Use of artificial sweeteners and fat-modified foods in weight loss maintainers and always normal weight individuals

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Abstract

Objective—The purpose of this study was to compare the dietary strategies and use of fat and sugar-modified foods and beverages in a weight loss maintainer group (WLM) and an always normal weight group (NW).

Subjects—WLM (N = 172) had maintained ≥10% weight loss for 11.5 yr, and had a BMI of 22.0 kg/m². NW (N=131) had a BMI of 21.3 kg/m² and no history of overweight. Three, 24-h recalls on random, non-consecutive days were used to assess dietary intake.

Results—WLM reported consuming a diet that was lower in fat (28.7% vs. 32.6%, p < .0001) and used more fat-modification strategies than NW. WLM also consumed a significantly greater percentage of modified dairy (60% vs. 49%; p = .002) and modified dressings and sauces (55% vs. 44%; p = .006) than NW. WLM reported consuming three times more daily servings of artificially sweetened soft drinks (0.91 vs. 0.37; p = .003), significantly fewer daily servings of sugar-sweetened soft drinks (0.07 vs. 0.16; p = .03), and more daily servings of water (4.72 vs 3.48; p = .002) than NW.

Conclusions—These findings suggest that WLM use more dietary strategies to accomplish their weight loss maintenance, including greater restriction of fat intake, use of fat- and sugar-modified foods, reduced consumption of sugar-sweetened beverages, and increased consumption of artificially sweetened beverages. Ways to promote the use of fat-modified foods and artificial sweeteners merits further research in both prevention and treatment controlled trials.

Keywords

Fat-modified foods; artificial sweeteners; successful weight loss; sugar-sweetened beverages

INTRODUCTION

Fat and sugar-modified foods and beverages are currently widely available and consumed in the belief that they assist in reducing caloric intake and in achieving or maintaining a healthy
body weight. However, the role of modified foods and beverages in promoting long-term weight control is still open to considerable debate. In the general population, use of fat-modified foods has been reported to be easily adopted and highly acceptable weight control strategy and has been associated with consumption of a more nutrient-dense diet. Normal weight individuals who switch from full fat to reduced fat products have shown reductions in fat and energy intake, and use of fat-modified products has been identified as a strategy to prevent overweight and obesity in this population. In obese individuals, however, most reports have shown that those who switch to reduced fat foods do not have significant reductions in total energy or sustained body weight decreases over time. Similarly, reduced fat diets have been shown to produce only modest (~2 kg) weight losses; thus, for obese individuals, the recommendation has been to consume a low fat diet in the context of a calorie restriction. There is still no consensus on the usefulness of substituting artificial sweeteners for sugar to obtain better weight control. Short-term lab-based studies have been mixed; with some studies showing artificial sweeteners have a stimulating effect on appetite and (most) other studies finding no appetite effects. Several epidemiologic studies have found positive dose-response relationships between intake of artificial sweeteners and subsequent prospective weight gain in adults, raising concerns that use of artificial sweeteners may be fueling the obesity epidemic. However, randomized intervention studies of obese individuals both with and without energy restriction have shown that intake of artificial sweeteners can increase adherence to a low calorie diet and result in decreased energy intake and body weight and improved weight loss maintenance over time.

Surprisingly little is known about the use of fat and sugar modified foods and beverages in the two groups who are achieving long-term weight control in our current obeseogenic environment: long-term weight loss maintainers (WLM) and normal weight individuals who do not have a history of obesity (NW). Understanding whether and how these two groups use nutrient-modified products is important to the design of future weight loss and weight gain prevention interventions. Previously we reported that WLM engaged in more physical activity than NW of equal weight, suggesting that WLM must work harder than NW to maintain normal body weight. The purpose of the current study was to examine the diet and use of modified foods and beverages in these two groups. We hypothesized that, due to their prior history of obesity, WLM would report consuming a lower calorie and lower fat diet and correspondingly report higher dietary restraint. Moreover, we hypothesized that WLM would employ more low-fat dietary strategies, consume more fat-modified and sugar-modified foods, and consume more artificially sweetened beverages than NW controls.

METHODS AND PROCEDURES

Subjects and Procedures

A convenience sample of men and women was recruited by placing advertisements in national and local publications and articles about the study in publications that target a general audience. Individuals interested in joining the study were asked to call a 1–800 number or to visit our website (www.nwcr.ws). Participants were located across United
States, but predominantly in New England, California, and the Washington, D.C. area. Eligibility was confirmed via phone screen.

