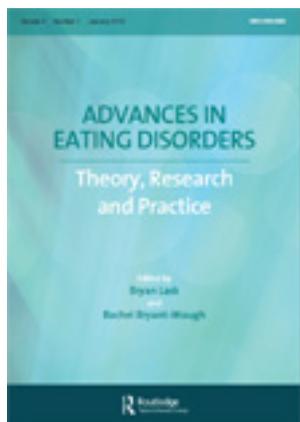


This article was downloaded by: [Marney White]

On: 19 March 2013, At: 06:41

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Advances in Eating Disorders: Theory, Research and Practice

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/reat20>

Examining the relationship between soda consumption and eating disorder pathology

M. A. Bragg^a & M. A. White^{a b c}

^a Department of Psychology, Yale University, New Haven, CT, USA

^b Department of Psychiatry, Program for Obesity, Weight, and Eating Research, Yale University School of Medicine, New Haven, CT, USA

^c Department of Epidemiology and Public Health, Yale University, New Haven, CT, USA

Version of record first published: 19 Mar 2013.

To cite this article: M. A. Bragg & M. A. White (2013): Examining the relationship between soda consumption and eating disorder pathology, *Advances in Eating Disorders: Theory, Research and Practice*, DOI:10.1080/21662630.2013.742317

To link to this article: <http://dx.doi.org/10.1080/21662630.2013.742317>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Examining the relationship between soda consumption and eating disorder pathology

M.A. Bragg^a and M.A. White^{a,b,c*}

^aDepartment of Psychology, Yale University, New Haven, CT, USA; ^bDepartment of Psychiatry, Program for Obesity, Weight, and Eating Research, Yale University School of Medicine, New Haven, CT, USA;

^cDepartment of Epidemiology and Public Health, Yale University, New Haven, CT, USA

(Received 6 September 2012; final version received 8 September 2012)

Objective: This study aimed to compare diet soda drinkers, regular soda drinkers, and individuals who do not regularly consume soda on clinically significant eating disorder psychopathology, including binge eating, overeating, and purging. *Method:* Participants ($n = 2077$) were adult community volunteers who completed an online survey that included the Eating Disorder Examination Questionnaire and questions regarding binge-eating behaviors, purging, current weight status, and the type and frequency of soda beverages consumed. *Results:* Diet soda drinkers (34%, $n = 706$) reported significantly higher levels of eating, shape, and weight concerns than regular soda drinkers (22%, $n = 465$), who in turn reported higher levels on these variables than non-soda drinkers (44%, $n = 906$). Diet soda drinkers were more likely to report binge eating and purging than regular soda drinkers, who were more likely to report these behaviors than non-soda drinkers. Consumption of any soda was positively associated with higher BMI, though individuals who consumed regular soda reported significantly higher BMI than diet soda drinkers, who in turn reported higher weight than those who do not consume soda regularly. *Conclusions:* Individuals who consume soda regularly reported higher BMI and more eating psychopathology than those who do not consume soda. These findings extend previous research demonstrating positive associations between soda consumption and weight.

Keywords: obesity; sugar-sweetened beverages; eating disorders

Introduction

Obesity is a major public health concern in the USA (Institute of Medicine, 2012). While a number of environmental and genetic factors have been identified as contributors to weight gain (Institute of Medicine, 2012), sugar-sweetened beverages (SSBs) have been a recent focus of scrutiny because they represent the largest source of added sugars in the American diet (Guthrie & Morton, 2000). Recent estimates suggest that adults receive 5–8% of daily caloric intake from SSBs (Ogden, Kit, Carroll, & Park, 2012), and soda consumption alone rose 135% between 1977 and 2001 (Nielsen & Popkin, 2004). Individuals who consume SSBs do not compensate for calories by reducing food intake (Swithers & Davidson, 2008), and a number of studies and reviews have shown that SSB consumption is associated with weight gain in children and adults (Ludwig, Peterson & Gortmaker, 2001; Malik, Schulze, & Hu Frank, 2006; Vartanian, Schwartz, & Brownell, 2007).

