Cognitive restraint can be offset by distraction, leading to increased meal intake in women

France Bellisle and Anne-Marie Dalix

ABSTRACT

Background: Cognitive restraint, a stable disposition to limit food intake, can be assessed by questionnaires, but there is no quantitative, objective measure of its effect.

Objective: The goal was to provide an objective measure of the intake-limiting effects of cognitive restraint by testing meal intake under conditions intended to minimize or accentuate restraint.

Design: Healthy women (n = 41; aged 35 ± 9 y; body mass index, in kg/m²: 21.3 ± 1.9) participated in once-weekly laboratory lunch tests under 4 conditions: condition 1, subjects ate alone (baseline); condition 2, subjects ate alone while listening to recorded instructions focusing on the sensory characteristics of the foods (attention); condition 3, subjects ate alone while listening to a recorded detective story (distraction); and condition 4, a group of 4 subjects had lunch together. On all occasions, the same foods were presented and ingested ad libitum. The Three-Factor Eating Questionnaire (TFEQ) was filled out after the series of 4 meals was completed.

Results: Meal size was significantly higher in the distraction condition than at baseline (by 301 ± 26 kJ; P < 0.001). The difference in energy intake between the baseline and distraction conditions significantly correlated with factor 1 (cognitive restraint) of the TFEQ (r = 0.51, P < 0.01) and with total score (r = 0.32, P < 0.05) but not with disinhibition or hunger. For each additional point on factor 1, meal size increased by 50 kJ under the distraction condition compared with baseline. The group eating condition induced no increase in meal size.

Conclusion: Cognitive restraint exerts a quantifiable limiting effect on intake at meal times and this effect can be offset by cognitive distraction.

KEY WORDS Dietary restraint, diet, energy intake, body weight, BMI, body mass index, cognitive restraint, cognitive distraction, food intake, women, hunger, questionnaire, TFEQ, Three-Factor Eating Questionnaire, DEBQ, Dutch Eating Behavior Questionnaire

INTRODUCTION

Since Herman and Mack (1) developed the concept of dietary restraint in 1975, much research has been devoted to the presence and the adverse consequences, in certain individuals, of a chronic tendency to limit food intake as a means of controlling body weight (2–9). Dietary restraint is measured by using various scales or questionnaires developed to assess the strength of potential nonphysiologic attitudes affecting food intake. The Dutch Eating Behavior Questionnaire (DEBQ) (2) provides a total score plus scores of different traits: restrained, emotional, and external eating. According to this view, chronic dietary restraint and excessive susceptibility to emotions and external stimulation may induce irrational uncontrollable eating. The Three-Factor Eating Questionnaire (TFEQ), developed by Stunkard and Messick (3), also assesses various dimensions of food intake motivation. The TFEQ establishes a total score by adding the contributions of 3 individual traits: cognitive restraint (factor 1), disinhibition (factor 2), and hunger (factor 3). It is suggested that the TFEQ provides the best assessment of dietary restraint (4).

Early studies reported that “restrained eating” was predictive of “counter-regulatory behavior” when subjects were challenged with an energy-rich preload (5). More recently, it was suggested that only persons with high restraint and high disinhibition showed counter-regulatory responses when challenged with energy-rich foods (6). Obese patients with dietary restraint who exert flexible, rather than rigid, control on intake are at lower risk of developing disturbed eating patterns during a reducing diet (9).

Until now, restraint has remained a psychological variable assessed by self-administered questionnaires. Its actual effect on energy intake, if any, has never been quantified under controlled conditions. In the present study, healthy women participated in several tests of their lunch intake behavior under different conditions intended to minimize or accentuate dietary restraint. Meal intake and TFEQ scores were then analyzed in terms of the power of mental attitudes to affect behavior.

SUBJECTS AND METHODS

Subjects

The subjects were adult women recruited through posted advertisements in the hospital and in nearby department stores. Criteria

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for inclusion in the study were age of 18–60 y, no declared pathology, and not presently under any medical treatment. The women were paid for participating in the study. The present protocol was approved by the Hôtel-Dieu hospital committee on human experiments and agreed with the Helsinki Declaration.