To be eligible for the study, weight loss maintainers had to be overweight or obese (BMI ≥ 25) at some point in their life, currently normal weight (BMI 18.5–25), and must have lost ≥ 10% of maximum body weight. In addition, to identify individuals who were clearly succeeding at weight loss maintenance, they were required to have kept off a loss of ≥ 10% for at least 5 years, and be weight stable (± 10 lbs) within the past 2 years. Participants in the always normal weight group had to be normal weight (BMI between 18.5–25) and have no history of overweight or obesity (BMI ≥ 25). The criteria for participants in the always normal weight group also required that they be weight stable (± 10 lbs) for at least 2 years prior to enrollment. Of the 556 subjects who responded to advertisements specifying these criteria, 386 (69%) were deemed eligible for the current study. Of these, 303 signed written informed consent forms and participated in all study assessments. Participants were paid $50 for completing the study assessments. The study was approved by the Institutional Review Board at the Miriam Hospital in Providence, Rhode Island.

Measures

**Weight and Demographics**—Weight and weight history were based on self-report. Participants provided information about marital status, ethnicity/race (Hispanic/Non-Hispanic, American Indian, Asian, Black/African-American, Native Hawaiian, White, or other), and education. These data were collected for descriptive purposes.

**Dietary Intake**—Food intake information was obtained via 24-h telephone-based dietary recall, using the Nutrition Data System Software (NDS) developed by the Nutrition Coordinating Center, University of Minnesota in Minneapolis. Trained and “blinded” dietary interviewers administered three recalls on random, non-consecutive days of the week (2 weekday and 1 weekend day). Food pictures were sent to participants and used to facilitate portion size quantification. Previous research has shown strong linear relationships (rs. > .66) between 24-hour recalled food intake and independently observed food intake as well as food diaries. With three independent observations, within-person variation is adjusted for and distributions of nutrient intake can be estimated.

Variables of interest included calories, protein, carbohydrates, and fat. Beverage consumption was also calculated. Beverage groupings were based on NDS categorizations that, in some cases, were combined across NDS groups: 1) sweetened soft drinks; 2) other sweetened drinks (i.e., sweetened fruit drinks, tea, coffee, coffee substitute, water); 3) artificially sweetened soft drinks; 4) other artificially sweetened drinks (i.e., fruit drinks, tea, coffee, coffee substitute, water); 5) unsweetened water; 6) juices (i.e., citrus juice, fruit juice excluding citrus juice, vegetable juice); 7) whole milk (i.e., ≥ 2% fat); 8) low fat and fat free milks (i.e., 1% or fat free); and, 9) alcohol (i.e., beer and ales, cordial and liquor, distilled liquor, wine). Standard servings sizes were based on NDS classifications with one serving equaling: 8 fluid ounces of soft drinks, sweetened drinks, or water; 12 fluid ounces of beer; 1.5 fluid ounces of liqueurs or cordials; 5 fluid ounces of table wine; 3 fluid ounces of...
dessert wine; 3 fluid ounces of Sake; 12 fluid ounces of wine coolers; 1 cup of milk; and, 4 fluid ounces of juice.

The frequency of use of fat-modified foods was also calculated using NDS standard serving sizes (available upon request) and groupings for energy dense snacks (e.g., cakes, cookies, chips, pudding, candy, dessert), unmodified dairy foods (e.g., full fat cheese, yogurt, cream), unmodified dressings (e.g., margarine, butter, salad dressing, gravy, sauces), modified dairy foods (e.g., reduced fat/artificially sweetened/no sugar added yogurt, cheese, cream), and modified dressings (reduced fat/artificially sweetened/no sugar added salad dressings, gravy, sauces, butter).

Kristal Eating Pattern Questionnaire—This 21-item questionnaire assesses 5 dimensions of low-fat dietary strategies (on a scale where 1 = always; 2 = usually; 3 = sometimes; and, 4 = never), including: 1) avoiding fat as a spread or flavoring; 2) avoiding meat; 3) modifying commonly used foods to lower their fat (e.g., broiling instead of frying); 4) substituting specifically manufactured low fat foods; and, 5) replacing high fat foods with low fat food (e.g., using fruit instead of ice cream for dessert). Using the Kristal Eating Pattern Questionnaire during the Women’s Health Trial,31 it was shown that avoiding use of fat as a seasoning was the scale most strongly associated with decreased dietary fat intake. High scores on these scales are associated with less effort to reduce dietary fat intake.