The negative impact of SSB intake on health has led to public health campaigns advocating for reduced consumption of SSBs and increased intake of non-caloric beverages (Kick the Can home page, 2012; Scaperotti & De Leon, 2009). The SSB taxes have also been proposed in a number of cities and states in an attempt to reduce consumption (Strum, Powell, Chriqui, &

*Corresponding author. Email: marney.white@yale.edu

Chaloupka, 2010). Replacement of caloric beverages with non-caloric options may be an important component of weight reduction (Laska, Murray, Lytle, & Harnack, 2012). However, artificially sweetened beverages (ASBs) may also pose some health risks. The ASB consumption may dysregulate hunger cues and increase desire for sugary foods (Davidson & Swithers, 2004; DiMaggio & Mattes, 2000). Furthermore, the consumption of ASBs has also been associated with weight gain (Fowler et al., 2008; Davidson & Swithers, 2004) as well as higher risk for the development of metabolic syndrome and type 2 diabetes (Nettleton, 2009).

While previous research has examined the impact of SSBs and ASBs on weight and some diet-related diseases, few studies have investigated the relationship between SSB/ASB consumption and other forms of disordered eating. Therefore, this study was aimed to compare diet soda drinkers, regular soda drinkers, and non-soda drinkers on several clinically significant variables related to disordered eating and weight. Based on previous research findings that indicated that SSBs/ASBs are associated with weight gain and can be associated with dysregulation of hunger cues, we predicted that (1) regular soda drinkers would have higher BMI levels than diet soda drinkers and non-soda drinkers; (2) diet soda drinkers would report higher levels of eating disorder psychopathology (such as shape and weight concerns) than regular soda drinkers and non-soda drinkers; and (3) diet soda drinkers would report more objective binge episodes and purging behaviors as compared to regular soda drinkers.

Method

Participants

Participants were 2077 community volunteers who responded to an online advertisement about a study relating to eating and health behaviors. Craigslist advertisements for the online study were posted in various cities in the USA. Participants completed several self-report questionnaires through the secure online survey software website SurveyMonkey after providing informed consent. The study was approved by Yale University's institutional review board. The racial/ethnic breakdown of the sample was: 77.6% white, 6.3% Hispanic, 5.8% Asian, 5.8% African-American, and 4.5% other or missing data. The mean BMI was 30.78 kg/m² (s.d. = 9.2) and mean age was 34.4 years (s.d. = 12.0).

Assessments and measures

The Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1994) is the self-report version of the Eating Disorder Examination interview (Fairburn & Wilson, 1993) and assesses eating disorder features, including objective and subjective binge episodes and purging behaviors, and produces dietary restraint, and eating, shape, and weight concern subscales. The EDE-Q has received psychometric support, including adequate test-retest reliability (Luce & Crowther, 1999), and strong convergence with the Eating Disorder Examination interview (Reas, Grilo, & Masheb, 2006; Grilo, Masheb, & Wilson, 2001).

Self-reported data were collected on type and frequency of beverages consumed, height, current weight, and demographics. Beverage consumption questions were: (1) 'What type of soda do you usually drink?' and the response options were diet and regular; and (2) 'How many sodas do you drink per day?' and response options asked participants to indicate the number of 12-ounce cans, 20-ounce bottles, and 2-liter bottles. If the participant indicated they consumed zero servings of soda per day, they were categorized as a non-soda drinker.

