorie or Diet Soda** | 113 | 26.0 | 44 | 25.7 | 35 | 21.1 | 34 | 35.1 | 0.0447 |
| **Low/No Calorie or Diet Sweetened Coffee** | 107 | 24.7 | 42 | 24.6 | 38 | 22.9 | 27 | 27.8 | 0.6681 |
| **Unsweetened Tea** | 86 | 19.8 | 45 | 26.3 | 26 | 15.7 | 15 | 15.5 | 0.0235 |
| **Low/No Calorie or Diet Sweetened Tea** | 50 | 11.5 | 21 | 12.3 | 17 | 10.2 | 12 | 12.4 | 0.8056 |
| **Low/No Calorie or Diet Sweetened Flavored Water** | 47 | 10.8 | 20 | 11.7 | 17 | 10.2 | 10 | 10.3 | 0.8960 |
| **Wine** | 37 | 8.5 | 24 | 14.0 | 11 | 6.6 | 2 | 2.1 | 0.0018 |
| **Carbonated Water** | 31 | 7.1 | 10 | 5.9 | 15 | 9.0 | 6 | 6.2 | 0.4811 |
| **Regular Calorie 100% Fruit Juice** | 29 | 6.7 | 15 | 8.8 | 10 | 6.0 | 4 | 4.1 | 0.3117 |
| **Regular Calorie Sweetened Coffee** | 29 | 6.7 | 10 | 5.9 | 10 | 6.0 | 9 | 9.3 | 0.5080 |
| **Unsweetened Flavored Carbonated Water** | 17 | 3.9 | 7 | 4.1 | 9 | 5.4 | 1 | 1.0 | 0.2060 |
| **Unsweetened Flavored Water** | 15 | 3.5 | 4 | 2.3 | 6 | 3.6 | 5 | 5.2 | 0.4746 |
| **Regular Calorie Sweetened Tea** | 13 | 3.0 | 4 | 2.3 | 7 | 4.2 | 2 | 2.1 | 0.4974 |
| **Low/No Calorie or Diet Fruit Juice Drinks** | 8 | 1.8 | 0 | 0 | 5 | 3.0 | 3 | 3.1 | 0.0706 |
| **Low/No Calorie or Diet Sweetened Flavored Carbonated Water** | 6 | 1.4 | 2 | 1.2 | 2 | 1.2 | 2 | 2.1 | 0.8091 |
| **Beer** | 6 | 1.4 | 2 | 1.2 | 3 | 1.8 | 1 | 1.0 | 0.8334 |
| **Low/No Calorie or Diet Sports Drinks** | 5 | 1.2 | 2 | 1.2 | 1 | 0.6 | 2 | 2.1 | 0.5639 |
| **Regular Calorie Soda** | 4 | 0.9 | 2 | 1.2 | 1 | 0.6 | 1 | 1.0 | 0.8551 |
| **Mixed Drinks** | 3 | 0.7 | 1 | 0.6 | 2 | 1.2 | 0 | 0 | 0.5114 |
| **Hard Liquor** | 3 | 0.7 | 3 | 1.8 | 0 | 0 | 0 | 0 | 0.0980 |
| **Regular Calorie Sports Drinks** | 3 | 0.7 | 2 | 1.2 | 1 | 0.6 | 0 | 0 | 0.5315 |
| **Low/No Calorie or Diet Energy Drinks** | 1 | 0.2 | 0 | 0 | 1 | 0.6 | 0 | 0 | 0.4453 |
| **Regular Calorie Energy Drinks** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| **Regular Calorie Fruit Juice Drinks** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ***Combined Beverage Categories*** | | | | | | | | | |

| | Overall (*n* = 464) | | Normal weight (*n* = 171) | | Over-weight (*n* = 166) | | Obese (*n* = 97) | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***N*** | **%** | ***N*** | **%** | ***N*** | **%** | ***N*** | **%** | **Overall *P*-value[b]** |
| **Any low/no calorie sweetened beverage (LNCSB)[c]** | 228 | 52.5 | 87 | 50.9 | 85 | 51.2 | 56 | 57.7 | 0.5074 |
| **Any sugar-sweetened beverage (SSB)[d]** | 45 | 10.4 | 17 | 9.9 | 16 | 9.6 | 12 | 12.4 | 0.7606 |

[a] Normal weight: BMI <25, overweight: BMI ≥ 25 to <30, obese: BMI ≥ to 30.