Dietary Restraint—The Eating Inventory (EI), developed by Stunkard and Messick 32 was used to assess dietary restraint. Restraint can be defined as the degree to which a person is consciously aware of constantly monitoring their food intake.33 Items ask participants to indicate, for example, whether they “stop eating as a conscious means to limit intake,” and “consciously hold back at meals.” The EI has demonstrated adequate internal consistency (>.80) and test-retest reliability (.91-.93).34

Statistics

Descriptive statistics are presented in the tables as either means ± SDs for continuous measures or percentages for categorical responses. Independent t-tests and chi-square analyses were used to examine group differences in baseline demographic variables. Univariate general linear model analyses adjusting for BMI were conducted to examine group differences in macronutrient consumption, low fat dieting strategies, beverage consumption, and intake of modified food. Spearman’s correlations were used to examine associations among variables.

RESULTS

Subject characteristics are displayed in Table 1. The weight loss maintainer group had reduced from 91.6 ± 18.1 kg to 61.6 ± 8.8 kg and maintained a ≥10% weight loss for over 11 years. Both groups were normal weight, but the weight loss maintainer group weighed significantly more and had a higher BMI than the always normal weight group (ps < 0.0002).
We first compared the always normal weight and weight loss maintainer groups on dietary intake. Both groups reported consuming a low calorie diet; however, WLM reported consuming a diet that was lower in fat and higher in protein and carbohydrates than the always normal weight group (Table 2). Consistent with these findings, WLM also employed more low-fat dieting strategies, including avoiding fat as a spread or flavoring, replacing high fat foods with low fat foods, and substituting high fat foods with commercially available low fat foods. WLM also scored significantly higher on dietary restraint, suggesting a greater degree of conscious control over food intake.

We next compared WLM and always normal weight on consumption of modified foods (i.e., modified fat, sugar, or both). WLM consumed a significantly greater percentage of dairy that was modified (60 vs. 49%; p = .002) and dressings and sauces that were modified (55 vs. 44%; p = .006) compared with the always normal weight group. However, there were no significant group differences in number of daily servings and average serving sizes of these foods. Both groups reported having at least one serving per day of energy dense snacks, such as cakes, cookies, chips, pudding, candy, and dessert (Table 3).

We next compared the two groups on average daily beverage consumption. As shown in Table 4, WLM reported consuming three times more daily servings of artificially sweetened soft drinks and had significantly larger average serving sizes. Also, expressed as a percentage of overall beverage intake, WLM’s intake of artificially sweetened soft drinks was two times greater than that of always normal weight individuals. Although consumption of sugar sweetened soft drinks was relatively rare in both groups, WLM consumed significantly fewer daily servings, consumed smaller serving sizes, and had a significantly smaller percentage of beverages coming from sugar-sweetened soft drinks than always normal weight individuals (1.0 vs 2.3%, respectively; p = .04). There were no significant differences between WLM and NW in juice consumption as a percentage of overall beverage intake (7.2 vs 9.8%; p = .22, respectively); however, WLM consumed significantly fewer daily servings of juice and smaller average serving sizes. The two groups also differed significantly in alcohol consumption. WLM consumed fewer daily servings, had smaller serving sizes, and a smaller percentage of overall beverage intake than the always normal weight group (6.2 vs. 13.3%; p = .0002). In both groups, the predominant beverage consumed was unsweetened water; however, WLM consumed more daily servings of water, larger serving sizes, and had a marginally greater percentage of overall beverage intake from water relative to always normal weight individuals (58.2% vs. 52.4%, respectively; p = .06).

