LIFE Science Hub
JOURNAL OF SCIENCE
EXPANDING KNOWLEDGE ABOUT NUTRITION AND HEALTH

ORIGINAL RESEARCH

Predicting glucose and insulin responses in healthy subjects after consuming mixed meals varying in energy, protein, fat, carbohydrates, and glycemic index - Review of the evidence

D.ssa M. Mondini[1]

1 Biologist, Italy

1. ABSTRACT

The analyzed study evaluated whether, after mixed meals, the amount of carbohydrates was sufficient to predict the postprandial increase in glucose and insulin, or if their quality, expressed by the glycemic index, also mattered. Eight non-diabetic young adults consumed five meals with different compositions. The amount of carbohydrates alone did not significantly predict the average responses; when combined with the glycemic index, it explained approximately 90% of their variability.In section 2.3 of “The Choice to Live in Health or Illness” by Dr. A. Colonnese and R. Panzironi, the study contributes to the narrative that the pancreas responds to both the quantity and the quality of carbohydrates present in a meal. Independent research, conducted on healthy individuals and overweight adults, confirms that reducing the glycemic index or the amount of carbohydrates can lower glycemia and insulinemia after mixed meals. The confirmation is moderate: the physiological principle is consistent, but individual prediction remains influenced by the meal context and the person's characteristics.

ONLINE ARTICLE

ARTICLE INFORMATION

Published: November 11, 2026
Updated: November 11, 2026

DOI 10.5281/zenodo.24140523

MISSION

LIFE Science Hub – Journal of Science was founded with the aim of making scientific knowledge accessible without giving up methodological rigour, quality of sources and authoritativeness of content. The journal promotes the dissemination of knowledge in the health, nutrition, medical and longevity sciences, building a bridge between the world of research and society.

Through articles, reviews, in-depth analyses and expert contributions, the Journal champions evidence-based medicine and science, fostering a correct interpretation of scientific data and countering misinformation. Every piece of content is developed with the aim of translating the complexity of research into understandable, useful and applicable information, while keeping intact the principles of accuracy, transparency and scientific independence.

Free from political, industrial and commercial influence, the journal stands as an authoritative and independent editorial space, dedicated to promoting scientific culture, professional development and the growth of health awareness among the public.

2. ANALYZED STUDY

The research question was whether the body's response to a mixed meal depends solely on the grams of carbohydrates or also on their source. In simple terms, the authors verified whether two meals with different or similar amounts of carbohydrates could produce different increases in glycemia and insulin based on the speed at which the carbohydrates make glucose available.The hypothesis evaluated was that quantity and glycemic index work together. The glycemic index is a measure of how quickly a carbohydrate-containing food tends to increase glycemia compared to a reference food. The study is relevant to the book's section because it precisely documents the segment stating that the pancreas does not respond only to the grams of carbohydrates, but also to the quality of the carbohydrate source.The publication can demonstrate an acute experimental association between meal characteristics and postprandial responses in eight healthy individuals. However, it cannot establish which dietary composition is better in the long term, nor can it accurately predict the response of each individual, nor demonstrate clinical effects on diabetes, body weight, or cardiovascular diseases.

3. MATERIALS AND METHODS OF THE ORIGINAL STUDY

According to the available abstract, the study involved eight young, lean, non-diabetic subjects. Each participant consumed five different mixed meals. The meals varied in total energy, from 1,650 to 2,550 kJ; fat, from 8 to 24 g; protein, from 12 to 25 g; carbohydrates, from 38 to 104 g; and glycemic index, from 43 to 99.The authors measured the incremental glucose and insulin responses after the meal. Incremental response refers to the increase relative to the pre-meal value. They then compared the predictive capacity of carbohydrate quantity alone with that obtained by combining quantity and glycemic index using previously derived equations.This information is not reported in the available material: sex, exact age, inclusion and exclusion criteria, order of meal administration, duration of blood sampling, analytical method for glucose and insulin, details of the foods used, study period, and further statistical procedures.

