
CASE STUDY

Relationship Between Rate of Eating and Degree of Satiation

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ABSTRACT. Behavioral psychologists have developed effective methods of treatment for overeating and weight control, including mealtime regulation, avoidance of taboo foods, and removal of identified precursors to the bingeing behavior. The current study sought to examine the relationship between speed of eating and levels of satiation in weight conscious individuals. Ten participants were instructed to eat at a fast and a slow rate in a within-subjects reversal design. Consuming food at a slow rate helped participants achieve satiation quicker with comparable amounts of food intake. Slow eaters were also less likely to overeat. These results suggest that slow eating may prevent excessive food consumption in weight conscious individuals, constituting an effective means of weight management.

KEYWORDS. Binge eating, satiation, spaced eating, weight control

Weight control is desirable in promoting physical and mental health and has resulted in extensive study of weight reduction programs (Fairburn, 1995).

The rate of food intake was suggested quite incidentally as a possible method of dietary control in a recent study of bulimia (Azrin, Brooks, Kellen, Ehle, & Vinas, 2007). In that study, 2 of the 6 participants made unsolicited comments during their directed slow eating condition that they felt "full" and could not comfortably finish eating compared to the group that was directed to eat fast. These statements seemed contradictory to the interpretation of previous studies (Azrin, Jamner, & Besalel, 1986, 1987) which found that actual vomiting and the urge to vomit was greater among the rapid versus slowed eating group. These findings seemed explicable because of the increased degree of "fullness" that is associated with the greater stomach loading during rapid eating due to less time for the passage of food from the stomach to the intestine. Slowed eating, conversely, could be expected to result in less stomach loading, and decreased feelings of "fullness."

Correlations have been reported by several studies which have found that obese individuals are more likely to eat rapidly than the nonobese individuals (Otsuka et al., 2006; Sasaki, Katagiri, Tsuji, Shimoda, & Amano, 2003). This information leaves open the question as to which variable is causal: Does obesity cause more rapid eating, does rapid eating cause obesity, or are both variables

the joint resultant of some other influencing factor, such as genetics or another family aspect for which this causal relationship is explained. Following the initial behavioral treatment of Stuart (1967), many behavioral diet programs have suggested a slowed rate of eating, but experimental variations in the rate of eating have not been conducted to confirm how satiation might be influenced by the rate of eating.

The present study attempts to identify experimentally the relationship between the rate of eating and the degree of subjective satiation in a controlled experiment with 10 weight conscious individuals in a within-subjects reversal design that compared the effects of directed slowed versus rapid eating when eating comparable amounts and type of food. The results of this comparison were expected to identify experimentally the role of eating rate in producing satiation, clarify whether stomach loading is a useful construct in predicting the role of eating rate and for practical purposes would suggest an experimentally identified variable that might be included in weight reduction programs.

METHOD

Participants

The participants were 10 women of average weight in a physical fitness program who had expressed concern with their weight. Their mean age was 24.3 years (range = 18–28 years), 7 of whom were single college students; the other 3 participants were married with children. Three of them reported a regular mealtime pattern of three meals per day, while the remaining 7 participants reported irregular patterns in which meals were frequently skipped. No participant reported bingeing or purging behaviors. All participants were within the normal range of weight for their height and frame.

Measures

Meals were eaten during an office session thereby providing direct observation and immediate self-report as well as providing direct experimental control of the eating rate and amount and type of foods in a controlled environment. The meal was divided beforehand

"pizza-style" into 10 equal wedge-like segments, which were eaten sequentially; thereby allowing self-reports to be given after each one tenth of the meal, thus permitting comparison between the fast versus slow eaten meals for comparable amounts of food intake. The principal measure was the participant's self-report of level of satiation. The participants were instructed to rate the point of complete satiation as a "10," defined as the point of total fullness with no desire to continue eating; intermediate degrees of satiation were rated on a continuum from 0-10. They provided these ratings immediately prior to the meal and at the end of each one-tenth segment of the meal. This procedure provided a continuous measured report of the degree of satiation for each one-tenth portion of the meal. The time spent eating each meal was measured from the moment of the first insertion of food into the mouth to the moment when the last morsel being swallowed.

