



Heterogeneity of curcumin studies: a review of 103 randomized trials

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1. ABSTRACT

A 2024 systematic review brought together 103 randomized clinical trials on curcumin. The work shows favorable signs for certain metabolic and inflammation parameters, but also highlights an essential point: the products, participants, doses, and measurements used were different. Therefore, the results cannot be automatically transferred from one preparation to another. The authors' synthesis searched for randomized clinical trials—research in which people are randomly assigned to an intervention or a comparison—published up to September 2023. 103 studies were included, for a total of 7,216 participants and 42 measured outcomes. Twenty-three out of 42 outcomes showed a statistically significant difference between curcumin and placebo. In simple terms, for some indicators, the group receiving the studied product had different values compared to the comparison group; this does not mean that every turmeric formulation produces the same effect in every person. The authors assessed the evidence regarding fasting glycemia, C-reactive protein, HDL cholesterol, and body weight as the most reliable. C-reactive protein is a blood indicator that can increase in the presence of inflammation, but it does not identify a cause on its own. For various other parameters, including insulin and estimates of insulin resistance, the certainty was found to be moderate, low, or very low. The review therefore concludes that curcumin can modify certain markers, but requires larger, longer studies with more uniformly described products.

VIDEO ARTICLE



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2. WHAT THIS RESEARCH ANALYZED

For anyone reading a label, the main takeaway is that the name “curcumin” does not identify a single, uniform intervention. The 2024 review by Jafari and colleagues collected clinical studies in which preparations derived from *Curcuma longa* were compared with a placebo—that is, a preparation lacking the component under study. The authors searched for publications in PubMed, EMBASE, Scopus, and Web of Science up to September 2023. The work aggregated 103 randomized trials involving 7,216 participants and examined 42 outcomes: glycemia parameters, blood lipids, body measurements, markers of inflammation, and indicators related to oxidative stress. Oxidative stress describes an imbalance between reactive molecules and cellular defense systems. It is a biological indicator, not a diagnosis, and does not prove a clinical benefit on its own. To combine different studies, the authors used a random-effects model, a statistical method that accounts for the possibility that effects may not be identical across all studies. This choice is consistent with a highly varied body of evidence, which must be read with caution.

3. WHAT RESULTS EMERGE FROM THE STUDY

The most immediate result is that having many studies does not equate to having a single answer. Twenty-three of the 42 outcomes reached statistical significance. This indicates that, for those indicators, the difference observed between the intervention and the placebo was unlikely to be attributable to chance alone according to the statistical criteria adopted. However, it does not automatically indicate a significant change for the health of every single person. The authors assigned a high level of evidence to glycemia, C-reactive protein, HDL cholesterol, and body weight. Glycemia measures blood glucose after a period without food; HDL cholesterol is a fraction of cholesterol involved in lipid transport. For waist circumference, body mass index, insulin, and HOMA-IR—an indirect estimate of insulin resistance—the reliability of the results is moderate. Fourteen outcomes had low evidence, and another fourteen had very low evidence. Jafari and colleagues therefore report possible changes in glycemic, lipid,

inflammatory, and oxidative parameters, but they do not demonstrate a uniform effect, nor do they prove the prevention or cure of diseases.

4. WHY THIS STUDY IS RELEVANT

This publication is particularly useful for correctly interpreting expressions such as “clinically studied turmeric.” By bringing together many trials, it shows that human literature exists and that some signals are converging. At the same time, it makes it clear how different the objectives are: a blood value, a body measurement, or a marker of inflammation are not the same thing as an improvement in symptoms, quality of life, or long-term disease risk. Practical relevance also concerns product composition. An extract, a formulation with higher absorption, and the spice added to meals are not automatically equivalent in terms of the amount ingested, availability in the body, and context of use. An independent review of body measurements observed small average effects and noted differences based on the formulation, with many studies at high risk of bias [1]. Another synthesis of reviews found favorable results for some inflammatory and vascular markers, but not for all the indicators examined [2]. These verifications support the general picture without turning it into a guarantee for every product.

5. STUDY LIMITATIONS AND WHAT IT DOES NOT DEMONSTRATE

The main limitation is heterogeneity, meaning the presence of significant differences between studies: participants with different conditions, non-comparable preparations, varying durations, and outcomes measured using different methods. An average value obtained from aggregation can be informative, but it does not allow us to determine which dose, form, or duration is suitable for everyone. Furthermore, the review reports that the methodological quality of the included studies requires caution and calls for larger, longer-term trials. The work does not demonstrate that curcumin used in cooking has the same effects as the capsules evaluated in the trials. It does not prove that a change in a biomarker prevents a disease or replaces medical treatments. It also does not allow for the deduction of an individual effect: in a small crossover trial on 18 healthy smokers, an acute dose of 5 g did not modify



vascular function in the entire group, while some subgroup analyses suggested different responses [3]. Individual variability is therefore a possible explanation, not proof that a formulation works selectively based on sex or cardiovascular risk.