4. RESULTS

In simple terms, different meals placed very different metabolic demands on the body. The average incremental glucose and insulin responses showed a 2.3-fold variability across the five meals. This indicates that the post-meal spike did not follow the grams of carbohydrates alone in a uniform way.The amount of carbohydrates considered in isolation was not significantly associated with the average glucose and insulin responses. Conversely, the combination of carbohydrate quantity and glycemic index explained approximately 90% of the observed variability in average glycemic and insulin responses, with $P = 0.01$. A P-value of 0.01 indicates that, in the statistical model adopted, it would be unlikely to observe an association of this magnitude if there were no real relationship between the variables.Within the range studied, variations in protein and fat appeared negligible for postprandial glucose and insulin responses. This result does not mean that protein and fat cannot influence the metabolic response in other meals or populations; it simply means that, within the quantitative limits and the small sample examined, they did not add relevant predictive capacity beyond the quantity and quality of carbohydrates.

5. INTERPRETATION

The main takeaway is that the quantity of carbohydrates remains important, but it does not, by itself, describe how quickly glucose will enter the bloodstream or how much insulin will be released after a mixed meal. The glycemic index adds information about the quality of the carbohydrate source and, together with the quantity, allows for a better description of the average response observed.This is the passage that connects to section 2.3 of “The Choice to Live in Health or Illness” by Dr. A. Colonnese and R. Panzironi: carbohydrates with different quantities or digestive characteristics can produce different insulin demands. The study does not prove that every high-glycemic index carbohydrate is unfavorable in any situation, nor that insulin is an indicator of harm. Instead, it documents that, in these participants and for these meals, the quality and quantity of carbohydrates acted jointly in determining the postprandial response.The interpretive power is limited by the very small sample

size and the availability of only the abstract. Furthermore, the statement that fats and proteins have negligible effects should not be extended beyond the range of composition examined, because other studies on mixed meals have found effects dependent on the quantity, the structure of the meal, and the characteristics of the participants.

6. INDEPENDENT SUPPORTING EVIDENCE

A particularly relevant independent verification was conducted by Bao and colleagues in healthy young adults. The study compared responses to 121 individual foods and 13 mixed meals. In mixed meals, the glycemic load—the mathematical combination of carbohydrate quantity and glycemic index—explained 58% of the variability in the glycemic response and 46% of the variability in the insulin response. Carbohydrate quantity alone did not predict these responses in mixed meals. The result directly confirms the core narrative of the book: to understand the post-meal response, it is necessary to consider both the quantity and quality of carbohydrates together. The limitation is that the proportion of explained variability was lower than that reported in the original study, showing that other factors contribute to the individual response [1].A second crossover study, meaning a study in which the same participants receive multiple experimental conditions, evaluated 14 mixed breakfasts in healthy subjects from Sydney and Toronto. The meals differed in the amount of available carbohydrates and glycemic index. The two variables together explained 88% of the variability in the glycemic response; furthermore, the insulin response increased along with the glycemic response. This directly confirms that the glycemic index of the components and the quantity of carbohydrates can maintain predictive value even within realistic meals. However, the portions and composition of the meals were experimentally controlled, so they do not represent the full variability of daily life [2].A further randomized crossover study expanded the context to 26 adults with overweight or obesity, without known chronic diseases. For an entire day, participants consumed four mixed meal patterns that combined high or low glycemic index and high or low carbohydrate quantity. Compared to the condition with high glycemic index and high carbohydrates, reducing carbohydrates or reducing the glycemic index decreased the area under the glucose curve by 24% to 42% and the insulin curve by 20% to 29%, with P less than 0.001. The area under the curve summarizes how much glucose or insulin circulates overall over time after meals. This research confirms that both levers, carbohydrate quantity and quality, can reduce the postprandial response. However, it does not establish which choice is optimal for each person, nor does it evaluate long-term clinical effects [3].

