Appetite 89 (2015) 215–218

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

An experimental field study of weight salience and food choice ☆

Angela C. Incollingo Rodriguez [a], Laura E. Finch [a], Julia Buss [b], Christine M. Guardino [a], A. Janet Tomiyama [a,*]

[a] Department of Psychology, University of California, Los Angeles, Los Angeles, CA, USA
[b] School of Nursing, University of California, San Francisco, San Francisco, CA, USA

ARTICLE INFO

Article history:
Received 2 December 2014
Received in revised form 6 February 2015
Accepted 9 February 2015
Available online 16 February 2015

Keywords:
Obesity
Eating
Weight salience
Food choice
Field study

ABSTRACT

Laboratory research has found that individuals will consume more calories and make unhealthy food choices when in the presence of an overweight individual, sometimes even regardless of what that individual is eating. This study expanded these laboratory paradigms to the field to examine how weight salience influences eating in the real world. More specifically, we tested the threshold of the effect of weight salience of food choice to see if a more subtle weight cue (e.g., images) would be sufficient to affect food choice. Attendees ($N = 262$) at Obesity Week 2013, a weight-salient environment, viewed slideshows containing an image of an overweight individual, an image of a thin individual, or no image (text only), and then selected from complimentary snacks. Results of ordinal logistic regression analysis showed that participants who viewed the image of the overweight individual had higher odds of selecting the higher calorie snack compared to those who viewed the image of the thin individual (OR = 1.77, 95% CI = [1.04, 3.04]), or no image (OR = 2.42, 95% CI = [1.29, 4.54]). Perceiver BMI category did not moderate the influence of image on food choice, as these results occurred regardless of participant BMI. These findings suggest that in the context of societal weight salience, weight-related cues alone may promote unhealthy eating in the general public.

Published by Elsevier Ltd.

Introduction

Two-thirds of the United States population is now overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014), leading to the coining of the now popular term the "obesity epidemic." Not surprisingly, weight is therefore a salient societal dialogue – for example, over 100 million people in the United States are dieting (Marketdata Enterprises Inc, 2013) – but successfully maintained weight loss is elusive (Tomiyama, Ahlstrom, & Mann, 2013). Could such high societal concern surrounding weight have real-world consequences for eating behavior and food choices?

Several laboratory studies offer evidence of how weight salience may influence eating behaviors. One study, for example, found that diners consumed more calories when their "server" was overweight (McFerran, Dahl, Fitzsimons, & Morales, 2010b). Another laboratory study found evidence of a tendency to calibrate food selection and consumption based on the consumption of those around us, especially when in the presence of heavier individuals (McFerran, Dahl, Fitzsimons, & Morales, 2010a). A similar study found that the mere presence of an overweight fellow diner was sufficient to promote increased consumption and unhealthy food choices among study participants regardless of what the overweight diner actually consumed (Shimizu, Johnson, & Wansink, 2014). Finally, Campbell and Mohr (2011) conducted a series of studies suggesting lower thresholds for such effects, finding that images alone were sufficient to induce an effect.

Our investigation extends these prior laboratory findings to a real-world context. This is an important next step considering that individuals tend to consume fewer calories when they know they are being observed (Robinson, Kersbergen, Brunstrom, & Field, 2014), as is the case in artificial laboratory settings. To create similar weight salience as in laboratory paradigms, we chose the setting of Obesity Week 2013, a joint annual meeting of The Obesity Society and the American Society for Metabolic and Bariatric Surgery. At Obesity Week 2013, doctors, clinicians, researchers, and other obesity experts presented work on obesity research, treatment, and interventions.

In the present study, we examined whether people would make different food choices after viewing an image of an overweight individual versus a thin individual, or after viewing no weight cue at all. We hypothesized that participants would be most likely to choose more food when viewing an image of an overweight individual.

☆ *Acknowledgments:* The authors wish to express their utmost gratitude to The Obesity Society for its unparalleled patience and goodwill in donating space at their conference booth and facilitating the successful execution of this research. They are particularly indebted to Francesca Dea, Executive Director of The Obesity Society, as well as Deborah Bell, Kathie Cleary, Kelly Evans, and Deborah Rice. The authors also wish to thank Mary H. Himmelstein and Lauren C. Callahan for their support in preparing the study materials and their contribution to data collection and processing. *Conflict of interest:* The authors declare no conflict of interest.
* Corresponding author.
E-mail address: tomiyama@psych.ucla.edu (A.J. Tomiyama).

http://dx.doi.org/10.1016/j.appet.2015.02.016
0195-6663/Published by Elsevier Ltd.