Statistical analyses

ANOVAs and chi-square analyses were conducted to determine whether soda groups differed on demographic variables. A multivariate analysis of variance (MANOVA) was conducted to determine whether clinically relevant variables differed among adults who report consuming diet soda, regular soda, and no soda on a daily basis. Follow-up ANOVAs examined whether the soda

groups differed on EDE-Q subscale scores, frequency of binge eating, purging, and overeating episodes, and BMI. Chi-square tests examined whether soda groups differed on the presence of clinically significant binge eating or purging. Finally, a series of ANCOVAs was conducted to control for age, gender, and race. All analyses were conducted using SPSS for Windows (SPSS 19, Chicago, IL) and were based on a 0.05 significance level.

Results

Approximately one-third of the sample (34.0%, $n = 706$) indicated they consumed diet soda, 22.4% ($n = 465$) indicated they consumed regular soda, and 43.6% ($n = 906$) of individuals indicated they do not consume soda. On average, soda drinkers reported consuming 34.0 (sd = 40.8) ounces of soda daily, or nearly three 12-ounce cans of soda per day.

Psychological and behavioral features associated with soda consumption

Table 1 presents demographic characteristics of the participants within the soda consumption groups. Diet soda drinkers were significantly older than regular soda drinkers. Women were more likely than men to consume diet soda, while men were more likely than women to report consuming regular soda. African-American participants were more likely than other racial/ethnic groups to consume regular soda, Caucasian groups were more likely to consume diet soda, and Asian participants were more likely than other racial/ethnic groups to report they did not consume soda on a regular basis.

Diet soda drinkers, regular soda drinkers, and individuals who do not consume soda were compared on a number of psychological and behavioral variables associated with disordered eating. The MANOVA comparing soda type on clinical variables (i.e. EDE-Q subscales and eating and purging episodes) was highly significant ($F(14, 4096) = 11.21, p < 0.001$; Wilks' Lambda = 0.928). Follow-up ANOVAs indicated significant group differences on all clinically relevant variables. Table 2 presents results of these univariate comparisons and Scheffe *post hoc* analyses. Because the homogeneity of variances assumption was violated, the Welch–Swattharwaite test is reported. ANCOVAs were conducted to control for age, gender, and race. The pattern of group differences persisted after controlling for demographic variables. Regular soda drinkers also had significantly higher BMI than diet soda drinkers, and

Table 1. Demographic characteristics of participants.

	Regular soda ($n = 465$)		Diet soda ($n = 706$)		No soda ($n = 906$)		F	p
	M	SD	M	SD	M	SD		
Age ^a	33.4	10.9	35.4	12.0	34.2	12.4	3.5	0.03
							χ^2	p
Gender	% (N)		% (N)		% (N)		22.0	<0.001
Male	33.6 (89)		30.2 (80)		36.2 (96)			
Female	20.8 (375)		34.6 (625)		44.6 (806)			
Race							67.8	<0.001
White	19.6 (334)		36.8 (626)		43.6 (745)			
Hispanic	32.9 (46)		27.9 (39)		39.3 (55)			
African American	44.4 (60)		14.8 (20)		40.7 (55)			
Asian	25.2 (33)		29.7 (35)		48.1 (63)			

^aScheffe *post hoc* test: significant difference between diet soda and regular soda.

Table 2. Psychological and behavioral characteristics of participants.

