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ORIGINAL RESEARCH

Reducing the glycemic index or carbohydrate content of mixed meals lowers postprandial glycemia and insulinemia throughout the day, without affecting satiety - A review of the evidence

D.ssa D. Iodice[1]

1 Biologist, Italy

1. ABSTRACT

The original study compared four dietary days with different combinations of glycemic index and carbohydrate content in 26 adults who were overweight or obese. Reducing the glycemic index, the amount of carbohydrates, or both decreased overall glucose and insulin exposure over the following 12 hours compared to a high-glycemic index, high-carbohydrate diet. No statistically significant differences emerged in subjective feelings of hunger, fullness, or satiety.In the narrative of "The Choice to Live in Health or Illness" by Dr. A. Colonnese and R. Panzironi, this publication contributes to the assertion that the quality and quantity of carbohydrates can attenuate the postprandial insulin response throughout the day. Independent studies confirm that the glycemic load—the integration of carbohydrate quality and quantity—predicts the glucose and insulin response to mixed meals. However, the evidence does not demonstrate that lower acute insulinemia directly reduces the functional load on pancreatic beta cells or prevents long-term disease.

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MISSION

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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 modifying the glycemic index and the carbohydrate content of mixed meals could change post-meal increases in glycemia and hyperinsulinemia, not just after a single food or a single meal, but throughout an entire day. The glycemic index indicates how quickly a carbohydrate-containing food tends to raise glycemia compared to a reference food. The glycemic load, on the other hand, integrates both this quality of the carbohydrate and the actual amount consumed.The hypothesis was that low glycemic index meals, with fewer carbohydrates, or both, would produce smaller postprandial increases in glucose and insulin compared to high glycemic index and carbohydrate-rich meals. The study is relevant to section 2.1.1 because it verifies, under controlled conditions, the most concrete segment of the narrative: modifying the quality and quantity of carbohydrates can reduce daily exposure to glucose and insulin.The research can demonstrate an acute biological difference in blood concentrations over 12 hours because each participant tried the different dietary conditions. However, it cannot demonstrate that this reduction produces, over time, lower insulin resistance, lower incidence of type 2 diabetes, or a lower functional load on pancreatic beta cells, which are the cells in the pancreas that produce insulin.

3. MATERIALS AND METHODS OF THE ORIGINAL STUDY

This was a randomized crossover study: the same participants received four dietary treatments in random order, allowing for a comparison of individual responses to different daily meal plans. 30 healthy volunteers aged between 18 and 70 years, with a body mass index between 25 and 35 kg/m² and fasting glycemia no higher than 125 mg/dL, were enrolled; 26 completed all phases.Participants followed four test days consisting of breakfast, lunch, and dinner: high glycemic index and high carb; high glycemic index and low carb; low glycemic index and high carb; and low glycemic index and low carb. The diets were isocaloric, meaning they provided the same amount of energy for each participant. Protein provided 20% of the energy; the fat content varied inversely with the carbohydrate content. Fiber was kept constant.Before each experimental day, participants consumed a standardized diet for three days. An interval of at least three days was scheduled between each condition. After a ten-hour fasting period, blood samples were collected before and repeatedly after each meal for 12 hours via a venous catheter. The primary outcomes were the area under the curve, or AUC, for glucose and insulin: a measure that summarizes how much and for how long these values remain elevated. Hunger, satiety, and fullness were assessed using visual analog scales from 0 to 100 mm. The statistical analysis used a linear mixed model to account for repeated measurements in the same subject.

4. RESULTS

Of the 26 participants who completed the study, 10 were men and 16 were women. The average age was 43.5 ± 14.7 years, and the mean body mass index was 29.1 ± 2.8 kg/m². In the primary comparison, the high-glycemic index and high-carbohydrate diet produced the highest overall glucose and insulin exposure throughout the day.Compared to this reference diet, the glucose AUC was reduced by 24% with a high-glycemic index and low carb diet, by 33% with a low-glycemic index and high-carbohydrate diet, and by 42% with a low-glycemic index and low carb diet. All three comparisons had $P < 0.001$, a value consistent with a low probability that these differences were due to chance alone.Insulin exposure also decreased compared to the high-glycemic index and high-carbohydrate diet: by 20% with a high-glycemic index and low carb diet, by 20% with a low-glycemic index and high-carbohydrate diet, and by 29% with a low-glycemic index and low carb diet; for all comparisons, $P < 0.0001$. In practical terms, the combination of a low-glycemic index and a lower carbohydrate intake produced the greatest observed daily reduction in both glycemia and insulinemia.After breakfast, glycemia was higher with the high-glycemic index and high-carbohydrate diet. After lunch and dinner, a progressive relationship emerged between glycemic load and glucose and insulin AUC: as the glycemic load decreased, postprandial exposure decreased. No significant differences were detected between the four diets in subjective scores of hunger, fullness, or satiety. Some variations in mood and energy were statistically significant, but they did not show a consistent

relationship with glycemic index or glycemic load.