Selection of Foods

The types of food selected and provided by the participants included that which they reported they typically consumed in a meal. Food types included: lasagna, Chinese food, pizza, macaroni and cheese, pastries, meat, pasta, fish, chips, and corn meal. To maintain consistency of the amount and type of food in each of the participant's six meals, all meals within each participant were arranged to be of the same weight and the same type as the first meal. For each participant on each day, the three meals were spaced 5 hours apart.

Experimental Design

Participants were exposed to both a Slow-Fast-Slow and Fast-Slow-Fast counterbalanced sequence of eating rates in a type of within-subjects reversal experimental design to compare the effects of a slowed versus fast rate of food intake. This design avoids some of the problems of a between-subjects statistical design and controls for sequence effects within participants by counterbalancing the order in which the fast versus slowed rates were performed by use of the two sequences for each participant. Each participant was given six meals to eat on two separate days; three meals per day with the Slow-Fast-Slow sequence on one day, and three meals per day with the Fast-Slow-Fast sequence on the other day. Under this schedule,

each participant ate three meals under the slow instructions and three meals under the fast instructions.

Instructions

Each participant was told factually that the procedures were an assessment to determine whether her level of satiation was affected by her manner of eating and that she would select and provide the foods typically eaten in a meal. The instructions were given to her in writing and repeated orally. Under the "fast" eating condition, she was instructed to eat quickly, and specifically to consume large quantities with each mouthful, to chew quickly and told that she need not swallow each mouthful completely before reaching for the next portion. When eating under the "slow" condition, she was instructed to eat slowly, specifically to place only small amounts in her mouth, to chew slowly, to reach for the next portion only after completely swallowing the previous portion, and to roll her tongue slowly around the food to savor the full taste before swallowing.

Reliability

A second observer was present who independently obtained the measures of meal duration and weight, and assured that the instruction and types of foods selected were as intended. The duration of eating recorded by the observer varied less than 30 seconds for all meals across all participants from that of the first recorder. The weight recorded by the observer of the meals varied by no more than 1 ounce.

RESULTS

The mean duration of the 30 meals eaten under the rapid eating instructions was 5.00 minutes (range 2.0-9.0 min, $SD = 2.11$). For the 30 meals eaten under the slow eating instructions, the mean duration was 19.80 minutes (range 8.0-33.0 min, $SD = 8.59$) indicating that the observed speed of eating was in accord with the instructions. There was approximately a four-fold difference between the mean duration of the rapid and slow speed of eating conditions; a paired t test of participants mean scores between the three meals in each

condition revealed this difference was statistically significant, $t(9) = 6.160$, $p < .001$.

The grand mean satiation level reported for all participants across all segments of the meal in both treatment conditions was 5.95 ($SD = 3.02$) for slow eating versus 3.71 ($SD = 2.72$) for fast eating. The data revealed that slow eating produced higher levels of satiation for comparable amounts of food in each participant. A paired t test revealed that this difference was statistically significant, $t(9) = 7.161$, $p < .001$.

Looking at the mean satiation level between the fast versus slow eating condition at the midpoint of the meal (i.e., after 5 wedges of the meal had been consumed), the fast condition had a mean of 6.20 ($SD = 2.74$) while the slow condition yielded a mean of 2.72 ($SD = 1.67$). This data was found to be statistically significant using a paired t test, $t(9) = 7.127$, $p < .001$.

At the end of the meal (i.e., after all 10 wedges of the meal were consumed), rapid eating produced a mean satiation level of 7.73 ($SD = 2.73$) as opposed to slow eating which produced a mean satiation level of 9.13 ($SD = 1.85$). A paired t test revealed that this difference was statistically significant, $t(9) = 3.367$, $p < .01$.