	Regular soda (<i>n</i> = 465)		Diet soda (<i>n</i> = 706)		No soda (<i>n</i> = 906)		ANOVA			ANCOVA ^a			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>df</i>	<i>F</i>	<i>P</i>	η^2	<i>F</i>	<i>p</i>	η_p^2
BMI ^{b,c,d}	33.8	10.6	31.4	9.0	28.7	8.0	2069	52.6	0.000	0.048	42.4	0.000	0.045
Soda ounces per day ^{b,c,d}	36.2	55.3	32.6	29.4	0	0	2055	305.4	0.000	0.229	258.1	0.000	0.226
EDE-Q ^c													
Dietary restraint ^{b,c,d}	1.9	1.6	2.7	1.7	2.3	1.6	2074	36.9	0.000	0.034	35.0	0.000	0.038
Eating concern ^{b,d}	1.9	1.6	2.4	1.6	1.7	1.6	2074	33.3	0.000	0.031	30.7	0.000	0.033
Weight concern ^{b,c,d}	3.3	1.6	3.7	1.4	3.1	1.6	2074	32.5	0.000	0.030	28.7	0.000	0.031
Shape concern ^{b,c,d}	3.9	1.7	4.3	1.4	3.6	1.7	2074	31.5	0.000	0.029	27.2	0.000	0.030
No. of objective binge ^{b,d} episodes within the past month	2.7	5.2	4.1	7.0	2.3	6.6	2062	14.8	0.000	0.014	10.9	0.000	0.012
No. of subjective binge ^d episodes within the past month	2.6	4.8	3.3	5.8	2.4	6.1	2069	5.3	0.005	0.005	2.9	0.055	0.003
No. of overeating episodes ^{b,d} with the past month	3.5	5.5	4.7	7.2	3.2	7.3	2066	9.6	0.000	0.009	7.0	0.001	0.008
No. of purges within the past ^d month	2.1	7.4	3.4	10.1	2.0	9.4	2067	4.6	0.010	0.004	5.1	0.006	0.006

^aANCOVA controlling for race, gender, and age.

^bScheffe *post hoc* test: significant difference between diet soda and regular soda.

^cScheffe *post hoc* test: significant difference between regular soda and no soda.

^dScheffe *post hoc* test: significant difference between diet soda and no soda.

^eEating Disorder Examination – Questionnaire.

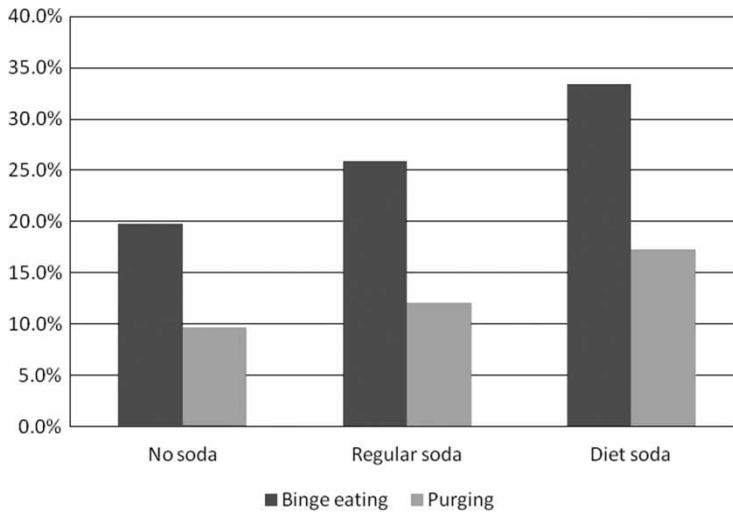


Figure 1. Rates of clinically significant binge eating and purging within soda groups.

diet soda drinkers had significantly higher BMI than individuals who reported consuming no soda. With regards to the EDE-Q subscales, diet soda drinkers reported higher levels of dietary restraint, and higher eating concerns, shape concerns, and weight concerns than both regular soda drinkers and those who do not consume soda. Furthermore, regular soda drinkers reported higher eating concerns, shape concerns, and weight concerns than participants who do not consume soda. Diet soda drinkers reported more frequent objective binge episodes and objective overeating episodes during the past 28 days than both regular soda drinkers and those who reported not consuming soda. Finally, we examined whether rates of clinically significant binge eating and purging – defined as reporting binge eating or purging at a frequency of once per week or more – differed across soda groups. This frequency threshold for determining clinical significance corresponds with *DSM-5* frequency thresholds for the diagnoses of bulimia nervosa and binge-eating disorder (Diagnostic and Statistical Manual, 5th Edition, Proposed Revisions, 2012a, 2012b). Diet soda drinkers were significantly more likely to report clinically significant binge eating ($\chi^2(2, n = 2072) = 37.8, p < 0.001$) and purging ($\chi^2(2, n = 2072) = 21.1, p < 0.001$) than were the regular soda and non-soda drinkers.

