

**Citation:**

Gilhooly CH, Das SK, Golden JK, McCrory MA, Dallal GE, Saltzman E, Kramer FM, Roberts SB. Food cravings and energy regulation: the characteristics of craved foods and their relationship with eating behaviors and weight change during 6 months of dietary energy restriction. *Int J Obes* (Lond). 2007 Dec;31(12):1849-58.

**PubMed ID:** [17593902](#)

**Study Design:**

Randomized trial

**Class:**

A - [Click here](#) for explanation of classification scheme.

**Research Design and Implementation Rating:**

POSITIVE: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

This study was conducted to identify changes in reported food cravings during a 6 month period of energy restriction leading to weight loss.

**Inclusion Criteria:**

Subjects were overweight (BMI 25-30), healthy women, who were part of the CALERIE trial (a 12 month study of energy restriction) at Tufts University.

**Exclusion Criteria:**

Subjects had to be free of diseases that might influence outcomes (eg diabetes, cancer, coronary heart diseases, etc) and could not be using medications that influenced energy intake or metabolism. Ineligibility criteria also included high dietary restraint score measured by Eating Inventory, very high activity levels, inability to complete a plausible dietary record, reported weight gain or loss of >6.8 kg in the previous year, and anticipated lifestyle changes over the following year such as pregnancy or moving out of state.

**Description of Study Protocol:**

**Recruitment** Subjects were recruited as part of the Comprehensive Assessment of Long-term Effects of Reducing Intake of Energy (CALERIE) study, a one-year pilot study at Tufts Jean Mayer USDA Human Nutrition Research Center on Aging. Subjects gave written, informed consent, and were provided a stipend.

**Design** Baseline energy requirements were determined as total energy expenditure using the doubly labeled water (DLW) technique during a 7-week weight-stable baseline period. Subjects

were then randomized into two diets: either a high glycemic (HG) load or low glycemic (LG) load diet.

**Blinding used (if applicable)** NA

**Intervention (if applicable)** A high glycemic (HG) load or low glycemic (LG) load diet and either a 10% (N=7) or 30% (N=25) energy restriction (ER). The HG diet provided 60% CHO, 20% protein, and 20% fat, mean glycemic index (GI) of 86. The LG diet provided 40% CHO, 30% protein, and 30% fat, with a glycemic index of 53. All foods and beverages were provided during the 24-week food-provided phase.

**Statistical Analysis** Paired *t*-tests were used to compare changes within subjects over the 6 months. Independent *t*-tests and analysis of variance were used to assess any difference between the randomized groups (diet composition and ER level). Linear regression and Pearson correlation coefficients were calculated to assess the relationship between food cravings and factors of eating behavior and BMI. Predictors of weight loss were assessed with multiple regression.

**Data Collection Summary:**

**Timing of Measurements** Baseline measurements were made and energy requirements were determined during a 7-week weight-stable baseline period. Subjects were then randomized into a diet group and provided with appropriate foods for 24 weeks. Outcome measures were then taken.

**Dependent Variables**

- Weight was measured using standard procedures
- Food cravings measured by the Craving Questionnaire and an analog scale to assess the frequency and strength of food cravings

**Independent Variables**

- Eating Inventory to measure dietary restraint, disinhibition, and susceptibility to hunger
- LG or HG diet
- 10% or 30% ER diet