7. CONFLICTING EVIDENCE

No directly conflicting evidence of sufficient relevance has been identified; this does not prove the absence of contrary results.However, there are elements that require caution. The study by Bao et al. confirmed the superiority of glycemic load over the quantity of carbohydrates alone, but in mixed meals, it explained a smaller portion of the variability compared to that observed in the original study. Furthermore, the study by Ballance et al. showed that, in mixed meals, proteins and fats can reduce the relative glycemic response and increase the insulin response compared to the isolated consumption of the same carbohydrate-rich food. This does not contradict the role of quantity and glycemic index, but it indicates that the overall composition of the meal can modify the prediction based on the characteristics of the individual food [1,2].

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The table distinguishes the publication under review from the independent research used to verify the same scientific narrative.

Quadro comparativo

Reference	Study type	Population or model	Main result	Direction of evidence	Strength of evidence
Original study	Experimental study on mixed meals	8 young non-diabetic subjects	Carbohydrate quantity and glycemic index together explained approximately 90% of the variability in mean glucose and insulin responses.	direct confirmation	preliminary
[1]	Experimental study on foods and mixed meals	Healthy young adults; 13 mixed meals	Glycemic load explained 58% of glycemic variability and 46% of insulin variability; carbohydrates alone did not predict responses to mixed meals.	direct confirmation	moderate
[2]	Crossover study	26 healthy subjects in two centers; 14 mixed breakfasts	Carbohydrate quantity and glycemic index explained 88% of the variability in the glycemic response.	direct confirmation	moderate
[3]	Crossover RCT	26 adults with overweight or obesity	Reducing glycemic index or carbohydrate quantity reduced postprandial glycemia and insulinemia compared to high-glycemic index and high-carbohydrate meals.	direct confirmation	moderate

9. SINTESI EDITORIALE E CONCLUSIONI

CONCLUSIONS

The analyzed study pertinently supports the idea that, after a mixed meal, the glycemic and insulin response depends not only on the amount of carbohydrates but also on their glycemic index. Independent evidence confirms that considering both the quantity and quality of carbohydrates describes the postprandial response better than carbohydrate counting alone. The framework is moderately supported by acute human studies, but it does not allow for precise prediction of individual responses nor for the formulation of long-term clinical conclusions.

Aggiornato al 17/11/2026. Questo contenuto riflette una sintesi divulgativa delle evidenze scientifiche al momento della pubblicazione e non sostituisce il parere medico.

10. TRANSPARENCY AND SCIENTIFIC RESPONSIBILITY

Artificial Intelligence was used solely as a tool for editorial and documentary support. All content, interpretations, bibliographic citations and conclusions have been verified, reviewed and approved by the author, who assumes full scientific responsibility for them.

The manuscript was also subjected to independent peer review prior to publication.

To ensure the greatest transparency, the complete history of the article, including the dates of submission, revision, acceptance and publication, as well as information on the peer review process, is available on the dedicated Article History page.

11. RIFERIMENTI BIBLIOGRAFICI

[1] **Prediction of postprandial glycemia and insulinemia in lean, young, healthy adults: glycemic load compared with carbohydrate content alone**
Bao et al., 2011
The American Journal of Clinical Nutrition
DOI: https://doi.org/10.3945/ajcn.110.005033

[2] **Food glycemic index, as given in Glycemic Index tables, is a significant determinant of glycemic responses elicited by composite breakfast meals**
Wolever et al., 2006
The American Journal of Clinical Nutrition
DOI: https://doi.org/10.1093/ajcn/83.6.1306

[3] **Reducing the Glycemic Index or Carbohydrate Content of Mixed Meals Reduces Postprandial Glycemia and Insulinemia Over the Entire Day but Does Not Affect Satiety**
Liu et al., 2012
Diabetes Care
DOI: https://doi.org/10.2337/dc12-0329