doi: 10.1002/osp4.14

SHORT COMMUNICATION

Fast food, soft drink and candy intake is unrelated to body mass index for 95% of American adults

David R. Just, Brian Wansink

Charles H. Dyson School of Applied Economics and Management, Cornell University, Ithaca, NY, USA

Received 25 March 2015; revised 22 July 2015; accepted 4 September 2015

Address for correspondence: B Wansink, Charles H. Dyson School of Applied Economics and Management, Cornell University, 210C Warren Hall, Ithaca, NY 14853, USA. E-mail: : fblsubmissions@cornell.edu

Summary

Objective

Excessive intake of fast food, soft drinks and candy are considered major factors leading to overweight and obesity. This article examines whether the epidemiological relationship between frequency of intake of these foods and body mass index (BMI) is driven by the extreme tails (+/−2 standard deviations). If so, a clinical recommendation to reduce frequency intake may have little relevance to 95% of the population.

Methods

Using 2007–2008 Centers for Disease Control's National Health and Nutrition Examination Survey, the consumption incidence of targeted foods on two non-continuous days was examined across discrete ranges of BMI. Data were analysed in 2011.

Results

After excluding the clinically underweight and morbidly obese, consumption incidence of fast food, soft drinks or candy was not positively correlated with measures of BMI. This was true for sweet snacks ($r = 0.005$, $p = <0.001$) and salty snacks ($r = 0.001$, $p = 0.040$). No significant variation was found between BMI subcategories in weekly consumption frequency of fast food meals.

Conclusions

For 95% of this study's sample, the association between the intake frequency of fast food, soft drinks and candy and BMI was negative. This result suggests that a strategy that focuses solely on these problem foods may be ineffective in reducing weight. Reducing the total calories of food eaten at home and the frequency of snacking may be more successful dieting advice for the majority of individuals.

Keywords: BMI, diet, fast food, food intake, obesity.

Introduction

Overweight patients are often advised to reduce their intake of fast food, soft drinks and candy (1). Part of the reason for the recommendation is that these indulgences are primary contributors to obesity and body mass index (BMI) (2). These foods have also been linked to chronic diseases such as diabetes (3). While this seems reasonable, the epidemiological relationship between the incidence of intake of these indulgent foods and BMI may be driven by the extreme tails (+/−2 standard deviations) (1). As a result, a clinical recommendation to reduce the intake frequency of certain foods may have little relevance to 95% of the population.

Past analyses of 'junk food' intake and BMI may have spuriously capitalized on the extreme tails of the BMI distribution, which are associated with eating disorders (4–6). On one extreme, there are the clinically underweight (BMI < 18.5); on the other extreme, there are those clinically classified as morbidly obese (BMI > 40). The eating habits of both groups are atypically extreme (5). Extreme behaviour at these endpoints could cloud any generalization made for the 95% of the population with more moderate weight problems.

This research examines how consumption frequency of seemingly unhealthy foods relates to the BMI of the 95% of Americans who are neither extremely underweight nor extremely overweight (7). This has direct application for providing efficacious clinical advice that will not be discarded as irrelevant by most people (8).

Methods

A representative sample of the non-institutionalized civilian population of the USA was selected for the 2007–2008 Centers for Disease Control's National Health and Nutrition Examination Survey (9). The National Health and Nutrition Examination Survey consists of approximately 5000 in-person surveys, with a complex multistage probability sample design used to ensure that results are representative of the US population. We restrict our sample to adults, defined as age 18 years or older, who completed two 24-h dietary recall surveys. Participants were given a broad health survey that included general food intake questions. On two separate occasions, participants were administered 24-h dietary recalls. These recalls are administered in face-to-face interviews using a five-step process designed to encourage accurate reporting of all eating episodes and foods consumed as well as where the foods were purchased and consumed. These foods are then coded into narrow categories using the hierarchical US Department of Agriculture Food Coding Scheme.[1] We used location data to classify food as being eaten away from home, or fast food. The US Department of Agriculture Food Codes were used to classify foods by food type (e.g. fruits, vegetables and desserts). Both 24-h dietary recalls are summed within subjects for a non-continuous 2-d consumption profile. Foods analysed were chosen on an *ad hoc* basis to represent foods often targeted by both policy and interventions.