The subjects were told that the study was about the effect of various meal conditions on appreciation of foods. They knew that they would complete questionnaires at the end of the meal series, but the exact nature of the tests (the DEBQ and the TFEQ) was not disclosed. In addition, the subjects were asked about their likes and dislikes for various foods, including the foods to be served in the experimental meals. It was thus ascertained that all subjects knew and liked the test foods.

Protocol

The subjects took part in 4 lunch meals served in the laboratory. The foods served were commercial brands and were bought in a nearby supermarket. The lunch meals were scheduled on the same day of the week for each subject, with ≥1 wk between successive tests to minimize boredom with the test foods. The subjects arrived at the laboratory around noon. They were tested either individually or in groups of 4 subjects. During 2 of the 3 individual test meals, the subjects listened to tape-recorded messages. After each meal, the subjects noted all foods and drinks ingested during the subsequent 24 h (until lunch on the next day) by using validated dietary record booklets (10). The total intake of energy was quantified by using food-composition tables (11). After the series of 4 lunch meals was completed, every subject completed the TFEQ (3), as validated for the French population (12), and the DEBQ (2). Total and factor scores were computed.

Foods

On all 4 meal occasions, the menu was identical. The foods served were 1 kg Hachis Parmentier (casserole of ground beef and potatoes, much like shepherd’s pie; composition per 100 g: 414 kJ, 7.1 g protein, 3.4 g fat, and 9.9 g carbohydrate) and 150 g fruit sherbet (composition per 100 g: 472 kJ, 0.34 g protein, 0.14 g fat, and 27.7 g carbohydrate). Mineral water was available during meals. The subjects were instructed to eat and drink ad libitum. The leftover food was weighed after the end of the meals. Meals lasted ≥30 min but could last as long as the subjects wished.

Test conditions

There were 4 different test conditions. For condition 1, the first meal was ingested ad libitum without any special instructions. This condition served as baseline. For condition 2, the subjects listened to tape-recorded instructions during the meal encouraging them to pay special attention to the sensory qualities of the food. This condition was meant to focus the subject’s attention on the foods, to facilitate awareness of the amount eaten, and perhaps to reinforce restraint. For condition 3, the subjects listened to a tape-recorded detective story during the meal. This condition was meant to distract the subject’s attention and to prevent cognitive monitoring of intake by the subject. For condition 4, a group of 4 subjects were invited to have lunch together. This social situation was meant as another way to distract the subjects from their own behavior during the meal.

The test lunches took place in a quiet room that was equipped with a table, a chair, and a tape recorder. The Hachis Parmentier was served hot and rested on a hot plate during the meal. The sherbets were taken out of the freezer just before being served. Mineral water was served at room temperature. The first meal test for each subject was eaten alone without any instructions, so that baseline intake could be established without contamination by other meal conditions. The other 3 conditions occurred in random order. At the beginning and at the end of each meal, the subjects rated their subjective hunger by using a 9-point category scale. The appreciation of the overall meal palatability was assessed with the same tool.

Recordings

Two types of cassettes were recorded for the study. One type contained instructions encouraging the subjects to pay attention to the sensory characteristics of the foods (eg, focusing on color, temperature, texture, etc). The other type of cassette was designed to induce distraction from the meal. It contained the recording of detective stories without any allusion to food or to eating. The same investigator recorded both types of cassettes. The subjects were informed that questions would be asked after the end of the meal about the content of the recordings, so as to maximize attention. Questions were asked immediately after meal termination (data not shown).

Statistics

The data obtained under the 4 meal conditions were compared by using analyses of variance for one factor (meal condition) and repeated measurements. Significant analyses of variance were followed by post hoc Tukey tests. The Pearson $r$ correlation coefficient was used; results are reported as means ± SDs in the text and tables. Analysis was done with SPSS (version 9.0; SPSS Inc, Chicago).

RESULTS

Characteristics of subjects

The personal characteristics of the 41 women who participated in the study are shown in Table 1. The subjects’ mean age was $35.1 ± 9$ y and their mean body mass index (BMI; in kg/m$^2$) was $21.3 ± 1.9$. Only one woman could be considered obese (BMI = 27); one woman was underweight (BMI = 17).

TFEQ scores

The levels of dietary restraint, disinhibition, and hunger as assessed by TFEQ are shown in Table 1. Total TFEQ scores in the present study correlated neither with age ($r = 0.21$, NS) nor with BMI ($r = 0.18$, NS).

