



Research report

Which comes first in food–mood relationships, foods or moods? ☆

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ABSTRACT

College students ($n = 44$) completed seven-day records of foods and moods. Nutritionist™ software measured daily nutrition scores including calories, carbohydrates, saturated fat, and sodium. Hierarchical stepwise multiple regression (controlling for gender, restrained eating) revealed that nutrition scores were more consistently associated with negative moods than positive moods, and with moods across a two-day span rather than a one-day span as typically studied in past research. The more calories, saturated fat, and sodium consumed by the students, the more negative mood they reported 2 days later. Results suggest that foods come first in the temporal sequence of food–mood relationships.

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Introduction

Despite widely-known recommendations from the Centers for Disease Control and Prevention (CDC, 2000) that Americans can enhance their health and weight management by limiting consumption of calories, carbohydrates, saturated fat, and sodium, many individuals report being “emotional eaters” who stray from these recommendations during times of intense moods. Research with retrospective questionnaires has supported this relationship between foods and moods with correlations between negative affect and increased consumption of “comfort foods” high in calories, carbohydrates, saturated fat, and sodium (Liu et al., 2007; Oliver & Wardle, 1999). However, the relationship between foods and moods is potentially bidirectional (Christensen & Brooks, 2006) and physiological studies with rats have documented that stress can activate the hypothalamic–pituitary–adrenal (HPA) stress pathway with the release of hormones (glucocorticoids), which increases consumption of “comfort foods,” which in turn dampens activation of the HPA system (Dallman, Pecoraro, & la Fleur, 2005).

Experimental research with humans has also examined moods-to-foods and foods-to-moods causal directions within a one-day span. For example, studies that examine the moods-to-foods sequence typically evoke negative moods in study participants and then observe their food choices immediately after, with some studies finding (especially in dieting women) that negative moods are followed by more selection of high-calorie, high-carbohydrate, and high-fat foods (Christensen & Brooks, 2006; van Strien, Frijters,

Bergers, & Defares, 1986; Zellner et al., 2006). Studies that examine the foods-to-moods sequence have found inconsistent results suggesting that consumption of high-carbohydrate and high-fat foods produces improved moods, but only for a few minutes (Macht & Mueller, 2007).

Because more than 1 day may be needed for complete absorption and distribution of nutrients from foods, significant foods-to-moods relationships may have been missed by past research that considers only time spans of 1 day or less after food consumption. Also, because accumulated negative moods across more than 1 day may be required for “restrained eaters” to reach a threshold for “disinhibition” in which they show increased consumption of “comfort foods,” significant moods-to-foods relationships may have been missed with a focus only on time spans of 1 day or less before food consumption. Very little research has used the approach of longitudinal records of naturally-occurring foods and moods across many days to examine their associations (Bowen & Brunberg, 1990; Tomiyama, Mann, & Comer, 2009), no available study compares both temporal sequences of moods-to-foods and foods-to-moods to determine which pattern provides a better fit for naturally-occurring events in the lives of adults, and no study considers food–mood relationships across both one-day and two-day spans.

Theories to explain food–mood relationships

Mood regulation theories (Heatherton & Baumeister, 1991; Kopp, 1989; McManus & Waller, 1995; Polivy & Herman, 1985; Stice, 2001; Waller, 2000) and self-medication theories (Leibluft, Fiero, Bartko, Moul, & Rosenthal, 1993) are most often used to explain the associations found between moods and foods, with the suggestion that people learn that when they experience unpleasant negative moods, consumption of high-fat and high-carbohydrate

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foods will make them feel better, even if only for a few minutes (Macht & Mueller, 2007). One interpretation of the physiological mechanism behind this temporary mood improvement is that carbohydrates increase availability of serotonin (Markus et al. 1998), but other researchers doubt this explanation because of the delay needed for absorption and because consumption of protein in addition to the carbohydrates can block the synthesis of serotonin (Christensen & Brooks, 2006). Another interpretation of the physiological mechanism behind the immediate and temporary mood improvement after fat and carbohydrate consumption is release of endogenous opioids (Drewnoswki, Krahn, Demitrack, Nairn, & Gosnell, 1992) due to the palatability and perceived pleasure of eating these foods (Macht & Mueller, 2007).

Gender differences are often found in food–mood relationships, with women being more likely than men to increase consumption of high-fat foods when experiencing negative moods (Christensen & Brooks, 2006). The most common interpretation of these results is that women are more preoccupied with body weight and practise “restrained eating” patterns in which they eat more high-fat foods than they would like, so that their “disinhibition” when experiencing negative moods tends to be displayed as increased consumption of these foods (Polivy & Herman, 1985; van Strien et al., 1986). Other gender differences found in food consumption and food–mood associations are that women crave carbohydrates more than men (Christensen & Pettijohn, 2001), men consume more calories than women (De Castro, 1987), and men choose more high-fat, high-carbohydrate, and high-calorie foods when experiencing positive or neutral moods, rather than when experiencing negative moods as shown in women (Christensen & Brooks, 2006; De Castro, 1987; Zellner, Saito, & Gonzalez, 2007).