Anthropometric body measurements including height and weight were taken by trained professionals, while participants were wearing identical gowns and slippers. BMI is calculated as weight in kilogrammes divided by height in metres squared. Participants were divided into eight groups for analysis based upon their BMI. Consistent with the World Health Organization classifications (10), those with BMIs less than 18.5 are classified underweight, 18.5 to 24.9 as normal, 25 to 29.9 as overweight, 30 to 39.9 as obese and over 40 as morbidly obese. The morbidly obese were further classified as morbidly obese 1 (BMI of 40 to 44.8) and morbidly obese 2 (BMI above 44.9). These values ensure that each of the eight groups had sufficient observations for analysis while corresponding with commonly used classifications.

Data were analysed in 2011. All analyses were performed using STATA statistical software (version 11.0, StataCorp LP, College Station, TX, USA). A p value < 0.05 was considered statistically significant. We compare average eating episodes within food and across BMI categories. We focus on eating episode rather than amount eaten because the authors believe it is less subject to recall bias (11,12). We do not analyse total quantity of these foods, one limitation of this study. Mean instances of food intake are reported for various food categories, by BMI classifications and sub-classifications in Table 1. Differences in subgroup consumption frequency patterns are tested using standard analysis of variance F-tests for differences between subgroups. This analysis is conducted both with and without those who are clinically underweight (1.8% of the sample) and most morbidly obese (2.5% of the sample) to demonstrate the impact of the extremes on the statistical results. Missing data were omitted from the analysis leaving a sample of $n = 4895$.

Results

After excluding the clinically underweight and most morbidly obese, consumption incidence of indulgent foods was not positively correlated with measures of BMI. With these individuals, there is no significant variation between BMI subcategories in weekly consumption incidence of away-from-home meals or fast food meals. Consumption incidence of away-from-home meals for each BMI subcategory in the restricted set varies little from a mean of 3.5, while the number of fast food meals per week remains close to the mean of 2.1 for all BMI subgroups (Figure 1).

Among indulgent items from 24-h food recalls, no significant variation exists between BMI subcategories in consumption incidence of French fries, full-calorie soft drinks or desserts. There is significant variation among BMI categories for sweet and salty snack consumption, but this variation suggests a negative relationship between snacking and BMI. Those with BMIs in the normal range average 1.3 sweet snacks over 2 d, while the overweight, obese and morbidly obese in the restricted group average 1.2, 1.1 and 1.1 sweet snacks over 2 d, respectively. Likewise, those with normal BMIs consume an average of 1.1 salty snacks over 2 days, while overweight, obese and morbidly obese consume an average 0.9, 1.0 and 0.9 salty snacks, respectively.

Fruit and vegetable consumption incidence varies significantly between BMI subcategories, after excluding the highest and lowest BMI subcategories. With the minor

[1] In addition to dietary recall, participants also completed a Food Frequency Questionnaire via mail. We find similar results using the Food Frequency data, however, consider the dietary recall data to be more accurate.