6. INDEPENDENT CONFIRMATORY EVIDENCE

The first confirmation concerns the fact that average results, when present, can be small and depend on the form of the product. An umbrella review with an updated meta-analysis brought together 50 randomized trials on body measurements. It found average reductions in body mass index, weight, and waist circumference; for weight, the mean difference was -0.59 kg, with a 95% confidence interval from -0.81 to -0.36 . However, the authors classified 21 trials as being at high risk of bias and observed differences linked to formulations with increased bioavailability, i.e., designed to improve the absorbed portion [1]. This directly supports the idea that the quantity of studies does not make all preparations equivalent; the confirmation is moderate for the topic of body measurements, but it does not extend to every outcome of the Jafari review. A second point concerns biological markers. A meta-analysis of meta-analyses, based on 21 trial syntheses, found average reductions in C-reactive protein, tumor necrosis factor- α , and interleukin-6, along with changes in certain oxidative indicators and endothelial function [2]. Endothelial function describes the ability of the inner lining of blood vessels to regulate blood flow. The link with Jafari and colleagues is direct for inflammatory and oxidative markers; however, it remains indirect with respect to clinical outcomes, because biomarkers are not synonymous with disease prevention. Finally, a placebo-controlled trial in 90 adults between 50 and 69 years of age who were overweight evaluated an extract composed of an aqueous fraction and a fraction extracted with supercritical carbon dioxide for 12 weeks. Compared to the placebo, the treated group showed lower values of C-reactive protein and complement C3, in addition to differences in weight and body mass index [4]. Complement C3 is a protein involved in immune defenses and inflammation. This human result is consistent with some aggregated signals, but it concerns a specific extract, a limited sample, and researchers employed by the

manufacturing company; the confirmation is therefore limited.

7. CONFLICTING EVIDENCE

Contradictory evidence does not negate the average findings of the review, but it does show why they should not be generalized. In a crossover trial by Barber-Chamoux and colleagues, 18 healthy smokers received a single 5 g dose of curcumin or a placebo. After two hours, no significant effect on flow-mediated dilation was observed in the group as a whole; flow-mediated dilation is a test that assesses how an artery responds to increased blood flow. Exploratory analyses suggested differences based on sex and cardiovascular risk, but the very small sample size and short observation period severely limit these conclusions [3]. The study therefore contradicts the idea of a predictable and uniform vascular response. A second randomized trial followed 39 healthy middle-aged or older adults for 12 weeks. The Longvida formulation provided approximately 400 mg of curcumin per day within 2,000 mg of the product. No improvements compared to the placebo were found in the main measures of strength, mobility, balance, endurance, or cognitive function; the P-values for these comparisons were greater than 0.05 [5]. This evidence does not directly conflict with the blood markers in the Jafari review, as it measures different outcomes. However, it is relevant because it serves as a reminder that a change in certain biological indicators does not necessarily lead to a perceptible functional improvement in healthy individuals. No directly conflicting evidence sufficiently relevant to every single outcome of the review was identified; this does not prove the absence of contrary results.

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

The following publications help compare the aggregate data with results obtained in independent summaries and individual trials.

Quadro comparativo

Publication	Design and model	Main result	Relationship to Jafari's study
Unhapipatpong et al., 2023 [1]	Umbrella review and updated meta-analysis; 50 randomized trials	Small average reductions in weight, body mass index, and waist circumference; 21 trials at high risk of bias.	Partial confirmation for body measurements and the importance of the formulation.
Kavyani et al., 2024 [2]	Meta-analysis of meta-analyses; 21 syntheses of randomized trials	Favorable signals for some inflammatory, oxidative, and vascular markers; no significant effect on total antioxidant capacity.	Partial confirmation of results on biomarkers and the non-uniformity of outcomes.
Uchio et al., 2021 [4]	Randomized, double-blind, placebo-controlled trial; 90 overweight adults	Reductions in C-reactive protein and C3 complement with a specific Curcuma longa extract.	Confirmation limited to one formulation and inflammatory markers.
Barber-Chamoux et al., 2018 [3]	Randomized, double-blind, crossover trial; 18 healthy smokers	No significant vascular effect in the overall group after an acute dose; wide individual variability.	Conflicting evidence on the predictability of individual response.
Santos-Parker et al., 2018 [5]	Randomized, double-blind, placebo-controlled trial; 39 healthy adults	No major improvement in motor or cognitive function after 12 weeks.	Conflicting evidence for functional outcomes, not directly for biomarkers.

9. SINTESI EDITORIALE E CONCLUSIONI

EDITORIAL CONCLUSION

The review by Jafari and colleagues gathers a significant amount of trials on the use of curcumin-based preparations in humans. The most useful takeaway is not an absolute message of efficacy or inefficacy, but the distribution of certainty: some indicators, such as fasting glycemia, C-reactive protein, HDL cholesterol, and weight, had support that the authors evaluated as more solid; many other results remain moderate, low, or very low. Independent verifications confirm that average changes in some markers and body measurements may emerge, but they also highlight small-scale effects, differences between formulations, and methodological limitations. Smaller trials also show that not everyone responds in the same way and that some functional outcomes may remain unchanged. To interpret these data, it is therefore essential to know

which product was studied, in whom, for how long, and with what objective. The food spice, a standardized extract, and an enhanced-absorption formulation are not interchangeable evidence.

Aggiornato al 27/10/2026. 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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