**Control Variables**

**Description of Actual Data Sample:**

**Initial N:** 34 women

**Attrition (final N):** 32 women (2 dropped out with no explanation)

**Age:** 20-42 years

**Ethnicity:** not described

**Other relevant demographics:**

**Anthropometrics**

**Location:** Tufts University, Boston

## Summary of Results:

### Key Findings:

- There were statistically significant decreases in weight and BMI after six months of ER ( $76.3 \pm 7.8$  vs  $69.6 \pm 7.7$ ;  $P < 0.001$ ), but there was no significant difference in weight loss between the 10% and 30% ER groups, nor significant differences due to diet composition.
- 29 women at baseline and 30 women after six months of ER reported that they experienced food cravings over the past three months. Food records indicated that they consumed craved foods more frequently than they reported on the food craving battery. There was a significant decrease in reported percent of time volunteers gave in to cravings after six months of ER ( $64.4 \pm 23.5$  vs  $26.5 \pm 23.4$ ,  $P < 0.001$ .)
- There was a statistically significant association between the reported portion of craved food consumed at baseline and adult lifetime high BMI ( $P = 0.005$ ). However, frequency and strength of cravings were not significantly related to lifetime high BMI.
- Multiple regression showed that the mean calories of craved food consumed per portion was a statistically significant predictor of adult lifetime BMI ( $P = 0.03$ ).
- Foods reported as the strongest craved foods at baseline were more than two times as high in energy density as the habitual diet (without beverages) and on average were about 50% lower in protein, 30% lower in fiber and 30% higher in fat than the habitual diet. Chocolate was the most commonly reported strongest craved food, followed by salty snacks.
- Hunger susceptibility was positively associated with both a craving frequency score ( $P = 0.01$ ) and calories of craved food per portion consumed ( $P = 0.004$ ) at baseline. This association persisted after six months of ER. Craving strength and percent time that subjects gave in to cravings were significantly associated with hunger score ( $P = 0.01$ ) at baseline and at month six.
- Controlling for baseline BMI and age, the reported percentage of time a subject gave in to cravings during the previous three months and the energy density of craved foods were both significant predictors of percent weight loss. Subjects with a higher percentage of weight loss craved foods with higher energy densities compared to those who lost a lower percentage of weight, but they also gave in to their food cravings less frequently.

### Author Conclusion:

Cravings for energy-dense foods are common, have origins in the expression of hunger susceptibility, and do not decrease in frequency during a six month ER regimen. Lifetime high BMI was predicted by larger self-reported portion sizes of craved foods, while weight loss success was predicted by reduced frequency of giving in to the desire to eat craved foods.

### Reviewer Comments:

*This study received a neutral quality evaluation due to the small N and no description of subject recruitment.*

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### Research Design and Implementation Criteria Checklist: Primary Research

## Relevance Questions

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|----|---|-----|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | Yes |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?   | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?  | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies)  | Yes |

## Validity Questions

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|------|---|-----|
| 1.   | <b>Was the research question clearly stated?</b>  | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?   | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated?  | Yes |
| 1.3. | Were the target population and setting specified?   | Yes |
| 2.   | <b>Was the selection of study subjects/patients free from bias?</b>   | Yes |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups?  | Yes |
| 2.3. | Were health, demographics, and other characteristics of subjects described?   | Yes |
| 2.4. | Were the subjects/patients a representative sample of the relevant population?  | No  |
| 3.   | <b>Were study groups comparable?</b>  | Yes |
| 3.1. | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)   | Yes |
| 3.2. | Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?  | Yes |
| 3.3. | Were concurrent controls used? (Concurrent preferred over historical controls.)   | Yes |

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
<b>4.</b>	<b>Was method of handling withdrawals described?</b>	<b>Yes</b>
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
<b>5.</b>	<b>Was blinding used to prevent introduction of bias?</b>	<b>N/A</b>
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
<b>6.</b>	<b>Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?</b>	<b>Yes</b>
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	Yes
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
<b>7.</b>	<b>Were outcomes clearly defined and the measurements valid and reliable?</b>	<b>Yes</b>
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
<b>8.</b>	<b>Was the statistical analysis appropriate for the study design and type of outcome indicators?</b>	<b>Yes</b>
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
<b>9.</b>	<b>Are conclusions supported by results with biases and limitations taken into consideration?</b>	<b>Yes</b>
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
<b>10.</b>	<b>Is bias due to study's funding or sponsorship unlikely?</b>	<b>Yes</b>
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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