**Correlational analyses**

In correlational analyses, reduced calorie intake was significantly correlated with lower intake of sugar sweetened beverages (r = .22; p = .0002) and less alcohol (r = .15; p = .01) and milk (r=.16; p = .004) but was not related to lower fat intake or percentage of modified foods consumed. Lower fat intake was significantly related to greater use of low-fat dietary strategies on the Krystal questionnaire (rs between .12 and .46; ps ≤ .04) and greater intake of modified dairy products (r=−.30; p=.0001) and modified sauces and dressings (r=−.38 p = .0001). Higher dietary restraint was significantly associated with lower intake of sugar sweetened beverages (−.26; p = .0001) and alcohol (r = −.17; p = .004), and greater intake of...
DISCUSSION

Both NW and WLM reported consuming a low calorie, low fat diet, but WLM reported consuming less fat, more fat-modified foods, and using more low-fat dietary strategies than always normal weight. These findings are consistent with a large body of research suggesting that consumption of a low calorie low fat diet is consistent with long-term weight control. Reasons for greater fat restriction and use of fat modified foods among WLM compared with NW are unknown. Greater fat restriction may reflect a strategy adopted by WLM to reduce intake in the context of their less sensitive internal cues. Alternatively, fat restriction among WLM could reflect their history of dieting and, thus, greater knowledge of low fat dieting as compared with always normal weight individuals.

WLM also scored significantly higher on dietary restraint than NW, and dietary restraint was significantly correlated with lower fat and calorie intakes and higher intake of artificially sweetened beverages. High dietary restraint appears to be characteristic among successful weight losers. A restrained eating style may distinguish WLM from NW and enable WLM to consume a low calorie, low fat diet in the context of biological, environmental, and/or other obesity-promoting cues.

We found that both groups consumed artificially-sweetened beverages but WLM consumed significantly more than normal weight. While WLM consumed the equivalent of more than one serving (> 8 fl oz) per day, normal weight controls consumed less than half a serving per day, which is an amount consistent with the general population. Some have argued that intake of artificial sweeteners may lead to overcompensation, taste distortion and increased appetite for intensely sweet highly caloric foods, and could be fueling the obesity epidemic. However, several intervention studies and a meta-analysis of weight change data from nine randomized clinical trials in obese individuals have shown significantly greater weight loss among users of artificial sweeteners than non-users. Our findings are more consistent with these latter data and suggest that use of artificially-sweetened beverages may be an important weight control strategy among WLM. Use of artificially-sweetened beverages may assist WLM in maintaining a reduced calorie diet in the context of biological, metabolic, and cognitive factors promoting over-consumption of energy from liquids.

Both groups consumed very little in the way of sugar sweetened beverages. While national data indicate that Americans consume the equivalent of about two 8 fl oz servings of sugar-sweetened beverages each day, both groups in our study consumed the equivalent of a few daily sips (< 0.16 serving/day). Evidence is mixed on the role of sugar-sweetened beverages in the promotion of weight gain and obesity; seven reviews on the topic have reached differing conclusions, with three concluding a positive effect, and four suggesting inconclusive evidence. Our study adds to the existing literature by suggesting that individuals maintaining a healthy body weight consume little in the way of sugar-sweetened beverages. Moreover, WLM appeared to follow a general strategy of

artificially sweetened beverages (r = .36; p = .0001) and use of all the low-fat dietary strategies (rs between −.17 and −.49; ps<.003).
choosing lower calorie beverages, such as artificially-sweetened drinks and water, and limiting consumption of higher calorie drinks, such as sugar-sweetened beverages, juice and alcohol. Monitoring calories from beverages may be another key strategy in maintaining long term weight control.

In a previous report, we found that the weight loss maintainers in this sample engaged in significantly more physical activity (as assessed by accelerometry) than the always normal weight. In the current study, both groups had similar calorie intakes, but WLM reported higher dietary restraint, greater fat restriction, and greater practice of low fat dietary strategies. Taken together, these data suggest that the weight loss maintainers may have to engage in more intensive weight control behaviors to maintain their body weight, perhaps to counteract a more efficient metabolism. Alternatively, WLM may be more likely to underreport their dietary intake. Future research with more objective measures of diet (doubly labeled water) is needed to adequately address energy balance differences between these groups.

The study is one of the first to conduct a detailed comparison of the dietary intake and use of fat- and sugar-modified products in a population of weight loss maintainers and individuals without a history of obesity. The study population, nonetheless, was limited to a self-selected sample of predominantly Caucasian females. Future research is needed to determine the generalizability of the current study’s findings to representative samples of weight loss maintainers and normal weight. Moreover, the groups in this study were assessed at one time point only, which limits more powerful prospective analyses.

Understanding the behaviors of individuals who are achieving long-term weight control in our current obesogenic environment is critical to informing the development of effective weight loss and weight gain prevention programs. The current study suggests that WLM use more dietary strategies to accomplish their weight loss maintenance, including greater restriction of fat intake, use of fat- and sugar-modified foods, reduced consumption of caloric beverages, and increased consumption of artificially sweetened beverages. Ways to promote the use of fat-modified foods and artificial sweeteners merits further research in both prevention and treatment controlled trials.