5. INTERPRETATION

The most direct implication is that the body does not respond solely to the amount of carbohydrates. The speed at which carbohydrates in a meal make glucose available in the blood also matters. By reducing the amount of carbohydrates, the glycemic index, or both, the overall daily exposure to both glucose and insulin was reduced.The finding supported by the publication is therefore: lower glycemic index and/or lower carbohydrate content lower glycemic load of the meal lower postprandial increase in glucose and insulin. The result is consistent with the idea that the insulin response depends on the combined effect of the quality and quantity of carbohydrates, not just the total carbohydrate content.However, the conclusion requires precision. The study did not directly measure beta-cell secretion using specific methods, did not assess pancreatic damage or fatigue, and did not follow participants over time. Therefore, it is correct to state that the tested meals required a lower circulating insulin response throughout the day; it is, however, an interpretation not directly proven that this reduces the functional load on beta cells or modifies the future risk of type 2 diabetes.

6. INDEPENDENT SUPPORTING EVIDENCE

Independent confirmation of the combined role of carbohydrate quality and quantity comes from a study of 12 women with obesity, who were subjected to four mixed meals of different sizes and glycemic indices in random order. With the same meal size, the high-glycemic index meal produced an incremental AUC for glucose and insulin that was nearly double that of the low-glycemic index meal. Furthermore, two meals with different amounts and types of carbohydrates but similar glycemic loads resulted in very similar glucose and insulin responses. The glycemic load was associated with both the glucose and insulin AUC in the first two and five hours after the meal [1]. This study directly confirms the narrative shift that the combined effect of carbohydrate quality and quantity is more informative than quantity alone.A second study analyzed 121 individual foods and 13 mixed meals in healthy young adults. In mixed meals, the glycemic load explained 58% of the variability in the glycemic response and 46% of the insulin response, whereas carbohydrate content alone did not predict these responses. The result supports the physiological plausibility of the original study's observation: when foods are combined with fats and proteins, the amount of carbohydrates alone does not adequately describe the post-meal response [2]. The limitation is that the sample consisted of lean, healthy young adults and that the observation covered individual foods or meals, not a full day.A meta-analysis of 11 randomized studies evaluated low- or high-glycemic index breakfasts in adults. Low-glycemic index breakfasts reduced postprandial glycemia at 60 minutes by 1.32 mmol/L, at 90 minutes by 0.74 mmol/L, and at 120 minutes by 0.44 mmol/L compared to high-glycemic index breakfasts. The 95% confidence intervals did not include zero for all these results [3]. This synthesis reinforces the direction of the effect on acute glycemia, but does not by itself demonstrate a reduction in whole-day insulinemia, because the included studies focused primarily on breakfast and insulin measurements were not uniformly available.

7. CONFLICTING EVIDENCE

No directly conflicting evidence of sufficient relevance regarding the direction of the acute effect has been identified: reducing the glycemic index or carbohydrate content tends to reduce postprandial glucose exposure in controlled meals. However, data exist that limit the extension of this result to broader and more lasting metabolic benefits.In the OmniCarb study, 163 overweight adults with elevated blood pressure were assigned four controlled diets for five weeks each. Compared to the high-glycemic index and high-carbohydrate diet, the low-glycemic index and low-carbohydrate diet reduced the 12-hour incremental AUC for glycemia by 20%, but did not improve insulin sensitivity. Furthermore, in the high-carbohydrate condition, the low-glycemic index diet reduced insulin sensitivity by 20% and increased LDL cholesterol by 6% [4]. This does not negate the reduction in postprandial glycemia, but it indicates that a lower glycemic index does not automatically guarantee an improvement in all metabolic indicators in the medium term.

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The table distinguishes the experimental evidence subject to the review from independent publications used to confirm or define the narrative of the paragraph.

Quadro comparativo

Reference	Study type	Population or model	Main result	Direction of evidence	Strength of evidence
Original study	Randomized controlled crossover	26 overweight or obese adults; four dietary days	Low glycemic index or low carb reduced daily glucose and insulin AUC; no difference in satiety	direct confirmation	moderate
[1]	Randomized crossover	12 women with obesity; four mixed meals	Meals with similar glycemic load induced similar glucose and insulin responses; glycemic load was associated with respective AUCs	direct confirmation	moderate
[2]	Physiological experimental study	Healthy young adults; 121 foods and 13 mixed meals	In mixed meals, glycemic load predicted postprandial glycemia and insulinemia better than carbohydrate content alone	direct confirmation	moderate
[3]	Meta-analysis of RCTs	11 randomized studies on adults	Low glycemic index breakfasts reduced postprandial glycemia at 60, 90, and 120 minutes	indirect confirmation	moderate
[4]	Randomized controlled crossover	163 overweight adults with elevated blood pressure	The combination of low glycemic index and low carb reduced glycemic AUC, without improving insulin sensitivity	discordant evidence	moderate

9. SINTESI EDITORIALE E CONCLUSIONI

CONCLUSIONS

The study analyzed shows in a controlled manner that, in the overweight or obese adults examined, reducing the glycemic index of mixed meals, the carbohydrate content, or both decreases daily exposure to glucose and insulin after meals. Independent evidence confirms that glycemic load, by integrating both the quality and quantity of carbohydrates, is an important determinant of the postprandial response.

The book's narrative is therefore well-supported regarding the acute attenuation of the glycemic and insulinemic response. However, the hypothesis that such differences reduce the functional load on pancreatic beta cells over time or produce lasting clinical benefits remains to be directly validated. Furthermore, the absence of differences in satiety in the original study indicates that a lower insulin response does not necessarily lead to a different perception of hunger.

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.

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