Considering previous evidence that weight salience affects high Body Mass Index (BMI) individuals more than low BMI individuals (Major, Eliezer, & Rieck, 2012), we hypothesized that any observed effects would be strongest in overweight and obese participants.

Materials and methods

Stimuli

At The Obesity Society's main membership and information booth in the lobby of the conference center, we displayed a laptop computer running a looping slideshow. In this slideshow, a fictitious "tour guide" named Sarah Brown offered attendees "tips for making the most out of your conference experience." This served as a cover story so that participants would not know they were engaging in a study. There were three different tour guide conditions: *Control*, showing a textbox labeled, "Sarah Brown, Meeting Guide;" *Thin*, showing an image of a thin woman; and *Overweight*, showing an image of an overweight woman. To control for confounds from attractiveness and other non-weight related characteristics, we chose images of the same woman before and after a~150-pound weight loss. Prior independent ratings of these images from research assistants uninvolved in this study revealed that the images were rated as significantly different in body size ($F(1, 13) = 120.69$, $p < .001$) but not in facial expression ($F(1, 13) = 1.42$, $p = .25$).

We placed bowls with 1.69-ounce M&Ms (230 calories/bag) or eight-ounce apple slices (90 calories/bag) in clear bowls on either sides of the laptop. We chose M&Ms as they are very commonly used as a high-calorie, sweet option in eating and food selection studies (for examples, see McFerran et al., 2010b; Wansink, 2004). We chose apples as the low-calorie snack to match the sweetness, portion, and packaging of the M&Ms. A sign between the bowls instructed participants to take only one, but we did not intervene if participants took more than one snack.

Participants

Participants were Obesity Week 2013 attendees who approached the booth and viewed the slideshow for at least 3 seconds before choosing foods (or choosing no foods). We decided upon this interval to maximize the likelihood that participants did in fact see the image on the screen. Those who viewed the slideshow for less than 3 seconds or not at all were excluded from data collection. Individuals who noticed that their behavior was being observed or who were overheard by study staff verbally expressing suspicions that a study was taking place ($n = 4$) were excluded after data collection but prior to analyses.

Procedure

The research team's Institutional Review Board approved all procedures, and The Obesity Society granted permission and provided space for this study. As participants viewed the slideshow, a trained study staff member seated 12 feet away recorded each participant's food choice, BMI, gender, ethnicity, and age-range. A second member of the research team, seated in a waiting area approximately 30 feet away, changed the slideshow image condition every 30 minutes according to a previously-determined counterbalanced schedule and switched the position of the M&M and apple bowls every 90 minutes. This staff person also periodically refilled the food bowls so they were at the same level of fullness at all times. Data were collected between the hours of 0900 and 1800.

Measures

Food choice

Participants' food choices were coded as none, apples, M&Ms, or both. The calorie content of each choice was as follows: none = 0 kcal; apples = 90 kcal; M&Ms = 230 kcal; both = 320 kcal. No participant took more than one package of apples or M&Ms, but 22 participants did take one of each.

Estimated BMI

Trained study staff estimated participant BMI using the BMI-based Silhouette Matching Test (BMI-SMT; Peterson, Ellenberg, & Crossan, 2003), a reliable measure for estimating BMI. This scale consists of four body silhouettes corresponding to each of the four BMI categories (underweight <18.5, normal weight 18.5–24.9, overweight 25.0–29.9, obese 30+) for each gender, which allowed us to simultaneously code for gender. Because very few participants (4.6%) were categorized as obese, we collapsed the overweight and obese categories into one group for analyses.

Ethnicity

Ethnicity was coded as one of the following: White, Black, Asian, Latino/a, or Other.

Age

Age was estimated as one of the following age ranges: 20–29, 30–39, 40–49, 50–59, 60–69, 70+.