Purpose of the present study

To add to our understanding of the temporal sequence of food–mood associations found for naturally-occurring events in the lives of adults, the purpose of the present study was to provide the first known longitudinal study of foods and moods recorded across 7 days. One advantage of seven-day records was that they allowed the first available evaluation of food–mood associations across multiple one-day and two-day spans to determine where the most consistent patterns appeared. Seven-day records also allowed the first available direct comparison of whether relationships between foods and moods were best explained by the temporal sequence of foods-to-moods or moods-to-foods. Another new feature of the present study was its direct comparison of positive moods and negative moods for their associations with food choices. Because restrained eating patterns and female gender have been found to influence food–mood associations, the present study examined the above temporal associations of foods and moods with these two variables statistically controlled.

Methods

Participants

Study participants were recruited in 12 undergraduate university classrooms from a number of disciplines, with 212 (92.6%) of the 229 students completing an initial in-class anonymous questionnaire (91 men, 121 women; mean age = 22.0 years, SD = 6.7; 87.5% Caucasian, 8.2% African-American). Participants were also given a small booklet and asked to complete an anonymous seven-day record of foods and moods, with 64 (30.2%) of the 212 students returning booklets 1 week later (16 men, 48 women; mean age = 24.0 years, SD = 8.7; 93.5% Caucasian, 6.5% African-American). Of the 64 students who returned booklets, 36 completed all

7 days of food and mood information and eight completed all food information, but missed 1 day of mood information (with the missing day's mood score replaced by the mean of the remaining 6 days). Scores for these 44 (68.8%) students were used in analyses of the present study (11 men, 33 women; mean age = 24.4 years, SD = 7.8; 95.2% Caucasian, 4.8% African-American).

Procedures

The initial in-class questionnaire asked students for demographic information including gender, age, ethnicity, height in inches, and weight in pounds (used to calculate the student's body mass index, BMI, as pounds/inches² × 704.5). The questionnaire also included a measure of the student's restrained eating patterns. Participants were asked to seal their completed questionnaires in a provided envelope and drop them in a covered box. They were also asked to use a four-digit code of their choice on both their completed questionnaires and the food–mood booklets they took away with them to keep them anonymous yet matched for later data analysis.

To guide participants to complete accurate records of their food consumption, a Registered Dietician gave them a five-minute class presentation on estimating food amounts, using sample plastic foods. The food–mood booklet also included illustrations of foods amounts. Participants were encouraged to carry the small booklets with them to record food consumption immediately after it occurred, to record daily moods at the same time at the end of each day, and if they forgot to record foods or moods on a particular day, to place a large “X” through that day's record. (Because the classes sampled were visited on all possible weekdays, participants began their seven-day records throughout the week, not just on Mondays.) Then, 1 week later, students could return their booklets in closed drop boxes brought to their classes, when they would receive a small “thank you” gift (a Penn State pen or keychain), regardless of how many days they had completed in the booklets. They also were given the option to ask for a written diet assessment that would be prepared for them by a Registered Dietician from 7 days of food records, sealed in an envelope, identified by the four-digit code number, and posted outside the researcher's office.

Measures

Restrained eating was measured in the questionnaire with the 10-item Restricted Eating subscale of the Dutch Eating Behaviour Questionnaire (DEBQ, van Strien et al., 1986) using a five-point rating for each item (1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always), with the mean rating used as score. Daily positive and negative moods were measured in the food–mood booklet with the 10-item subscales from the Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988) using a five-point rating for each item (as above), with mean ratings used as scores.

From the food–mood booklet, daily records of foods and beverages were analysed for their nutritional content by two Registered Dieticians and two advanced nutrition students using Nutritionist™ software to produce four nutrition scores each day: total calories, carbohydrate percentage of calories, grams saturated fat, and milligrams of sodium. Inter-coder reliability for each nutrition score was examined by having the four coders independently use the Nutritionist computer software to obtain the nutrition score for four sample 24-h food records (from two college men and two college women), calculating coder-pair agreements for each sample as the smaller score divided by the larger score, calculating mean coder-pair agreements across all four samples, then calculating the mean agreement score across all coder-pairs. The mean inter-coder reliability was found to be 87% for calories, 92% for carbohydrate percentage, 85% for saturated fat, and 83% for sodium.

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