FIGURE 1. Participant's Level of Satiation across Meals. Note. $N = 10$. "Level of Satiation" was self-rated on a 0–10 scale with "10" = total satiation and "0" = no satiation. Each data point is the mean for the three meals eaten by each participant in the designated rate of eating condition.

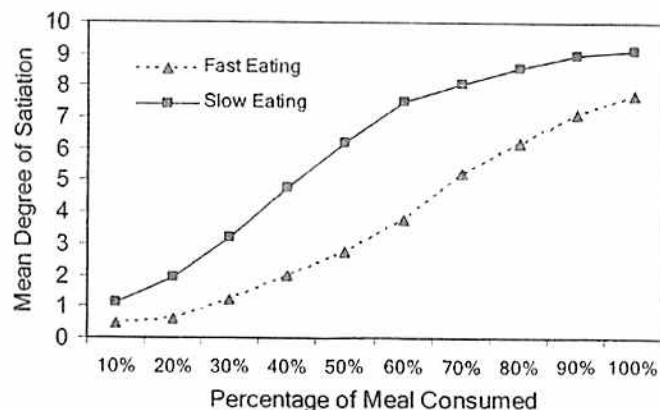


FIGURE 2. Mean Level of Satiation at the Midpoint of the Meal at Slow and Fast Rates of Eating

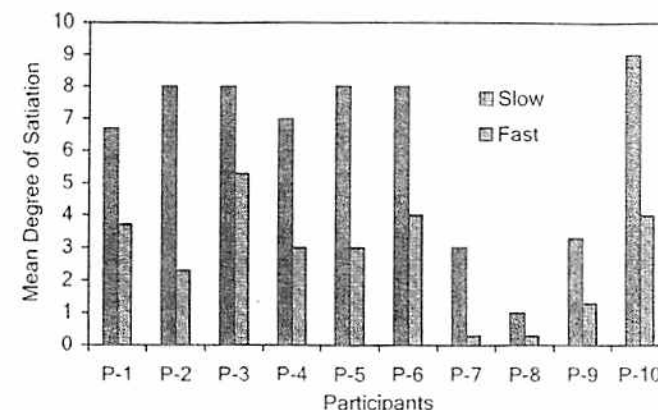


Figure 1 shows the difference in the mean level of satiation at the end of each one tenth segment of the meal for the 10 participants. Each data point represents the average of the three meals eaten at the designated rate of eating for each participant. At the start of the meals, prior to the first bite, the level of satiation was rated as a mean of 0 by all participants. Figure 1 shows that when eating slowly, the level of satiation rose to a mean of 6.2 halfway through the meal as opposed to a mean of 2.7 for the rapid eating condition, more than doubling the degree of satiation for the slow eating rate at that midpoint.

The extent of individual differences between participants can be seen in Figure 2, which shows the mean satiation level at the fast versus slowed rate of eating for each of the 10 participants at the midpoint of the meal. The value of each bar is the average of the three meals eaten for both eating rates. The Figure shows that for each of the 10 participants the degree of satiation was greater during the slowed rate of eating. Analysis of the data at all ten segments of the meal for each participant revealed that the degree of satiation was also higher during the slowed eating for each participant at all intervals.

DISCUSSION

The present results show that for all 10 participants, rapid eating of foods produced lower levels of satiation than did the slowed rate

of eating after eating comparable quantities of food. These results suggest that slowed eating is a possible alternative or supplemental treatment for losing weight in addition to the psychological factors such as stimulus control and response chaining identified by Stuart (1967) on which most subsequent psychological dietary programs have been based.

One noteworthy aspect of the present findings is the unexpected consistency of the relation between satiation and speed of eating. For each of the 10 portions into which the meal was divided across all 10 participants, slowed eating resulted in greater satiation. The magnitude of the effect seemed substantial in that a 2:1 ratio was attained at the midpoint of the meal.