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Characteristics of subjects$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>35 ± 9</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>56.7 ± 6.4</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.63 ± 0.006</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>21.3 ± 1.9</td>
</tr>
<tr>
<td>Three-Factor Eating Questionnaire$^2$</td>
<td></td>
</tr>
<tr>
<td>Total score</td>
<td>20.0 ± 9</td>
</tr>
<tr>
<td>F1: cognitive restraint</td>
<td>8.2 ± 4.5</td>
</tr>
<tr>
<td>F2: disinhibition</td>
<td>7.0 ± 3.8</td>
</tr>
<tr>
<td>F3: hunger</td>
<td>4.8 ± 3.2</td>
</tr>
</tbody>
</table>

$^1$ x ± SD; $n = 41$.

$^2$By Stunkard and Messick (3), as validated for the French population (12).
Energy intake, hunger, and palatability ratings in 41 women

<table>
<thead>
<tr>
<th>Lunch meal condition</th>
<th>Intake (kJ)</th>
<th>Hunger ratings</th>
<th>Palatability ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Distraction</td>
<td>Attention</td>
</tr>
<tr>
<td>Lunch (kJ)</td>
<td>1998 ± 92a</td>
<td>2299 ± 92b</td>
<td>2052 ± 109b</td>
</tr>
<tr>
<td>24-h (kJ)</td>
<td>7746 ± 389</td>
<td>7771 ± 431</td>
<td>7511 ± 418</td>
</tr>
<tr>
<td>Hunger ratings</td>
<td>Before lunch</td>
<td>5.8 ± 0.3</td>
<td>6.2 ± 0.2</td>
</tr>
<tr>
<td></td>
<td>After lunch</td>
<td>1.8 ± 0.2</td>
<td>1.3 ± 0.1</td>
</tr>
<tr>
<td>Palatability ratings</td>
<td>After lunch</td>
<td>6.2 ± 0.2a</td>
<td>6.6 ± 0.2a</td>
</tr>
</tbody>
</table>

* x ± SD, n = 41. Means within a row with different superscript letters are significantly different.

Mealt ime variables

Energy intake under each test condition is presented in Table 2. Intake at lunch was significantly different between the distraction condition and baseline: the subjects ate more when distracted by listening to a detective story (mean difference from baseline: 301 ± 26 kJ). Other comparisons were not significant. Cumulative intake over 24 h, starting with the laboratory lunch, was not significantly different according to lunch conditions. The 301-kJ difference observed at lunch between the distraction and the baseline conditions was no longer apparent in the 24-h intake.

Hunger ratings were not significantly different under the 4 conditions, either before or after lunch. Palatability ratings, however, were different according to meal conditions. The group meal was significantly different from the other 3 lunch conditions. The 301-kJ difference in energy intake between the distraction and the baseline conditions was no longer apparent in the 24-h intake.

Palatability ratings were not significantly different under the 4 conditions, either before or after lunch. Palatability ratings, however, were different according to meal conditions. The group meal was rated higher in palatability than baseline meals eaten alone.

The difference in energy intake between the distraction condition and baseline correlated positively with the total TFEQ score (r = 0.51, P < 0.01). The correlation was better still with the factor 1 score (cognitive restraint: r = 0.51, P < 0.01). The other 2 factors did not correlate with the difference in intake between the distraction and baseline conditions (disinhibition: r = 0.17, NS; hunger: r = 0.11, NS). The amplitude of this difference correlated neither with age (r = 0.21, NS) nor with BMI (r = 0.26, NS).

The correlation between factor 1 (cognitive restraint) and the difference in energy intake between the distraction and baseline conditions is displayed in Figure 1. The regression line corresponds to the equation

\[ y = 50x - 119 \]  

which shows an increase of 50 kJ in energy intake at lunch under the distraction condition for each additional point on factor 1. Factors 2 and 3 of the TFEQ had no such relation with the experimental conditions of the present study.

DEBQ scores

All subjects completed the DEBQ as well as the TFEQ. The intake responses as measured under the present experimental conditions showed no significant variation as a function of either the total DEBQ score or individual trait scores.