Table 1 Average instances of consumption in 48 h of various food items, sorted by BMI

	Underweight BMI <18.5	Normal$_1$ BMI 18.5–19.9	Normal$_2$ BMI 20–24.9	Overweight BMI 25–29.9	Obese$_1$ BMI 30–34.9	Obese$_2$ BMI 35–39.9	Morbidly obese$_1$ BMI 40–44.8	Morbidly obese$_2$ BMI 44.9+	*F*-test *p*-value for 95.7%	*F*-test *p*-value
	n = 86	*n* = 143	*n* = 1182	*n* = 1653	*n* = 1022	*n* = 446	*n* = 243	*n* = 120		
Meals eaten away from home (per week)										
All meals eaten outside home	3.8 (5.1)	3.5 (3.8)	3.6 (4.2)	3.6 (4.2)	3.5 (4.0)	3.6 (3.8)	3.2 (4.3)	4.0 (4.1)	0.916	0.332
Fast food meals, mean (SD)	3.2 (3.8)	2.2 (3.1)	2.1 (3.0)	2.1 (3.0)	2.0 (2.6)	2.1 (2.7)	2.0 (3.0)	3.0 (2.9)	0.947	<0.001
Instances of selected unhealthy food consumption (over 2 d)										
French fries, mean (SD)	0.2 (0.4)	0.3 (0.6)	0.2 (0.5)	0.2 (0.5)	0.2 (0.5)	0.2 (0.5)	0.2 (0.5)	0.3 (0.6)	0.734	0.506
Full calorie soft drinks, mean (SD)	1.0 (1.1)	0.6 (0.9)	0.6 (0.9)	0.5 (0.8)	0.6 (0.9)	0.5 (0.9)	0.6 (0.9)	0.6 (0.9)	0.188	<0.001
Desserts, mean (SD)	0.5 (0.7)	0.5 (0.8)	0.6 (0.9)	0.6 (1.0)	0.6 (0.9)	0.5 (0.8)	0.6 (0.9)	0.6 (0.8)	0.587	0.4946
Sweet snacks, mean (SD)	1.4 (1.5)	1.3 (1.4)	1.3 (1.5)	1.2 (1.4)	1.1 (1.2)	1.0 (1.2)	1.1 (1.2)	0.8 (1.1)	<0.001	<0.001
Salty snacks, mean (SD)	1.4 (1.3)	1.1 (1.2)	1.1 (1.2)	0.9 (1.1)	1.0 (1.1)	0.9 (1.0)	0.9 (1.1)	1.0 (1.1)	0.003	<0.001
Instances of fruit and vegetable consumption (over 2 d)										
Fruits, mean (SD)	1.0 (1.6)	1.7 (1.7)	1.7 (2.1)	1.8 (2.0)	1.5 (1.8)	1.3 (1.6)	1.3 (1.7)	1.1 (1.5)	<0.001	<.001
Vegetables, mean (SD)	1.8 (2.2)	3.1 (3.1)	3.0 (2.9)	2.9 (2.8)	2.9 (2.9)	2.8 (2.6)	2.6 (2.9)	2.2 (2.3)	0.029	<0.001

BMI classifications established by the World Health Organization, 1995.
BMI, body mass index; SD, standard deviation.

exception of fruit consumption among those classified as overweight, higher BMI category is associated with less fruit and vegetable intake.

Discussion

To lose weight, patients are commonly told to reduce or eliminate the frequency of their intake of indulgent foods, such as fast food, soft drinks and candy (4). Interestingly, for the majority of patients – including those who are overweight (BMI up to 44.8) – there was no relationship between the frequency they eat of these foods and their BMI in this sample. Indeed, when excluding the two most extreme BMI classifications, the Pearson's correlation coefficient between many of these bedevilled foods and the continuous measure of BMI was mildly negative. This was the case for sweet snacks ($r = 0.005$, $p = < 0.001$) and salty snacks ($r = 0.001$, $p = 0.040$). This is perhaps not too surprising as moderate consumption of foods across all food groups is currently encouraged by the Dietary Guidelines for Americans (13). One alternative explanation is that while frequency does not differ, amount consumed per episode may be higher among those with greater BMI—an explanation that deserves examination in future research.