Conceptually, the enhancement of satiation by slowed eating was unexpected. As noted above, previous findings by the present author had found that actual vomiting (Azrin, Jamner, & Besalel, 1986, 1987) and vomiting urge (Azrin et al., 2007) had been decreased by slowed eating. The plausible explanation given for that relation was that vomiting was enhanced by the greater stomach loading incurred by rapid eating which allowed less time for the ingested food to pass out of the stomach into the intestine. If the feeling of satiation is considered to be equivalent to the feeling of stomach fullness, rapid eating, not slowed eating, would be expected to result in a greater feeling of fullness (i.e., satiation).

A second factor that predicts a relation antithetical to that found here is that of flavor or taste. According to Sclafani, Lucas and Ackroff (1996), for example, positive flavor that results from increases in positive taste cause an increase in the volume of food ingested in rats, leading to overeating. Since eating slowly results in greater and more prolonged contact of the food with the taste buds, this flavor enhancement should be expected to result in more food ingested and consequently a greater degree of "fullness" or satiation, not the converse found in the current data.

We offer a possible explanation, alternative to that of "flavor enhancement" or "stomach loading" to explain the unexpected current data, namely Pavlovian conditioning. A Pavlovian view of the satiation process could view the ingested food as the unconditioned stimulus (UCS) and the subjective feeling of satiation "fullness" as the unconditioned response (UCR). The various stimuli and chewing response sensations that precede and accompany ingestion can be viewed as the conditioned stimulus (CS), which, by association with

the UCS of ingested food, results in the conditioned response (CR) of the feeling of satiation "fullness." Slowed eating directly produces a greater degree and duration of these conditioned stimuli and thereby would be expected to produce a greater degree of the CR of satiation "fullness" that could override the opposing influence of flavor enhancement and stomach loading.

Several cautionary considerations exist regarding the possible utility of slowed eating as a means of dietary control. First, the present data are for the subjective urge to cease eating and neither the amount actually eaten, nor the changing of the person's body weight, although the three measures could be presumed to be highly correlated. Secondly, many other factors (e.g., food volume, type of food, flavor, caloric value, stimulus control factors, etc.) are known to affect food intake and the degree of influence of eating rate relative to these other factors is unknown. A third caution is that of the relevant population, since the present study is comprised of participants who were young adult females who stated that they were concerned about their weight, and not a sample from both genders, other age groups or from the general population. Further research should utilize additional participants, including both men and women and measure actual weight loss over the long term.

Although conceptual interpretations of the present findings are complex, the findings do not seem to be entirely unexpected, in that many weight reduction programs recommend slowed eating, as noted above with Stuart's (1967) pioneering study, as well as recent reviews (e.g., Fairburn, 1995). The present study now provides experimental data support for this recommendation.

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BOOK REVIEWS

CLINICAL HANDBOOK OF PSYCHOLOGICAL DISORDERS, Fourth Edition. David H. Barlow (Ed.). New York: Guilford Press, 2008, xiv + 722 pp., \$75.00.

If you are going to buy only one book on psychotherapy this year, the book to buy is this fourth edition of David Barlow's *Clinical Handbook of Psychological Disorders*. As with previous editions of this comprehensive text, each chapter discusses one mental disorder, and almost all chapters are coauthored by leading experts on the chapter's disorder. Most chapters include information on diagnosing the disorder, theoretical models of the disorder, assessment and treatment of the disorder, a review of the outcome research, and a detailed case example. But rather than enumerate all of the excellent features of each chapter, I would prefer to discuss some of the limitations of this book—limitations which can be extended to the field of cognitive-behavior therapy.

The overarching limitation of both the book and the field is the focus on treating disorders, as opposed to a focus on treating patients. The focus on treating disorders creates the following problems:

1. *Problems not associated with any specific disorder are neglected or given short shrift.* Some examples include overcoming low self-esteem, getting patients to do their homework, handling patient cancellations, and establishing a strong therapeutic relationship with difficult patients.
2. *Psychotherapy systems that can be applied to all or many psychological problems are overlooked.* This fourth edition takes a step towards correcting this problem by including the chapter "Emotional Disorders: A Unified Protocol." This chapter by