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Table 1

Participant characteristics.

|                     | Weight Loss Maintainer Group (N =172) | Always Normal Weight Group (N =131) | p value |
|---------------------|--------------------------------------|-------------------------------------|---------|
| Age                 | 49.9±13.2                            | 48.2±11.6                           | NS      |
| Current weight (kg) | 61.6±8.8                             | 57.8±7.3                            | <0.0001 |
| BMI                 | 21.99±1.67                           | 21.29±1.45                          | 0.0002  |
| % Female            | 84.9%                                | 90.1%                               | NS      |
| % Caucasian         | 93%                                  | 92%                                 | NS      |
| % Married           | 67.4%                                | 68.7%                               | NS      |
| % College educated or more | 76.7%                        | 83.2%                               | NS      |
| Lifetime maximum weight (kg) | 91.6±18.1                | -                                   | -       |
| Duration of maintaining ≥10% weight loss, years | 11.49±8.88 (N=167) | -                                   | -       |

Note: P values are based on independent t-tests for continuous variables and chi-square tests for dichotomous variables.
### Table 2

Dietary intake and low-fat dietary strategies among weight loss maintainers and always normal weight individuals

|                      | Weight Loss Maintainer (N =169) | Always Normal Weight (N =125) | p value* |
|----------------------|---------------------------------|-------------------------------|----------|
| Calories, total      | 1718±487                        | 1792±539                      | 0.1013   |
| Fat, %               | 28.7±8.4                        | 32.6±7.1                      | <0.0001  |
| Protein, %           | 18.4±4.7                        | 17.0±3.8                      | 0.0102   |
| Carbohydrate, %      | 55.2±10.6                       | 48.9±8.8                      | <0.0001  |
| Dietary restraint    | 14.8 ± 4.2                      | 9.8 ± 4.8                     | <0.0001  |
| **Low fat dietary strategies** |                       |                                |          |
| Summary score (reflects overall use of low fat dietary strategies) | 1.96±0.40                      | 2.25±0.38                      | <0.0001  |
| Substituting specifically manufactured low fat foods | 1.84±0.81                      | 2.54±0.90                      | <0.0001  |
| Modifying foods to lower fat (e.g., broiling instead of frying) | 1.71±0.79                      | 1.82±0.74                      | 0.2462   |
| Avoiding meat        | 1.19±0.36                       | 1.25±0.32                      | 0.0339   |
| Replacing high fat with low fat foods | 2.76±0.55                      | 3.02±0.50                      | <0.0001  |
| Avoiding fat as spread or flavoring | 2.32±0.65                      | 2.60±0.55                      | <0.0001  |

* P-values are obtained from the GLM models with adjustment for BMI

** Scores are from the Krystal Eating Pattern questionnaire; 30 higher scores indicate less frequent use of the strategy (on a scale where 1 = always; 2 = usually; 3 = sometimes; and, 4 = never).
Table 3

Average number of servings per day and average serving sizes of energy dense and modified foods

|                        | Weight Loss Maintainer Group (N=172) | Always NW Group (N =131) | p value*  |
|------------------------|--------------------------------------|--------------------------|-----------|
| **Energy-dense snacks**|                                      |                          |           |
| # servings/day         | 1.41±1.77                            | 1.23±1.03                | 0.2816    |
| Avg serving size       | 0.67±0.66                            | 0.59±0.50                | 0.4641    |
| **Dairy foods**        |                                      |                          |           |
| Unmodified             |                                      |                          |           |
| # servings/day         | 0.51±1.64                            | 0.57±0.62                | 0.5008    |
| Avg serving size       | 0.29±0.46                            | 0.33±0.30                | 0.2285    |
| % of all dairy         | 40%±34%(N=161)                       | 51%±33%(N=122)           | 0.0020    |
| Modified               |                                      |                          |           |
| # servings/day         | 0.66±0.71                            | 0.57±0.67                | 0.2484    |
| Avg serving size       | 0.41±0.38                            | 0.35±0.33                | 0.1275    |
| % of all dairy         | 60%±34%(N=161)                       | 49%±33%(N=122)           | 0.0020    |
| **Dressings and Sauces**|                                     |                          |           |
| Unmodified             |                                      |                          |           |
| # servings/day         | 0.96±1.16                            | 1.23±1.12                | 0.0541    |
| Avg serving size       | 0.60±0.75                            | 0.69±0.58                | 0.3713    |
| % of all dressing      | 45%±35%(N=165)                       | 56%±32%(N=125)           | 0.0062    |
| Modified               |                                      |                          |           |
| # servings/day         | 1.54±3.98                            | 1.08±1.18                | 0.1395    |
| Avg serving size       | 0.84±1.49                            | 0.65±0.62                | 0.1048    |
| % of all dressing      | 55%±35%(N=165)                       | 44%±32%(N=125)           | 0.0062    |