While advising any person to reduce their frequent intake of indulgent foods is healthy advice, it does not appear to be a guaranteed key to weight loss. This unintuitive result may occur because of compensatory behaviours or other food choices we have not controlled for – weakening and even reversing the relationship one would normally expect. Clinical interventions often include avoiding such foods as part of interventions designed to reduce weight (14). The results in this paper suggest that the frequency of use of problem foods is not a strong indicator of healthy weight or diet and reduction may not be sufficient for weight loss without additional lifestyle changes. Those who fall into particular risk of extremely high or low BMI should perhaps be cautioned to moderate their consumption frequency of these problem foods. Reducing the calories of food eaten at home and the frequency of snacking may be more successful dieting advice for the majority of individuals. Future research should examine other indicators of health (e.g. presence of diabetes) and their relationship to consumption of fast foods, soft drinks and candy. Given the common problem of dietary under-reporting (15), additional work may be needed to confirm that such bias has not obscured some underlying relationship between BMI and consumption of fast foods, soft drinks and candy.

Using generalizations based on statistical extremes can lead to misleading, albeit seemingly reasonable advice to patients. The same may also be said for policy.

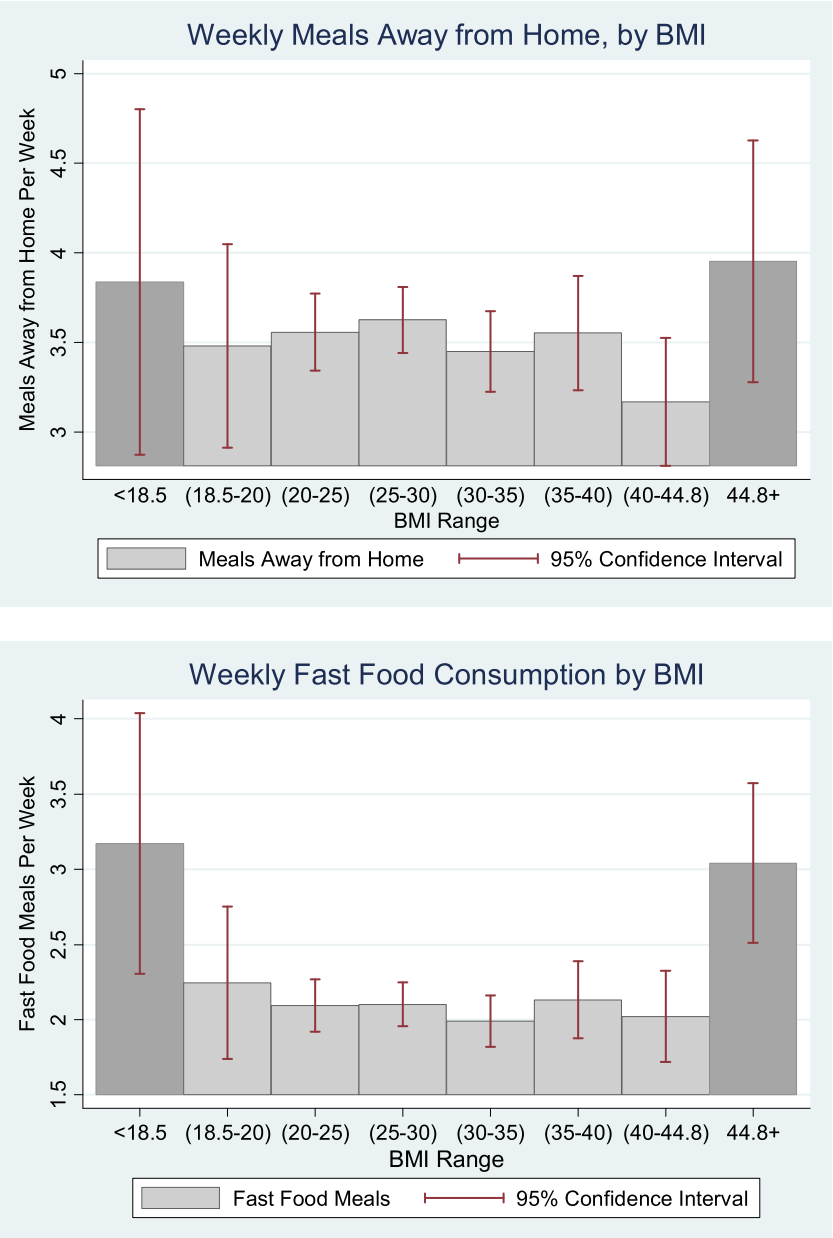

Figure 1 Average weekly meals away from home and fast food meals by BMI category.