[b] Pearson Chi Square tests used to compare BMI category groups on categorical variables.

[c] Combined data for: Low/No Calorie or Diet Soda, Low/No Calorie or Diet Sweetened Coffee, Low/No Calorie or Diet Sweetened Tea, Low/No Calorie or Diet Fruit Juice Drinks, Low/No Calorie or Diet Sweetened Flavored Carbonated Water, Low/No Calorie or Diet Sports Drinks, Low/No Calorie or Diet Sweetened Flavored Water, Low/No Calorie or Diet Energy Drinks.

[d] Combined data for: Regular Calorie Sweetened Tea, Regular Calorie Soda, Regular Calorie Sweetened Coffee, Regular Calorie Sports Drinks, Regular Calorie Fruit Juice Drinks, Regular Calorie Energy Drinks (100% fruit juice not included).

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**Table 4**

**Reasons for choosing a low/no calorie sweetened beverage (LNCSB)[a]**

| | Overall (*n*=287) | | Female (*N*=207) | | Male (*N*=80) | | |
|---|---|---|---|---|---|---|---|
| | *N* | %[c] | *N* | %[c] | *N* | %[c] | *P*-value[b] |
| **Because it tastes good** | 156 | 54.4 | 117 | 56.5 | 39 | 48.8 | 0.2359 |
| **To satisfy thirst** | 116 | 40.4 | 81 | 39.1 | 35 | 43.7 | 0.4746 |
| **Familiar/habitual/part of routine** | 76 | 26.5 | 55 | 26.6 | 21 | 26.3 | 0.9561 |
| **To try to reduce the calories I consume** | 63 | 22.0 | 38 | 18.4 | 25 | 31.3 | 0.0180 |
| **To go with meals** | 59 | 20.6 | 37 | 17.9 | 22 | 27.5 | 0.0704 |
| **To help me avoid gaining weight** | 55 | 19.2 | 36 | 17.4 | 19 | 23.8 | 0.2197 |
| **To energize me/get me going** | 51 | 17.8 | 39 | 18.8 | 12 | 15.0 | 0.4454 |
| **To indulge or treat myself** | 40 | 13.9 | 33 | 15.9 | 7 | 8.8 | 0.1147 |
| **So I can consume my calories elsewhere** | 35 | 12.2 | 27 | 13.0 | 8 | 10.0 | 0.4799 |
| **To satisfy a craving specifically for a soda** | 34 | 11.9 | 25 | 12.1 | 9 | 11.3 | 0.8458 |
| **To satisfy a craving for something sweet** | 33 | 11.5 | 25 | 12.1 | 8 | 10.0 | 0.6208 |
| **To distract me from eating/drinking** | 24 | 8.4 | 21 | 10.1 | 3 | 3.8 | 0.0793 |
| **To help me feel more full/less hungry** | 24 | 8.4 | 21 | 10.1 | 3 | 3.8 | 0.0793 |
| **To help me lose weight** | 16 | 5.6 | 9 | 4.4 | 7 | 8.8 | 0.1450 |
| **To help me unwind/relax** | 16 | 5.6 | 15 | 7.3 | 1 | 1.3 | 0.0471 |
| **To hydrate after exercise** | 16 | 5.6 | 8 | 3.9 | 8 | 10.0 | 0.0422 |
| **Other** | 16 | 5.6 | 12 | 5.8 | 4 | 5.0 | 0.7919 |
| **To tide me over between meals** | 13 | 4.5 | 13 | 6.3 | 0 | 0.00 | 0.0218 |
| **Instead of an alcoholic beverage** | 10 | 3.5 | 6 | 2.9 | 4 | 5.0 | 0.3840 |
| **Because it is healthy/good for me** | 6 | 2.1 | 3 | 1.5 | 3 | 3.8 | 0.2219 |
| **Because a physician/friend/nutritionist** | 2 | 0.7 | 0 | 0.0 | 2 | 2.5 | 0.0224 |
| **Before eating a meal in order to eat less** | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1.0000 |

[a] *n* = 287 participants who report consuming LNCSB at least once per week.

[b] Pearson Chi Square tests were used to compare females versus males on categorical variables.

[c] Does not sum to 100, more than one response possible.