Figure 1 displays the rates of clinically significant (i.e. \geq once weekly) binge eating and purging within soda groups.

Discussion

Results indicated that diet soda drinkers reported significantly more binge episodes, purging behaviors, higher levels of eating restraint, and higher concerns about body shape, weight, and eating as compared to the regular soda drinkers and non-soda drinkers. However, BMI was significantly higher among regular soda drinkers as compared to diet soda drinkers and those who do not consume soda. These results offer additional support for previous research, indicating a positive relationship between BMI and consumption of SSBs (Swithers & Davidson, 2008; Ludwig, Peterson, Gortmaker, 2001; Malik, Schulze, Hu, 2006). Furthermore, our findings contribute to the existing body of research indicating that both ASBs and SSBs have negative impact on health. Though research has focused on beverage consumption and the impact on weight and

some diet-related diseases, this study specifically examined the relationship between consumption of ASBs/SSBs and characteristics associated with eating disorders.

The study is strengthened by the large sample size that was recruited from a range of cities in the USA and the use of validated measures to assess behavioral and psychological variables associated with disordered eating behaviors. There are several limitations to this study. The cross-sectional nature of the study prevents drawing conclusions about causality. Furthermore, the data on soda consumption and BMI were all self-reported. Another possible limitation is the use of a convenience sample drawn from Internet volunteers. However, perceived anonymity has been shown to produce more candid responses regarding eating pathology (Lavender & Anderson, 2009), suggesting the method of data collection (i.e. questionnaires presented over the Internet to anonymous volunteers) may also serve as a strength of this study.

Future studies should investigate the relationship between other SSBs/ASBs, binge-eating behaviors, and associated psychological characteristics. Longitudinal investigations would permit analysis of specific health risks associated with beverage selection and consumption patterns. Such investigations would provide additional data on the potential adverse health effects associated with soda consumption, including high BMI and compensatory behaviors, and possible long-term complications such as type 2 diabetes.

Acknowledgements

M.A. Bragg originated the study idea, helped with the design data analysis, and led the writing. M.A. White acquired the data, assisted with the design and data analysis, and provided critical feedback on drafts of the manuscript. The authors have no conflicts of interest to report.

Notes on contributors

Marie Bragg, MS, MPhil, is a doctoral student at Yale University pursuing a degree in Clinical Psychology. Her current research focuses on how professional athletes and sports organizations are used to promote unhealthy foods and beverages.

Marney A. White, PhD, MS, is a clinical psychologist and an Assistant Professor of Psychiatry and of Epidemiology and Public Health (Chronic Diseases) at the Yale University School of Medicine. Her research focuses on binge-eating disorder and the interaction of cigarette smoking with eating disorder symptomatology and weight problems.

References

- Davidson, T. L., & Swithers, S. E. (2004). A Pavlovian approach to the problem of obesity. *International Journal of Obesity and Related Metabolic Disorders*, *28*, 933–935.
- Diagnostic and statistical manual*. (2012a). 5th Ed. Proposed revisions: Bulimia Nervosa. April 17, 2012. Retrieved July, 2012, from <http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=25>.
- Diagnostic and statistical manual*. (2012b). 5th Ed. Proposed revisions: Binge eating disorder. April 17, 2012. Retrieved July, 2012, from <http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=372>
- DiMeglio, D. P., & Mattes, R. D. (2000). Liquid versus solid carbohydrate: Effects on food intake and body weight. *International Journal of Obesity and Related Metabolic Disorders*, *24*, 794–800.
- Fairburn, C., & Wilson, T. (1993). *Binge eating: Nature, assessment and treatment*. New York: Guilford Press, pp. 333–360.
- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders*, *16*, 363–370.
- Fowler, S. P., Williams, K., Resendez, R. G., Hunt, K. J., Hazuda, H. P., & Stern, M. P. (2008). Fueling the obesity epidemic? Artificially sweetened beverage use and long-term weight gain. *Obesity*, *16*, 1894–1900.