Making generalizations and assumptions based on statistical extremes could lead to policy suggestions that may be ultimately irrelevant for the extremes and unrelated to most.

Conflict of Interest Statement

No conflict of interest was declared. Dr. Wansink is a member of McDonald's Global Advisory Council, and he is on the Executive Board for the EAT Initiative for Sustainability.

Acknowledgements

B. W. and D.R.J. conceived of and carried out the study. D.R.J. analysed data. Both authors were involved in writing the paper and approved its submission.

The authors thank Richard Patterson, PhD candidate in the Department of Policy Analysis and Management at Cornell University, for assistance with data analyses. Julia Hastings-Black provided editorial assistance.

Funding

There were no outside sources of funding.

References

1. Nestle M, Jacobson MF. Halting the obesity epidemic: a public health policy approach. *Public Health Rep* 2000 Jan–Feb; **115**(1): 12–24.
2. Dietary Guidelines Advisory Committee. Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010, to the Secretary of Agriculture and the Secretary of Health and Human Services. Agricultural Research Service. **2010**.
3. Gittelsohn J, Wolever TM, Harris SB, Harris-Giraldo R, Hanley AJ, Zinman B. Specific patterns of food consumption and preparation are associated with diabetes and obesity in a Native Canadian community. *J Nutr* 1998 Mar; **128**(3): 541–547.
4. Paeratakul S, Ferdinand DP, Champagne CM, Ryan DH, Bray GA. Fast-food consumption among US adults and children: dietary and nutrient intake profile. *J Am Diet Assoc* 2003; **103**(10): 1332–1338.
5. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA* 2014; **311**(8): 806–814.
6. Hudson JI, Hiripi E, Pope HG, Kessler RC. The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. *Biol Psychiatry* 2007; **61**(3): 348–358.
7. Kant AK, Graubard BI. Eating out in America, 1987–2000: trends and nutritional correlates. *Prev Med* 2004; **38**(2): 243–249.
8. Hill JO, Wyatt HR, Reed GW, Peters JC. Obesity and the environment: where do we go from here? *Science*. 2003 Feb 7; **299**(5608): 853–855.
9. US Department of Health and Human Services. National Health and Nutrition Examination Survey data. 2009.
10. World Health Organization. Physical status: the use of and interpretation of anthropometry. Report of a WHO Expert Consultation. WHO Technical Report Series Number 854. World Health Organization: Geneva, 1995.
11. Bradburn NM, Sudman S, Wansink B. *Asking Questions: The Definitive Guide to Questionnaire Design – For Market Research, Political Polls, and Social and Health Questionnaires*, Jossey-Bass: San Francisco, CA, 2004.
12. Bradburn NM, Stern M, Wansink B, Johnson T. *Asking Questions: The Definitive Guide to Questionnaire and Survey Design*, Jossey-Bass: San Francisco, CA, 2016.
13. US Department of Health Human Services and US Department of Agriculture. Dietary Guidelines for Americans, 2010. 2010.
14. Cade J, O'Connell S. Management of weight problems and obesity: knowledge, attitudes and current practice of general practitioners. *Br J Gen Pract* 1991 Apr; **41**(345): 147–150.
15. Emond JA, Patterson RE, Jardack PM, Arab L. Using doubly labeled water to validate associations between sugar-sweetened beverage intake and body mass among White and African–American adults. *Int J Obes* 2014; **38**(4): 603–609.