Analytic plan

To examine effects of condition, BMI, and the condition × BMI interaction on food choice, we used ordinal logistic regression models. Ordinal logistic regression analysis provides a single odds ratio for the association between a predictor and each combination of lower versus higher calorie food choice (none vs. apple or M&Ms or both, none or apple vs. M&Ms or both, etc.). The reference group was selecting no calories. In other words, the resulting odds ratio represented the likelihood that a participant would select a higher-calorie option over a lower-calorie option. Brant tests did not reveal evidence of violation of the proportional odds assumption (all p-values >.10), indicating that ordinal models were suitable. As snacking varies throughout the day (Cross, Babicz, & Cushman, 1994), and data were collected across mealtimes, we included time of day intervals as a covariate (morning, early afternoon, and late afternoon). Because the image was a young, White female, and age, ethnicity, and gender stereotyping were potential confounds (Burke, Heiland, & Nadler, 2010; Fallon & Rozin, 1985; Gordon, Castro, Sitnikov, & Holm-Denoma, 2010) that might influence image perceptions, we also tested whether these variables related significantly to the outcome. In the event that any did, we included them as covariates; the final covariates included in the model were time of day and gender. Model 1 included BMI, condition, and covariates. Model 2 added the condition × BMI interaction. We used Stata 12 to conduct all analyses.

Results

The final analysis sample included 262 participants (excluding the 4 who expressed suspicion). Food choice occurred at the following frequencies: 85 took nothing, 95 chose apples, 60 chose M&Ms, and 22 chose both (see Table 1).

Gender and time of day were significantly associated with food choice (see Table 1), and we therefore included these covariates in the ordinal logistic regression models (Table 2). Model 1 demonstrated a significant overall effect of condition ($\chi^2(2) = 8.11$, $p = .02$). There was no significant effect of participant BMI ($\chi^2(2) = 1.94$,

Table 1
Condition and participant characteristics by food choice.

	Sample characteristics (N = 262)	Food choice				χ^2	df	p
		None (n = 85)	Apples (n = 95)	M&Ms (n = 60)	Both (n = 22)			
Condition						12.95	6	.04
Control	25.2	34.1	20.0	18.3	31.8			
Thin	43.1	41.2	47.4	48.3	18.2			
Overweight	31.7	24.7	32.6	33.3	50.0			
BMI						4.18	6	.65
Underweight	21.8	23.5	17.9	23.3	27.3			
Normal	46.9	40.0	50.5	51.7	45.5			
Overweight/Obese	31.3	36.5	31.6	25.0	27.3			
Gender						8.67	3	.03
Male	28.2	36.5	17.9	30.0	36.4			
Female	71.8	63.5	82.1	70.0	63.6			
Ethnicity						7.14	12	.84
White	75.7	77.7	70.5	81.7	72.7			
Black	6.0	3.5	7.4	1.7	9.1			
Asian	8.0	7.1	8.4	8.3	9.1			
Latino/a	5.3	3.5	7.4	5.0	4.6			
Other	6.1	8.2	6.3	3.3	4.6			
Age						17.81	12	.12
20–29	14.1	9.4	15.8	18.3	13.6			
30–39	27.1	34.1	27.4	18.3	22.7			
40–49	34.7	29.4	39.0	36.7	31.8			
50–59	19.8	24.7	16.8	16.7	22.7			
60–69	4.2	2.4	1.1	10.1	9.1			
Time of day						18.63	6	.005
Morning	44.7	58.8	40.0	28.3	54.6			
Early afternoon	33.6	25.9	37.9	45.0	13.6			
Late afternoon	21.7	15.3	22.1	26.7	31.8			

Note: All values are given as %.
df = degrees of freedom.

p = .38). Participants in the overweight image condition had 2.42 times the odds of selecting a higher calorie snack than participants in the control condition (odds ratio [OR] = 2.42, 95% CI = [1.29, 4.54]), whereas there was no significant difference between the thin image and control conditions (OR = 1.36, 95% CI = [0.76, 2.43]). To examine differences between the overweight and thin image conditions, we also re-ran this model with the thin image as the reference category. Results indicated that participants who viewed the overweight image were more likely to select a higher calorie snack compared to those who viewed the image of the thin individual (OR = 1.77, 95% CI = [1.04, 3.04]). Model 2 added the condition × BMI interaction, which was not significant ($\chi^2(4) = 4.43$, $p = .35$).

Discussion

In this field study, participants had the greatest odds of selecting a higher-calorie food option when an overweight image was present than when a thin image was present or no image was present at all. We observed this difference regardless of participant BMI category, which suggests that exposing individuals to even subtle

Table 2
Ordinal logistic regression models testing associations of condition, participant BMI, and their interaction with food choice.