- Grilo, C. M., Masheb, R. M., & Wilson, G. T. (2001). A comparison of different methods for assessing the features of eating disorders in patients with binge eating disorder. *Journal of Consulting and Clinical Psychology, 69*, 317–322.
- Guthrie, J. F., & Morton, J. F. (2000). Food sources of added sweeteners in the diets of Americans. *Journal of the American Dietetic Association, 100*, 43–51.
- Institute of Medicine. (2012). Accelerating progress in obesity prevention: Solving the weight of the nation. Retrieved June 1, 2012, from <http://www.iom.edu/Reports/2012/Accelerating-Progress-in-Obesity-Prevention.aspx>
- Kick the Can home page. (2012). Retrieved June, 2012, from <http://www.kickthecan.info/>
- Laska, M. N., Murray, D. M., Lytle, L. A., & Harnack, L. J. (2012). Longitudinal associations between key dietary behaviors and weight gain over time: Transitions through the adolescent years. *Obesity, 201*, 118–125.
- Lavender, J. M., & Anderson, D. A. (2009). Effect of perceived anonymity in assessments of eating disordered behaviors and attitudes. *International Journal of Eating Disorders, 42*, 546–551.
- Luce, K. H., & Crowther, J. H. (1999). The reliability of the Eating Disorder Examination – Self-report questionnaire version (EDE-Q). *International Journal of Eating Disorders, 25*, 349–351.
- Ludwig, D. S., Peterson, K. E., & Gortmaker, S. L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *The Lancet, 357*, 505–508.
- Malik, V. S., Schulze, M. B., & Hu, F. B. (2006). Intake of sugar-sweetened beverages and weight gain: A systematic review. *American Journal of Clinical Nutrition, 84*, 274–288.
- Nettleton, J. A., Lutsey, P. L., Wang, Y., Lima, J. A., Michos, E. D., & Jacobs, D. R. (2009). Diet soda intake and risk of incident metabolic syndrome and type 2 diabetes in the multi-ethnic study of atherosclerosis (MESA). *Diabetes Care, 32*, 688–694.
- Nielsen, S. J., & Popkin, B. M. (2004). Changes in beverage intake between 1977 and 2001. *American Journal of Preventative Medicine, 27*, 205–210.
- Ogden, C. L., Kit, B. K., Carroll, M. D., & Park, S. (2011). Consumption of sugar drinks in the United States, 2005–2008. *NCHS Data Brief, 71*, 1–5.
- Reas, D. L., Grilo, C. M., & Masheb, R. M. (2006). Reliability of the Eating Disorder Examination-questionnaire in patients with binge eating disorder. *Behaviour, Research & Therapy, 44*, 43–51.
- Scaperotti, J., & De Leon, C. (2009). New Campaign Asks Yonkers if They're 'Pouring on the Pounds'. August 31, 2009. Retrieved June, 2012, from <http://www.nyc.gov/html/doh/html/pr2009/pr057-09.shtml>
- Strum, R., Powell, L. M., Chiqui, J. F., & Chaloupka, F. J. (2010). Soda taxes, soft drink consumption, and children's body mass index. *Health Affairs, 29*(5), 1052–1058.
- Swithers, S. E., & Davidson, T. L. (2008). A role for sweet taste: Calorie predictive relations in energy regulation by rats. *Behavioural Neuroscience, 122*, 161–173.
- Vartanian, L. R., Schwartz, M. B., & Brownell, K. D. (2007). Effects of soft drink consumption on nutrition and health: A systematic review and meta-analysis. *American Journal of Public Health, 97*, 667–675.