DISCUSSION

The present study of 41 healthy women established that spontaneous intake at a standardized lunch meal ingested under controlled laboratory conditions differed according to the experimental manipulation of the subjects’ attention. Intake was highest in this group of women when the subjects’ attention was distracted from the meal conditions by listening to a detective story. Moreover, the increase in intake in this condition over baseline was positively correlated with the score of dietary restraint, as assessed by the TFEQ (3). This observation shows that cognitive restraint can be offset by appropriate stimuli. The other 2 factors of the TFEQ (disinhibition and hunger) were not associated significantly with the meal variables.

The increased intake in the distraction condition and the correlation of factor 1 (cognitive restraint) with the amplitude of the effect constitute a behavioral, objective quantification of a motivational set, which had until now been assessed only by psychometric means. Behavioral tests of disinhibition (factor 2) were reported in previous studies (5–8). In addition, previously published works proposed equations to quantify motivational variables affecting food intake. Kissileff et al (13) showed that stimulatory and inhibitory factors determine meal eating and that these factors can be described by a quadratic equation. In free-living American subjects, de Castro et al (14) established that the amount of food ingested during a meal is a power function of the number of persons present at the meal. Such equations are helpful to understand, explain, and perhaps predict the interaction of crucial influences that determine food intake in humans. In the present study, it is obvious that the equation proposed as a result of the experimental observations is valid only in the context of this study. More studies should establish different equations for other types of populations, other types of foods, or other testing conditions.
The nature of the effective distracting stimulus is an open question. In the present study, the subjects were listening to a recorded detective story during the meal. Other stimuli could certainly play the same role and could offset cognitive restraint. The social stimulation caused by eating in a group could be a source of distraction from dietary restraint. In the present study, however, no significant increase in intake was found under the group eating condition. It must be recognized that the present protocol did not create the optimal conditions for social facilitation of eating, which is obtained when subjects eat in the company of family or friends (15). In the present study, the women subjects did not know one another before the group meal. Even though some social facilitation effect was evidenced by the fact that this meal (which included the very same foods as the other meals) was rated most palatable, this effect was not sufficient to influence energy intake. In free-living conditions, several stimuli could act as distractors at meal times: reading, conversation, talking on the telephone, listening to the radio or music, television viewing, and so forth. Several studies suggest that television viewing is associated with higher daily energy intake (16, 17), although the mechanisms responsible for this association are not entirely clear. The effect of potential distractors on energy intake, especially in people who exert restraint, should be investigated more thoroughly.

In this experiment, the phase of the menstrual cycle was not controlled. Five subjects were taking oral contraceptives, 2 were receiving postmenopausal hormone replacement therapy, and the other 34 subjects were supposedly experiencing normal ovulatory cycles. It is reported that food intake is increased during the luteal phase of the ovulatory cycle (18). The results reported here, however, are unlikely to have been influenced by such an effect because the luteal phase in the 34 women with ovulatory cycles was equally likely to happen on each of the 4 test conditions. No systematic bias was thus created. If stimulation of eating did occur in some women because of the menstrual phase, then this effect was randomly distributed over the 4 conditions; it would thus more likely blur the experimental effect rather than enhance it.

In the present group of adult women, all but 2 were normal weight (one was underweight and one was obese). The women’s BMIs were comparable to reference values for adult women in France (19); that is, their BMIs were rather low compared with reference values in other developed countries. Apparently, these women did not have to diet to maintain an acceptable body weight. Their scores on the TFEQ, however, revealed the presence of dietary restraint. In certain individual subjects, the scores were relatively high, independently of BMI. Perhaps these women would be heavier without their habitual dietary restraint attitude. Some of them could perhaps become overweight or obese. It is impossible to evaluate what effect habitual restraint exerts on body weight control in these women, but the results of the lunch tests suggest that dietary restraint limits intake when it is allowed to act. When restraint is offset by distractive stimuli, intake is higher. If maintained on the long term, such an effect could affect body weight.

If persons with chronic restraint successfully limit their intake, some form of dietary restraint might be helpful in present-day societies in which food stimuli are available without time or amount limits. The beneficial influence of dietary restraint should be explored.

In conclusion, cognitive restraint exerts a limiting influence on food intake that can be offset by distracting stimuli. At least in the short term, distracted subjects ingest more energy. Long-term effects of restraint and distraction and their potential consequences on body weight control remain to be investigated.

REFERENCES
14. de Castro JM, Brewer EM. The amount eaten in meals by humans is a power function of the number of people present. Physiol Behav 1991;51:121–5.