Variable	Model 1			Model 2		
	OR	95% CI	p	OR	95% CI	p
Time of day[a]						
Early afternoon	1.88	1.11–3.17	.02	1.80	1.04–3.11	.03
Late afternoon	2.61	1.42–4.80	.002	2.70	1.45–5.00	.002
Female gender	1.16	0.69–1.96	.56	1.13	0.67–1.92	.64
Condition[b]						
Normal weight	1.36	0.76–2.43	.30	1.08	0.26–4.40	.92
Overweight	2.42	1.29–4.54	.006	2.73	0.72–10.29	.14
BMI						
Normal weight	1.31	0.72–2.39	.37	1.80	0.50–6.45	.37
Overweight/Obese	0.93	0.48–1.79	.83	0.48	0.12–1.99	.32
Condition × BMI[c]						
Thin × Normal				0.84	0.16–4.27	.83
Thin × Overweight/Obese				3.00	0.51–17.46	.22
Overweight × Normal				0.53	0.11–2.61	.43
Overweight × Overweight/Obese				1.83	0.32–10.56	.49

Note: OR = Odds ratio; CI = Confidence interval.
[a] Reference category is Morning.
[b] Reference category is Control.
[c] Reference category is Underweight.

overweight cues may lead to increased eating behavior among individuals of all weights.

One possible explanation of our results is that they may have been driven by a priming effect. In this interpretation, the image of an overweight individual may have primed associated constructs such as overconsumption or unhealthy food choices (Puhl, Andreyeva, & Brownell, 2008), leading participants to choose higher calorie options. Previous research shows that subtly priming dieting (via posters, similar to our stimulus) can lead to reduced snack consumption (Papies & Hamstra, 2010). Perhaps, then, the reverse occurred here, which dovetails with laboratory findings (Campbell & Mohr, 2011).

This study is novel as it extends previous studies of weight salience and eating (Major et al., 2012; McFerran et al., 2010a, 2010b; Shimizu et al., 2014) to examine food choices in the real world. We also tested whether subtle weight cues unrelated to eating, rather than live exposure to an overweight individual consuming food, can influence real-world eating. We capitalized on a naturally weight-salient environment and minimized reactivity bias through surreptitiously recording food choice, which eliminated the need for interaction with participants. This is a particular strength of our study as recent research indicates that individuals limit their calorie intake when they know they are being monitored (Robinson et al., 2014). Because attendants may have felt uncomfortable selecting an unhealthy food (e.g., candy) at a conference focused on combatting obesity, our selection of Obesity Week 2013 as the setting is in fact a conservative test of the effect of weight salience on food choice. The fact that our results emerged in a context where choosing M&Ms was likely frowned upon (indeed, the conference staff expressed discomfort at the idea of offering M&Ms at their membership desk) supports the strength of the observed effect.

As with any field study, we faced a lesser degree of scientific control than laboratory studies (i.e. we did not know whether participants actually consumed the food, we could only estimate BMI, and we could not ask the participants if they believed a study had been occurring). The field study design also precluded the kind of careful mechanistic laboratory work done, for example, by Campbell and Mohr (2011). They found that lowered health goal commitments mediated the relationship between exposure to overweight pictures and cookie consumption, and that manipulating the accessibility of health goals and the behavior–stereotype link can attenuate such effects.

Nonetheless, our unobtrusive observation bolsters the ecological validity of our findings. Moreover, our study design contributed to the internal validity of the manipulation as it allowed for us to avoid contamination from demand characteristics and social desirability. We also note that "before-and-after" pictures have their pitfalls, as they were not identical in all respects. However, we attempted to equate the pictures through selecting images that were pre-rated as significantly different in body size but not facial expression.

We believe these findings offer important insight into food choices, and potentially eating behavior, in response to subtle weight cues in a real-world environment. All individuals, even those who are not overweight, might struggle to resist making unhealthy eating choices in the presence of minimal weight cues, even those unrelated to eating. This finding is congruent with evidence that typical normal, overweight, and obese individuals are much more sensitive to environmental eating cues than individuals who are highly successful at calorie restriction (Incollingo Belsky, Epel, & Tomiyama, 2014). Because weight stigma and stereotypes specific to how overweight and obese individuals eat are highly prevalent (Puhl et al., 2008), this obesity-related stigma might in fact induce unhealthy food choices in the general population who might not possess the ability to ignore these external cues. Although overweight and obese individuals are often the targets of blame for the "obesity epidemic" (Crandall & Schiffhauer, 1998), we propose that it may in fact be high social weight salience and its associated negative stereotypes undermining healthy regulation of eating. We suggest that the proper intervention is not to target and blame obese individuals, but to eliminate negative stigma surrounding obesity.

