

**Citation:**

Bertuccio P, Praud D, Chatenoud L, Lucenteforte E, Bosetti C, Pelucchi C, Rossi M, Negri E, La Vecchia C. Dietary glycemic load and gastric cancer risk in Italy. *Br J Cancer*. 2009 Feb 10;100(3):558-61.

**PubMed ID:** [19190635](#)

**Study Design:**

Case-Control Study

**Class:**

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

**Research Design and Implementation Rating:**

**POSITIVE:** See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

The researchers extracted data from an Italian case-control study to assess the relationship between glycemic load, glycemic index, and gastric cancer.

**Inclusion Criteria:**

Patients who had histologically confirmed gastric cancer between 1997 and 2007 and frequency matched controls who had acute non-neoplastic conditions and were all admitted to the same hospitals.

**Exclusion Criteria:**

Excluded were control subjects who were admitted with medical conditions that may require dietary changes (diabetes mellitus, cardiovascular disease, etc.).

**Description of Study Protocol:**

**Recruitment** - Study conducted between 1997 and 2007. Participants obtained from admissions to major teaching and general hospitals in the greater Milan area of Italy.

**Design** Case-control study

**Blinding used (if applicable):** not applicable

**Intervention (if applicable):** not applicable

**Statistical Analysis**

- Odds ratios and corresponding 95% confidence intervals for quintiles of glycemic index and glycemic load were estimated with conditional multiple logistic regression models, conditioned on age and gender.
- Conditional logistic regression models were used, including terms for major recognized gastric cancer risk factors and non-carbohydrate energy intake.

## Data Collection Summary:

### Timing of Measurements

- For both cases and controls, data were collected during their hospital stay by trained interviewers using a structured questionnaire covering socio-demographic characteristics, anthropometric measures, selected lifestyle habits, including tobacco and alcohol consumption, personal medical and family history of cancer.

### Dependent Variables

- Gastric cancer

### Independent Variables

- Glycemic index and glycemic load
  - Researchers assessed subjects' usual diet from the two years prior to hospital admission and/or diagnosis using a valid and reproducible food frequency questionnaire.
  - Glycemic index values were assigned to each food item using international tables.
  - Daily average glycemic index was calculated by adding the products of carbohydrate content per serving for each food or group, multiplied by the average number of servings of that food per week, multiplied by its glycemic index, all divided by the total available carbohydrates.
  - The daily average glycemic load was computed as glycemic index, but without dividing by the total carbohydrates.

### Control Variables

- Age
- Sex
- Period of interview
- Education
- BMI
- Tobacco smoking
- Intake of fruits and vegetables
- Family history of stomach cancer
- Non-carbohydrate energy intake

## Description of Actual Data Sample:

**Initial N:** 787 (429 males, 348 females) includes 230 in the study group (143 males, 87 females) and 547 in the control group (286 males, 261 women)

**Attrition (final N):** 787 (429 males, 348 females)

**Age:** study group and control group both had a median age of 63 years, range 22 - 80 years

**Ethnicity and demographics:** Not described here but may have been presented in the original article

**Anthropometrics:** In the control subjects, 20% admitted for trauma, 23% for orthopedic conditions, 22% for acute surgery, and 35% for other conditions. Less than 5% of all individuals declined to be interviewed.

Cases were matched by age and sex (ratio of 2:1 for men and 3:1 for women).

**Location:** Greater Milan area, Italy

## Summary of Results:

### Findings

The odds ratios in the highest quintile compared with the lowest quintile were 1.9 (95% CI: 1.0 - 3.3) for glycemic index and 2.5 (95% CI: 1.3 - 4.9) for glycemic load.

### Glycemic index

- The odds ratios for the highest quintile vs lowest quintile was 2.1 (95% CI: 1.2 - 3.6), with a significant risk of  $p = 0.034$ .
- Continuous odds ratios for differences between the 80th and 20th percentiles (based on controls) were 1.4 (95% CI: 1.1 - 1.9).

### Glycemic load

- Odds ratios were 2.5 and significantly above the third (95% CI: 1.4 - 4.5), odds ratios for the fourth were 2.7 (95% CI: 1.5 - 4.9), and highest quintile odds ratios were 2.7 (95% CI: 1.5 - 4.8), with a significant trend in risk ( $p < 0.001$ ).
- Continuous odds ratios for differences between the 80th and 20th percentiles (based on controls) were 1.5 (95% CI: 1.2 - 2.0).

After adjustment for non-carbohydrate calories, odds ratios were similar for glycemic index and glycemic load.

No significant differences were noted in age, gender, and major established risk factors for gastric cancer.

When compared with subjects who consumed a low glycemic load with high fruits and vegetables, the odds ratio was higher for increasing glycemic load mainly in subjects with low intake of fruits and vegetables, to reach 5.0 (95% CI: 2.2 - 11.5) for subjects with high glycemic load and low intake of fruits/vegetables.

## Author Conclusion:

There was a direct relation between GI, and mostly GL, and gastric cancer risk.

There was a five-fold difference in gastric cancer risk between subjects reporting low GL and high fruit and vegetable intake and those reporting high GL and with low fruit and vegetable consumption.

A high glycemic load may increase cancer risk via pathways of insulin-like growth factors (IGFs). Insulin can increase the activity of IGFs and sex hormones, both of which may be related to gastric cancer risk as found in some studies.

Some characteristics of carbohydrates, in particular refined carbohydrates, may affect gastric cancer risk.

## Reviewer Comments:

*The study suggests that a diet with a glycemic index and high glycemic load has a direct relationship with gastric cancer risk.*

*Authors note the following limitations:*

- *Lack of information on Helicobacter pylori infection*
- *Hospital controls may differ in their dietary habits from the general population*

## Research Design and Implementation Criteria Checklist: Primary Research

### Relevance Questions

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)	N/A
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
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### Validity Questions

<b>1.</b>	<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
<b>2.</b>	<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?	Yes
<b>3.</b>	<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.)	N/A
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.)	Yes
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>	Yes

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%.)	N/A
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>Yes</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?	Yes
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?	N/A
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>	Yes
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>	Yes
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)?	No
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>	Yes
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>	Yes
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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