* P-values are obtained from the GLM models with adjustment for BMI
| Beverage Type                          | Weight Loss Maintainer (N =172) | Always Normal Weight (N =131) | p value* |
|---------------------------------------|---------------------------------|------------------------------|----------|
| Artificially sweetened soft drink     | # serv/day                      | 0.91±1.59                    | 0.37±0.93| 0.0026   |
|                                       | Avg serv size                   | 0.61±0.90                    | 0.28±0.60| 0.0008   |
|                                       | % of all bev.                   | 13.5%±12.5% (N=169)          | 6.4%±14.5% (N=128) | 0.0043   |
| Other artificially sweetened drinks   | # serv/day                      | 0.21±0.75                    | 0.08±0.31| 0.0654   |
|                                       | Avg serv size                   | 0.16±0.52                    | 0.07±0.25| 0.0666   |
|                                       | % of all bev.                   | 3.3%±11.4% (N=169)           | 2.3%±9.5% (N=128) | 0.3899   |
| Sweetened soft drink                  | # serv/day                      | 0.07±0.30                    | 0.16±0.46| 0.0272   |
|                                       | Avg serv size                   | 0.05±0.23                    | 0.12±0.31| 0.0125   |
|                                       | % of all bev.                   | 1.0%±5.2% (N=169)            | 2.3%±5.8% (N=128) | 0.0407   |
| Other sweetened drinks                | # serv/day                      | 0.10±0.49                    | 0.15±0.34| 0.4662   |
|                                       | Avg serv size                   | 0.09±0.38                    | 0.13±0.27| 0.3673   |
|                                       | % of all bev.                   | 1.2%±4.8% (N=169)            | 3.5%±10.9% (N=128) | 0.0166   |
| Juices                                | # serv/day                      | 0.39±0.75                    | 0.64±1.00| 0.0289   |
|                                       | Avg serv size                   | 0.32±0.61                    | 0.51±0.76| 0.0335   |
|                                       | % of all bev.                   | 7.2%±14.9% (N=169)           | 9.8%±15.0% (N=128) | 0.2194   |
| Water (unsweetened)                   | # serv/day                      | 4.72±4.08                    | 3.48±2.84| 0.0026   |
|                                       | Avg serv size                   | 2.03±1.81                    | 1.35±1.00| 0.0001   |
|                                       | % of all bev.                   | 58.2%±31.5% (N=169)          | 52.4%±28.9% (N=128) | 0.0630   |
| Milk                                  | Whole                           | # serv/day                   | 0.03±0.13| 0.05±0.18| 0.4890   |
|                                       | Avg serv size                   | 0.03±0.12                    | 0.04±0.12| 0.8425   |
|                                       | % of all bev.                   | 0.7%±3.0% (N=169)            | 1.0%±4.7% (N=128) | 0.4209   |
|                                       | Reduced fat                     | # serv/day                   | 0.51±0.74| 0.39±0.54| 0.2151   |
|                                       | Avg serv size                   | 0.35±0.44                    | 0.26±0.32| 0.0888   |
|                                       | % of all bev.                   | 8.6%±14.2% (N=169)           | 9.0%±16.4% (N=128) | 0.6258   |
|                                       | % of all milk                   | 90%±27% (N=120)              | 87%±30% (N=82) | 0.4222   |
| Alcohol                               | # serv/day                      | 0.35±0.66                    | 0.70±0.92| 0.0001   |
|                                       | Avg serv size                   | 0.28±0.48                    | 0.55±0.69| <0.0001  |
|                                       | % of all bev.                   | 6.2%±13.5% (N=169)           | 13.3%±18.5% (N=128) | 0.0002   |

*P-values are obtained from the GLM models with adjustment for BMI.