References

Burke, M. A., Heiland, F. W., & Nadler, C. M. (2010). From "overweight" to "about right". Evidence of a generational shift in body weight norms. *Obesity*, *18*(6), 1226–1234. doi:10.1038/oby.2009.369.

Campbell, M. C., & Mohr, G. S. (2011). Seeing is eating. How and when activation of a negative stereotype increases stereotype-conducive behavior. *Journal of Consumer Research*, *38*(3), 431–444. doi:10.1086/659754.

Crandall, C. S., & Schiffhauer, K. L. (1998). Anti-fat prejudice. Beliefs, values, and American culture. *Obesity Research*, *6*(6), 458–460. doi:10.1002/j.1550-8528.1998.tb00378.x.

Cross, A. T., Babicz, D., & Cushman, L. F. (1994). Snacking patterns among 1,800 adults and children. *Journal of the American Dietetic Association*, *94*(12), 1398–1403. doi:10.1016/0002-8223(94)92542-9.

Fallon, A. E., & Rozin, P. (1985). Sex differences in perceptions of desirable body shape. *Journal of Abnormal Psychology*, *94*(1), 102–105.

Gordon, K. H., Castro, Y., Sitnikov, L., & Holm-Denoma, J. M. (2010). Cultural body shape ideals and eating disorder symptoms among White, Latina, and Black college women. *Cultural Diversity & Ethnic Minority Psychology*, *16*(2), 135–143. doi:10.1037/a0018671.

Incollingo Belsky, A. C., Epel, E. S., & Tomiyama, A. J. (2014). Clues to maintaining calorie restriction? Psychosocial profiles of successful long-term restrictors. *Appetite*, *79*, 106–112. doi:10.1016/j.appet.2014.04.006.

Major, B., Eliezer, D., & Rieck, H. (2012). The psychological weight of weight stigma. *Social Psychological and Personality Science*, *3*(6), 651–658. doi:10.1177/1948550611434400.

Marketdata Enterprises Inc. (2013). The U.S. weight loss & diet control market. *Marketdata Enterprises Biennial Report*, *12*, 1–420.

McFerran, B., Dahl, D. W., Fitzsimons, G. J., & Morales, A. C. (2010a). I'll have what she's having. Effects of social influence and body type on the food choices of others. *Journal of Consumer Research*, *36*(6), 915–929. doi:10.1086/644611.

McFerran, B., Dahl, D. W., Fitzsimons, G. J., & Morales, A. C. (2010b). Might an overweight waitress make you eat more? How the body type of others is sufficient to alter our food consumption. *Journal of Consumer Psychology*, *20*(2), 146–151.

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA: The Journal of the American Medical Association*, *311*(8), 806–814. doi:10.1001/jama.2014.732.

Papies, E. K., & Hamstra, P. (2010). Goal priming and eating behavior. Enhancing self-regulation by environmental cues. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, *29*(4), 384–388. doi:10.1037/a0019877.

Peterson, M., Ellenberg, D., & Crossan, S. (2003). Body-image perceptions. Reliability of a BMI-based silhouette matching test. *American Journal of Health Behavior*, *27*(4), 355–363. doi:10.5993/AJHB.27.4.7.

Puhl, R. M., Andreyeva, T., & Brownell, K. D. (2008). Perceptions of weight discrimination. Prevalence and comparison to race and gender discrimination in America. *International Journal of Obesity*, *32*(6), 992–1000. doi:10.1038/ijo.2008.22.

Robinson, E., Kersbergen, I., Brunstrom, J. M., & Field, M. (2014). I'm watching you. Awareness that food consumption is being monitored is a demand characteristic in eating-behaviour experiments. *Appetite*, *83*, 19–25. doi:10.1016/j.appet.2014.07.029.

Shimizu, M., Johnson, K., & Wansink, B. (2014). In good company. The effect of an eating companion's appearance on food intake. *Appetite*, *83C*, 263–268. doi:10.1016/j.appet.2014.09.004.

Tomiyama, A. J., Ahlstrom, B., & Mann, T. (2013). Long-term effects of dieting: Is weight loss related to health? *Social and Personality Psychology Compass*, *7*(12), 861–877. doi:10.1111/spc3.12076.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Review of Nutrition*, *24*, 455–479. doi:10.1146/annurev.nutr.24.012003.132140.